



# Female Earnings and the Returns to Spousal Education Over Time

Nicholas A. Jolly<sup>1</sup>

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## Abstract

Using U.S. Census data from 1960 to 2000 and American Community Survey data from 2010, this paper estimates the relationship between the husband's educational attainment and his wife's annual labor earnings. For full-time working wives, each additional year of completed schooling by the husband was associated with a 2% increase in his wife's earnings. The returns to spousal education were larger when the couple worked in the same occupation. The estimated relationship has increased slightly since 1970. This increase was larger for younger wives. These results are consistent with cross-productivity and documented increases in educational homogamy.

**Keywords** Marriage · Human capital · Female earnings · Assortative mating

**JEL Classification** J12 · J24 · J31

Since Benham (1974), economists have long recognized the existence of a positive correlation between spousal education and own labor earnings. Most research has focused on the correlation between the wife's schooling and her husband's earnings. Only a handful of studies exist that have estimated the wife's return to her husband's education. Of those papers that have studied the wife's return to spousal schooling, very few have used data from the United States and have examined how this return has changed over time. This paper uses U.S. Census and American Community Survey (ACS) data from 1960 to 2010 and studies the relationship between the educational attainment of the husband and the earnings of his wife and how this association changes over time. Results from the analysis suggest that for full-time working wives, the return to spousal education is between 1.3 and 2% and has grown since 1970. Women in their prime working years (ages 25–45), whose husbands have at least a college education and work in the same occupation, drive this growth.

There are two main explanations for the positive return to spousal education. The first is the cross-productivity/labor augmentation argument. Here, one spouse's human capital can augment the productivity of the other. Benham

(1974) stated that formal education increases one's productivity (aside from providing skills) by improving the ability to acquire and process information, the ability to perceive and understand change, and to respond to changing conditions efficiently. By this logic, a spouse's formal education can serve as a substitute for his/her partner's schooling and can help the partner acquire general and specific skills by sharing ideas and information and by helping to cope with change (Benham 1974). For example, spouses can provide information on proper etiquette at job interviews and access to professional networks (Bernardi 1999). Arguably, any peer network can help in the acquisition of skills through information sharing. Benham (1974) argued that there is greater incentive for information sharing in marriages because of the shared benefits of doing so and the lower costs involved with sharing information given the proximity of the couple. Bernardi (1999) stated that the large degree of trust that characterizes marriages relative to other relationships increases the likelihood that one spouse will transfer information and resources to the other.

The second reason for the positive return to spousal education is assortative mating. If individuals of similar characteristics tend to marry, then the positive coefficient associated with spousal education in an earnings equation will capture unobservable worker characteristics, such as innate ability. In other words, the assortative mating explanation states that spousal education is endogenous in the earnings

✉ Nicholas A. Jolly  
nicholas.jolly@marquette.edu

<sup>1</sup> Department of Economics, Marquette University, PO Box 1881, Milwaukee, WI 53201-1881, USA

function. Interestingly, some have argued that enhanced productivity is a by-product of assortative mating. If labor market outcomes are correlated with educational attainment, and if spouses match based upon education, then the sharing of professional networks and other forms of productive information is a natural consequence of assortative mating (Bernasco et al. 1998; Groothuis and Gabriel 2010).

Most of the earlier literature has focused on the association between the wife's schooling and her husband's earnings. Average estimated returns to spousal education have ranged from 0.7 to 9% (Benham 1974; Welch 1974; Scully 1979; Neuman and Ziderman 1992; Lam and Schoeni 1993, 1994; Loh 1996; Liu and Zhang 1999; Amin and Jepsen 2005; Jepsen 2005).<sup>1</sup> Loh (1996) used educational categories (e.g. less than high school, college degree, etc.) for the wife's schooling and found that the husband's return increases with his wife's level of education.

Fewer studies have examined the relationship between the husband's education and his wife's earnings. These estimated returns have ranged from 1.5 to 8% (Wong 1986; Tiefenthaler 1997; Huang et al. 2009; Groothuis and Gabriel 2010; Mano and Yamamura 2011; Amin and Jepsen 2012). Groothuis and Gabriel (2010) found negative returns to husbands' schooling for women with low levels of education and positive returns for those women with more education. Dribe and Nystedt (2013) showed that the marriage premium is higher for women entering hypergamous marriages (i.e. marrying someone with a higher level of education) relative to women entering homogamous unions (unions where both partners have the same level of education). Women entering hypogamous (marrying someone with less schooling) unions experience a marriage penalty relative to educational homogamy.<sup>2</sup>

The main contribution of this paper is its historical focus. To my knowledge, Jepsen (2005) is the only other paper that estimated the return to spousal education over time; however, the author focused on the husband's return to his

wife's schooling using US Census data from 1960 to 2000. While studying the husbands' returns to spousal education is important, the way in which women (particularly married women) have altered their participation in the US labor force is one of the most significant labor market changes during the 20th century (Goldin 2006). Therefore, studying the evolution and determinants of female earnings is equally important.

A secondary contribution of this paper is its focus on the United States. To my knowledge, Groothuis and Gabriel (2010) is the only other paper that used U.S. data to estimate the wife's return to her husband's education. The authors used data from the 2000 Census and 2003 Current Population Survey; therefore, the authors' temporal analysis was limited to three years. Other geographies studied include Hong Kong (Wong 1986), Brazil (Tiefenthaler 1997), China (Huang et al. 2009), Japan (Mano and Yamamura 2011), Malaysia (Amin and Jepsen 2012), and Sweden (Dribe and Nystedt 2013). Each of these countries is different from the US. Lam and Schoeni (1994) noted that Brazil has lower levels of intergenerational mobility and higher levels of assortative mating. Huang et al. (2009) stated that Chinese families are more patriarchal than those in Western cultures are. Sweden and other European countries tend to have generous social safety nets relative to the US. Given these differences, there is no reason to believe that estimated returns to spousal education will be similar across countries.

The paper proceeds by discussing some historical background to place this paper in proper context. The data and empirical methodology sections follow. The fourth and fifth sections present the results and concluding remarks, respectively.

## Background

Goldin (2006) provided a thorough discussion of the evolution of female participation in the US labor market during the past century. The author noted the negative stigma attached to wives working outside of the home before the 1920s due to the often dirty and dangerous nature of the jobs that existed at the time. However, starting in the early 1900s, the demand for office and clerical workers rose because of changes in office technology. Firms began to allow part-time working schedules, marriage bars were nearly eliminated, and advancements in household production technology occurred. With greater flexibility regarding work schedules, nicer working conditions within an office environment, and better household technology, the negative stigma associated with married women working diminished. The author noted that married women drove the large increase in female labor force participation that occurred during the early 1900s.

<sup>1</sup> Returns are relatively larger, 3.7 to 9%, when researchers have used non-US datasets. Other countries that have been studied include Iran (Scully 1979), Israel (Neuman and Ziderman 1992), Brazil (Lam and Schoeni 1993, 1994), Taiwan (Liu and Zhang 1999), and Malaysia (Amin and Jepsen 2005).

<sup>2</sup> Wong (1986), Tiefenthaler (1997), Huang et al. (2009), Groothuis and Gabriel (2010), and Dribe and Nystedt (2013) also examined the association between the wife's education and the husband's earnings. Wong (1986) and Tiefenthaler (1997) found estimates similar to those already reviewed. Huang et al. (2009) found an insignificant relationship using Chinese data. The authors claimed that this is due to the patriarchal nature of Chinese marriages. Groothuis and Gabriel (2010) found a positive relationship between the wife's education and the husband's earnings, and this relationship grows as the husband acquires more schooling. Dribe and Nystedt (2013) found that men also experience a relative penalty when they enter a hypogamous union. However, the penalty is not as large as it is for women.

Starting in the 1970s, Goldin (2006) noted that women began to change their perceptions regarding work and self-identification. Young women expected a longer, and more stable, working life. With regards to personal satisfaction, younger women began to place greater emphasis on career success and recognition from coworkers. To prepare for longer working lives, women started to enroll in college at rates higher than their male counterparts, and by 1980, they had higher rates of college attendance and graduation than men did (Goldin 1992, 2006; Kim and Sakamoto 2017; Van Bavel et al. 2018). Moreover, the gender gap in college major shrank (Goldin 2006; Kim and Sakamoto 2017; Van Bavel et al. 2018), and women started to further their graduate- and professional-level education (Goldin 2006).

Increased female educational attainment served to delay age at first marriage, and changes in health technology, such as oral contraception, helped to reduce fertility, particularly for women with higher levels of schooling (Kim and Sakamoto 2017). With reduced fertility and increased age at first marriage, women were able to spend more time investing in the labor market while younger (Gonalons-Pons and Schwartz 2017).<sup>3</sup> Those who invest more in human capital while younger exhibit stronger labor force attachment while older (Goldin and Mitchell 2017). With strengthening female labor market attachment and human capital investment came a shift in the types of occupations held by women, which led to a decrease in the gender occupation gap (Goldin 2006). Furthermore, female earnings increased relative to men, as did female returns to education and labor market experience (Goldin 2006; Stevenson and Wolfers 2007; Gonalons-Pons and Schwartz 2017). As earnings, returns to education, and returns to experience increase, there is a higher likelihood that married women will outsource housework (Van Bavel et al. 2018), thereby providing another avenue for increased labor market investments.<sup>4</sup>

The cross-productivity argument suggests that these demographic changes should lead to an increase in the wife's return to spousal schooling. Since earnings and the returns to education and experience have increased faster for women than men, husbands have a growing incentive to help actively develop their wives' careers given the shared benefits of labor market success within marriage. In fact, the probability of observing a couple where the wife is the dominant earner has increased (Van Bavel et al. 2018).

Furthermore, research has suggested that men's and women's preferences for mates have become more gender symmetric, and men have increased the importance of earnings potential when searching for a mate (Van Bavel et al. 2018). This shift in mate preferences should enhance these incentives for wives' career development.

Two themes arise from these demographic trends that may amplify the cross-productivity effect for different subsamples of the population. The first theme is a loosening of constraints related to household production. Historically, upon marriage women would take on roles related to tasks in household production and caretaking, particularly caring for children. Removal of marriage bars, diminished negative stigma associated with women working, increases in the age at first marriage, and a reduction in fertility remove or delay these constraints from becoming binding. As Goldin (2006) noted, delays in the age of first marriage and reductions in fertility allowed women a greater ability to make significant investments in human capital accumulation at younger ages, which led to higher returns to labor market experience relative to men. This provides a greater incentive for husbands to invest in their wives' careers while younger and when the couple does not have children. Therefore, the return to spousal schooling should be larger for younger wives and those without children.

The second theme is gender convergence with regards to educational and labor market outcomes. This theme suggests that the return to spousal education should be larger for wives with higher levels of schooling and those working in the same occupation as their husband. The cross-productivity argument is predicated on the sharing of productive information within marriage (Benham 1974). Workers benefit from information-sharing more when the information is related directly to an individual's career. Therefore, since the gender gap in college major and occupation has shrunk, it is reasonable to expect higher and growing returns to spousal education for wives with higher levels of schooling and when spouses work in the same occupation.

These demographic shifts may be changing the nature of marriage and assortative mating (Stevenson and Wolfers 2007). Marriage rates have declined since the 1970s, divorce rates have declined since around 1980, and rates of cohabitation have increased (Stevenson and Wolfers 2007). For those who do marry, they have been increasingly more likely to marry someone of similar education levels. Mare (1991), Schwartz and Mare (2005), and Eika et al. (2018) provided evidence of increases in educational homogamy throughout the last century. Schwartz and Mare (2005) and Eika et al. (2018) showed that educational homogamy increased, in part, because of reductions in educational inter-marriage at the bottom of the education distribution. In other words, the less educated are increasingly more likely to enter homogamous unions. Schwartz and Mare (2005) presented evidence

<sup>3</sup> Bailey (2006) presented evidence suggesting that access to oral contraception increases female labor force participation and hours worked. This would be particularly true for younger women. Furthermore, oral contraceptives have been linked to reduced marriage rates for women with a college education (Stevenson and Wolfers 2007).

<sup>4</sup> Furtado (2016) showed that native women respond to increases in immigrant inflows by working longer hours due to immigration lowering childcare costs.

that educational inter-marriage decreased for those with a college degree while Eika et al. (2018) showed the reverse.

With regards to race and nativity, Eika et al. (2018) showed that while African Americans and Caucasians experienced similar trends in assortative mating, African Americans had lower levels of educational homogamy and experienced a faster increase in entering homogamous unions from 1962 to the 1980s. Stevenson and Wolfers (2007) noted that African Americans have historically had higher rates of ever being married and ever being divorced when compared to Caucasians. However, the authors stated that this is no longer the case. Furtado (2012) showed that assortative mating on education is important when immigrants decide whether to marry natives. The author found that an increase in education leads to a higher likelihood of immigrants marrying natives for those immigrants surrounded by low-educated co-ethnics. The reverse is true for those immigrants surrounded by high-educated co-ethnics.

Van Bavel et al. (2018) stated that historically, when heterogamous unions existed, men were more likely to have a higher level of schooling compared to women. Van Bavel et al. (2018) noted that this pattern is now reversed given increases in female educational attainment. Furthermore, women with higher levels of education are more likely to marry now than in the past. In other words, there is more positive selection into marriage in recent decades. Moreover, Van Bavel et al. (2018) noted that while the probability of divorce was historically higher for couples where the wife had more schooling than the husband did, this is no longer true.

With increased educational homogamy and reduced gender gaps in wages, field of study, and occupation, it is logical to expect an increase in economic homogamy, i.e., observing spouses with similar earnings. Becker (1973) predicted negative assortative mating with respect to wages, which came from the assumption that the gains from marriage arose through specialization in the household. Lam (1988), however, allowed for gains from marriage through the joint consumption of goods purchased in the market. He noted that when this is the case, it is optimal for positive sorting based on incomes. Stevenson and Wolfers (2007) stated that these demographic changes are leading marital partners to match based upon consumption complementarities as opposed to specialization, which would lead to an increase in positive mating based upon incomes as suggested by Lam (1988). Nakosteen and Zimmer (2001) provided evidence of positive mating based on earnings and unobservable earnings traits.

Gonalons-Pons and Schwartz (2017) showed increases in economic homogamy over time. The authors noted how changes in the division of paid labor within marriage as opposed to changes in assortative mating through education

and occupation drove this increase.<sup>5</sup> Furthermore, the probability of observing marriages where the wife is the dominant earner increased (Van Bavel et al. 2018). Van Bavel et al. (2018) noted how, as with education, women with higher earnings are more likely to marry in current decades than in years past. Furthermore, while marriages with a higher-earning wife were historically relatively unstable, this is no longer the case in recent decades. Therefore, when focusing on earnings and earnings traits, there is more positive selection into marriage in recent decades, just like with education.

With marriages in recent decades being more positively selected along the dimensions of education and earnings (i.e., changes in marital sorting), the assortative mating argument suggests that these recent demographic shifts should lead to a measured increase in the returns to spousal education for women. Furthermore, these changes in marital sorting may lead to wives of different demographic groups experiencing dissimilar returns to spousal schooling. In some cases, this differential in returns across groups is predictable, while in others, it is not.

First, changes in marital sorting suggest a larger and growing return to spousal education for wives with higher levels of schooling and those working in the same occupation as their husbands do. With a decreased gender gap in college major and occupation, marital sorting can occur not only on college attendance, but also on field of study and occupation. With men and women increasingly more likely to obtain similar occupations, the gender wage gap shrank (e.g., Goldin 2006). Combined, these trends imply that the wife's return to her husband's schooling should increase over time for those wives with higher levels of schooling and those working in the same occupation as their husbands do.

Second, not only has the trend in marriage and divorce changed during the period under analysis here, but also Stevenson and Wolfers (2007) provided evidence showing that the rate of first marriages ending in divorce was lower for marriages formed in recent decades relative to marriages formed in the 1970s. This suggests that temporal changes in the return to spousal schooling may be different for wives in their first marriage relative to those in their second, or higher order, marriage. Furthermore, now that women are more likely to marry someone with less education than in earlier years, wives in heterogamous unions in recent decades may be inherently different from those in educationally dissimilar unions in years past. These changes may suggest different trends in the returns to spousal schooling for wives in different types of heterogamous unions. The same can be

<sup>5</sup> The authors showed that the correlation between spousal earnings differs by whether the couple is a newlywed or not (i.e. newlywed versus prevailing couples). For prevailing marriages, the correlation increased from 1970 to the 1990s. Since then, however, there was little increase. For newlyweds, the correlation between spousal earnings remained relatively flat over time.

said for differences across race. With differential rates of marriage, divorce, and educational homogamy, there is no reason to believe that the returns to spousal schooling should be similar for wives of different races. Finally, changes in economic homogamy may lead to differential trends in the returns to spousal schooling for wives in different portions of the earnings distributions.

In summary, many demographic changes occurred during the period of analysis in this paper. The cross-productivity and assortative mating effects suggest that the relationship between the wife's earnings and her husband's education should be positive and increase over time. Furthermore, these demographic trends suggest the potential for a different return to spousal schooling across different subsamples. It is important to remember, however, that the cross-productivity and assortative mating effects suggest a positive return to spousal education for different reasons. While cross-productivity is causal (i.e., an increase in the husband's schooling causes the wife's earnings to rise because of an enhancement to productivity), the assortative mating effect suggests an increase in returns to spousal education for women even if the causal mechanism (i.e., cross-productivity) does not exist.

## Data and Methodology

### Data

This paper used U.S. Census data from 1960 to 2000 and ACS data from 2010. All data came from the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al. 2018). For 1960 and 1980 to 2000, the data came from the 5% IPUMS samples. For 1970, the data came from the 1% form two state sample. The form one and two samples could not be combined because some required survey questions were only available in the form two sample.

To focus on labor market outcomes, such as earnings, the analysis sample included married working women with spouse present, where the wife was either the household head or spouse of the household head, and where both partners were between 25 and 55 years old. Those outside of this age range typically make labor market decisions simultaneously with education or retirement decisions. To ensure further that people were not making education and labor market decisions concurrently, the sample was restricted to couples where neither partner was enrolled in school.<sup>6</sup> Women were

<sup>6</sup> The survey question asking about school enrollment inquired about enrollment during a reference period. From 1960 to 2000, the period was since February 1 of the survey year. For the 2010 ACS, the reference period was the previous 3 months. The 1960 sample may contain some individuals currently enrolled in school if they are older than 34 because data on school enrollment was not available for that age range in that Census. During that year, the survey question was

removed from the sample if either they, or their husband reported their current employment status, main industry of employment, or main occupation was with the military. Couples were also removed if either partner reported being self-employed or an unpaid family worker. The Census and ACS gather information on labor earnings from the calendar year preceding the survey. Since the last survey year is 2010, all nominal dollar amounts were converted to 2009 dollars using the Consumer Price Index for All Urban Consumers.

Table 1 presents descriptive statistics for couples by decade. Focusing on wives, Table 1 shows that annual earnings more than doubled, from approximately \$15,000 in 1960 to \$39,000 in 2010. This coincided with a 75% increase in the percentage employed full time. From 1980 to 2010, full-time was defined as typically working at least 35 h a week for at least 40 weeks during the previous year. The 1960 and 1970 surveys did not ask about usual weekly hours last year. Instead, they inquired about hours worked last week, and responses were coded as intervals. Therefore, for 1960 and 1970, full-time work was defined as working at least 40 weeks during the previous year and at least 35 h during the previous week.<sup>7</sup>

Table 1 presents educational attainment in two ways, first as a series of degree categories, and second as a continuous measure of completed years of schooling.<sup>8</sup> Female

Footnote 6 (continued)

only asked of individuals younger than 35. Therefore, to keep the samples as comparable as possible across the six decades, the 1960 sample included couples where neither spouse was enrolled in school or where either spouse was at least 35 years old.

<sup>7</sup> The 1980 and 1990 Census also asked about hours worked during the previous week. As a comparison, the 1960/1970 full-time definition was applied to the 1980 and 1990 data. Using the 1980 sample, 87% of the full-time workers in the 1980 data were classified as full-time workers using the 1960/1970 definition. The rate in the 1990 data was 89%. Therefore, using the 1960/1970 full-time definition resulted in little difference in comparability across years. The main analysis was replicated using the 1960/1970 full-time definition on the 1980 and 1990 samples. Results were little changed and available upon request.

<sup>8</sup> The education variable in IPUMS does not have consistent responses from decade to decade. From 1960 to 1980, the Census gathered information on the number of completed years of education. It did not have information on degree completion. Therefore, when constructing the degree categories for 1960 to 1980, a high school degree was equivalent to completing 12 grades, a College Graduate was the equivalent of completing 4 years of college, and Above College included completing at least 5 years of college. Starting in 1990, the Census and ACS used three different types of responses. The first was degree completion (e.g. bachelor's degree). The second was ranges of grades, such as Grades 1 through 4. The final type was the completed year of education, such as Grade 10. When constructing the Years of Education variable from 1990 to 2010, a high school degree was equivalent to completing 12 grades, an associate's degree required two years of college, a bachelor's degree required 4 years of college, and a master's degree or above required 6 years of college. If the response was a range of grades (e.g. Grades 1 through 4),

**Table 1** Descriptive statistics of selected variables—means and proportions

	1960	1970	1980	1990	2000	2010
<b>Wives</b>						
Annual earnings (2009 \$)	15,182.44	20,465.41	22,819.65	27,786.26	33,959.62	39,227.77
Age	38.39	38.66	37.17	37.80	39.73	41.11
% Full time	39.38	41.21	53.00	59.93	65.77	68.72
Caucasian	88.77	89.11	88.34	89.61	87.77	86.42
African American	10.45	9.61	9.04	6.83	7.27	6.20
Asian	0.53	0.94	2.01	2.80	4.06	6.56
Other race	0.26	0.34	0.61	0.76	0.91	0.82
<b>Education</b>						
< High school	45.86	32.71	18.54	11.79	9.22	5.66
High school	36.27	44.54	45.09	36.36	29.21	22.40
Some college	10.77	12.89	19.69	29.66	32.99	31.80
College graduate	5.02	6.44	9.82	15.09	19.10	25.13
Above college	2.08	3.42	6.86	7.11	9.48	15.01
Years of education	11.87	12.65	13.51	14.10	14.39	15.05
<b>Husbands</b>						
Annual earnings (2009 \$)	36,823.17	50,933.25	52,753.63	54,580.39	58,051.84	58,259.14
Age	41.09	41.20	39.55	39.92	41.55	42.84
% Full time	80.64	83.92	87.23	87.15	87.32	83.01
White	88.80	89.19	88.42	89.73	87.89	86.70
Black	10.44	9.67	9.25	7.11	7.75	6.86
Asian	0.53	0.78	1.71	2.41	3.49	5.65
Other race	0.23	0.35	0.62	0.75	0.88	0.80
<b>Education</b>						
< High school	55.17	39.65	22.68	14.69	12.05	8.32
High school	25.13	33.22	34.54	31.30	29.44	27.07
Some college	10.48	13.37	19.61	27.96	30.11	29.54
College graduate	4.94	7.12	11.70	16.27	18.26	22.29
Above college	4.28	6.64	11.48	9.78	10.15	12.78
Years of education	11.40	12.45	13.65	14.15	14.29	14.68
Correlation b/n husband/wife educ.	0.61	0.61	0.62	0.60	0.60	0.60
<i>N</i>	373,037	98,319	669,945	867,436	970,775	176,903

Each sample includes married (with spouse present) working women aged 25 to 55. The husband is also aged 25 to 55, and neither partner is currently enrolled in school during the reference period. Neither the husband nor wife is employed with the military, is self-employed, or is an unpaid family member. See the descriptions in the manuscript regarding definitions of full/part-time workers, along with the discussion of the creation of the education variables

educational attainment increased considerably since 1960. In that year, women completed an average of 11.87 years of schooling, and 46% did not receive a high school degree. Only 7.10% completed college. By 2010, however, women completed an average of 15.05 years of education, and 72%

Footnote 8 (continued)

then the years of education equaled the midpoint of the range. When constructing the educational categories for 1990 to 2010, an associate's degree was included in Some College, and a master's degree and above was included in Above College. To maintain consistency across all six decades of data, the continuous measure of education was capped at 19 years of schooling.

received at least some college training. These changes in female educational attainment, earnings, and full-time work status match closely with the demographic changes documented elsewhere in the literature (e.g.; Jepsen 2005; Goldin 2006). Other variables in Table 1 showed that over 86% of each sample was Caucasian, and the average age in each year was approximately 38. The 2010 sample was slightly older, with an average age of 41.

Similar to wives, husbands experienced a relatively large increase in schooling, with average completed years increasing from 11.40 in 1960 to 14.68 in 2010. A majority of men (55%) did not complete high school in 1960, whereas 65% completed at least some college by 2010. Husbands' labor

earnings increased at a slower rate when compared to wives. As expected, the percentage of husbands working full time was always larger than it was for wives. This percentage increased until 2000 and subsequently declined. The trend in the percentage employed full time, together with the decline in the labor force participation rate, suggests that male labor force attachment is weakening. Together, the statistics in Table 1 suggest that, over time, men have a growing incentive to invest in their wives' careers.

The final statistic in Table 1 is the correlation coefficient between completed years of schooling of the husband and wife. This measure provides some indication of the degree of assortative mating in each sample. The correlation between schooling levels decreased slightly over time. These correlations are quite close to those in Jepsen (2005), who also reported a decrease over time. While this trend suggests that the degree of assortative mating is relatively unchanged, these coefficients are unconditional. Mare (1991) calculated conditional correlation coefficients and concluded an increase in assortative mating with respect to education from 1930 to the end of the 1980s, while Schwartz and Mare (2005) showed that the odds of educational homogamy increased from 1960 to 2003.

## Methodology

This paper focuses on how the wife's return to her husband's education changes over time. Jepsen (2005) performed a similar analysis; however, the author examined the husband's return to his wife's schooling. So that these results are comparable to Jepsen's (2005), the methodology used was similar. The analysis estimated earnings equations using ordinary least squares (OLS) separately for each decade of data. The general form of the equation is

$$y_i = x_i' \beta_1 + \beta_2 z_i + h_i' \beta_3 + \varepsilon_i \quad (1)$$

Here,  $y_i$  is the natural log of wife  $i$ 's annual earnings. Annual earnings, as opposed to wages, was used for two reasons. First, most of the earlier literature used annual earnings. Therefore, doing so allowed for a comparison to earlier work. Second, it was not possible to construct a consistent measure of wages over time. Hours worked in the previous year were not available in 1960 and 1970. While usual weekly hours in the previous year were available for 1980 onwards, weeks worked last year were only available in interval responses for each decade of data.

The vector  $x$  includes the wife's age, age squared, and dummies for race, industry, occupation, and educational attainment. Age and age squared capture the age-earnings profile and are a proxy for general labor market experience. Measuring the wife's education as a series of dummy variables allows for potential sheepskin effects associated with degree completion and a non-linear relationship between

education and earnings. The education categories used are the same as those in Table 1. The omitted category was less than a high school degree. The vector  $h$  includes dummy variables for region of residence and are specific to the household. The variable  $z$  is the husband's education. Following Jepsen (2005), results are presented when measuring the spouse's education as a continuous variable representing completed years of schooling and as a series of educational attainment dummy variables. Finally,  $\varepsilon$  is the random error term.

Estimates of  $\beta_2$  show the relationship between spousal education and earnings. The cross-productivity and assortative mating effects suggest a positive estimate that increases with each decade of data. Most of the earlier literature was concerned with trying to determine whether assortative mating or cross-productivity was more important in explaining the returns to spousal education. However, the methodologies used led to inconclusive results. Some of these papers concluded cross productivity was the main reason behind the estimated returns to spousal schooling, while others concluded assortative mating.

The most recent literature has suggested that enhanced productivity is a by-product of assortative mating (Groothuis and Gabriel 2010). Labor market outcomes are correlated with educational attainment. If spouses match based upon education, then the sharing of professional networks and other forms of productive information is a natural consequence of assortative mating (Bernasco et al. 1998; Groothuis and Gabriel 2010). Therefore, it might not be possible to separate the mating and productivity effects. Furthermore, Benham (1974) noted that it might not be possible to fully isolate one effect from the other because the result of any test for one effect can also be explained by the other. This inability to separate the cross-productivity and assortative mating effects might explain why researchers have come to different conclusions regarding which effect was more important in explaining the returns to spousal education. Therefore, this paper provided no direct test between the two.<sup>9</sup> Instead, it recognized that cross-productivity and assortative mating play important roles in estimating the returns to spousal education and that enhanced productivity may result from assortative mating. Therefore, positive and increasing estimates of  $\beta_2$  are indicative of increasing educational homogamy, productivity, or a combination of the two. Even if cross-productivity plays no role in the returns to spousal education, the changing nature of marital sorting in

<sup>9</sup> In an appendix available upon request, the various tests for assortative mating versus cross-productivity were discussed and performed. Like the earlier literature, the results from these tests were inconclusive regarding which effect was more important when explaining the estimated return to spousal education.

**Table 2** Earnings and Hours Regressions

	1960	1970	1980	1990	2000	2010
Panel A: Earnings						
Full-time working wives	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
$R^2$	1.68	1.26	1.27	1.70	1.91	2.05
$N$	146,920	40,522	355,088	519,840	638,511	121,576
Part-time working wives	-0.00** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
$R^2$	-0.26	-0.92	-1.45	-0.97	-0.97	-1.19
$N$	226,117	57,797	314,857	347,596	332,264	55,327
Panel B: Hours worked						
Full-time working wives			0.02*** (0.00)	0.04*** (0.00)	0.07*** (0.00)	0.07*** (0.01)
$R^2$			0.03	0.03	0.06	0.06
$N$			355,088	519,840	638,511	121,576
Part-time working wives			-0.29*** (0.01)	-0.36*** (0.01)	-0.40*** (0.01)	-0.40*** (0.02)
$R^2$			0.11	0.09	0.09	0.08
$N$			314,857	347,596	332,264	55,327

The sample includes working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, geographic region, industry, and occupation. The omitted categories include less than high school, white, the Northeast, management occupations, and the agriculture industry. For hours worked, the regressions also include the number of children and the number of children under the age of 5

Robust standard errors in parentheses. In panel A, the percentage change in earnings appears below the standard error. The percentage change is calculated as  $(e^{\hat{\beta}} - 1) * 100$ . All regressions use sample weights  
\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

the US is a significant demographic change and understanding its relationship with earnings is important.

## Results

### Husband's Education and Wife's Earnings

While Table 1 shows that the percentage of full-time working wives increased over time, there is still a large percentage who work part time. Therefore, Eq. (1) was estimated separately for full-time and part-time working wives. The results are in Panel A of Table 2. The first set of results in Panel A is for full-time working wives; the second set of estimates is for part-time workers. Since the coefficient associated with the husband's years of schooling is the one of interest, it is the only one shown. The full set of estimates is available on request. Below each standard error is the estimated return to spousal schooling measured as

a percentage.<sup>10</sup> For example, in 1960, for each additional year of schooling completed by the husband, the earnings of full-time working wives increased approximately 1.68%.

Focusing on full-time workers, results indicate that the husband's education had a positive, significant relationship with his wife's earnings in every decade. The estimated return to spousal education was typically less than 2% in most decades. The effect declined from 1.68% in 1960 to 1.26% in 1970, after which it subsequently increased. By 2010, the estimated return to spousal schooling equaled 2.05%. The growth in the return to spousal education was statistically significant. The estimate in 1990 was statistically larger than in either 1970 or 1980, and the estimates in 2000 and 2010 were larger than the estimate in 1960. Moving to part-time working women, results show that the husband's education had a negative, significant relationship with his

<sup>10</sup> The return as a percentage was calculated as  $(e^{\hat{\beta}} - 1) * 100$ .



wife's earnings. Estimated returns to spousal schooling were no smaller than  $-1.5\%$ . Unlike the case for full-time workers, the estimated coefficients had no upward or downward trend over time.

Annual earnings can change because of variation in wages and/or hours worked. To attempt to separate labor supply from wage changes, Eq. (1) was re-estimated using the 1980 to 2010 samples. Here, the dependent variable was the number of hours worked in a typical week in the previous year. The number of children and the number of children under five were added as regressors. The analysis did not use the 1960 and 1970 samples because the hours worked variable was coded as an interval response. The results are in Panel B of Table 2.

Focusing on full-time workers, results show that the husband's education had a positive, growing, and significant relationship with hours worked. This is similar to Benham (1974), who found a positive association between wives' education and husbands' time in the labor market. While the results are significant, they are economically small. The largest estimate occurred in 2000, and it suggests that as the husband's education increased by 1 year, his wife's weekly labor supply increased by 0.07 h. If the wife worked 52 weeks, this implies an increase of 3.64 h during the year. Using the average of the dependent variable in each year as a base, the estimates suggested that weekly labor supply increased by 0.04% in 1980, 0.09% in 1990, 0.16% in 2000, and 0.16% in 2010 for each additional year of schooling by the husband. Therefore, changes in labor supply do not drive the results in Table 2.

For part-time workers, results show that the husband's education had a negative, significant relationship with his wife's weekly labor supply. The magnitude of the coefficient increased in absolute value over time. Unlike full-time workers, these results help explain the negative effect of spousal education on part-time workers' earnings. Using the average of the dependent variable in each year as a base, the estimates suggested that each additional year of schooling completed by the husband reduced his wife's labor supply by 1.03% in 1980, 1.28% in 1990, 1.44% in 2000, and 1.53% in 2010. These percentage declines are similar to (and, in some cases, larger than) those found for earnings in Panel A. Therefore, it appears that the decrease in labor supply associated with the husband's education for part-time workers explains the drop in annual earnings for this group. Since positive returns to spousal education exist for full-time workers, and since decreases in labor supply explain the decline in earnings for part-time workers, the rest of the paper focuses on full-time working wives only.

The results in Panel A of Table 2 came from regressions where the husband's education was measured as a continuous variable and the wife's schooling was a series of dummy variables. This makes comparing the returns to spouse- and

own-education difficult. Equation (1) was re-estimated after replacing the wife's education dummy variables with a continuous measure of schooling. The results are in Panel A of Table 3. The results show that the return to own education was always larger than that for spousal education.<sup>11</sup> Furthermore, the growth in return to own education was much larger than that for spousal schooling. This suggests that while assortative mating may have increased over time, its importance in determining earnings has not grown to the same degree as own-investments in human capital accumulation through formal schooling.

It may be possible that the relationship between spousal schooling and own labor earnings is non-linear. The estimates in Panel B of Table 3 came from Eq. (1) after replacing the husband's continuous measure of schooling with a series of dummy variables. The coefficients associated with each were positive, significant, and suggested that wives with more educated husbands experienced relatively larger earnings premiums when compared to those with less-educated husbands.<sup>12</sup> The coefficient estimates increased from 1960 to 2010. Interestingly, those associated with the husband being a college graduate and having above a college degree increased more than the other two. In fact, the coefficients associated with College Graduate and Post College more than doubled during the period. This finding suggests that those husbands with the highest levels of education drive the increasing, positive relationship between spousal education and own labor earnings shown in Table 2.

The results here suggest an increasing, positive return to spousal schooling for full-time working wives. In a similar study, Jepsen (2005) estimated the husband's return to spousal education using a sample of full-time working husbands from Census data during the period 1960 to 2000. The author found a decreasing, positive return. Given the similarity between studies, it is instructive to compare the main findings. Results from replicating Jepsen's (2005)

<sup>11</sup> In results not shown, Eq. (1) was re-estimated after removing husband's education from the regression. When doing so, the returns to own education changed by 1.5 percentage points or less.

<sup>12</sup> Instead of using educational dummy variables to allow for a non-linear relationship between the husband's education and his wife's earnings, an alternative strategy is to include a quadratic in his years of schooling. Equation (1) was re-estimated when including the husband's years of schooling and years of schooling squared in the regression instead of the educational dummy variables. Results showed that wives experienced a positive return to spousal schooling for every year of completed schooling of the husband. The only exception to this was in 1960 when the husband had 19 years of completed education. However, this value of education only applied to 2% of the sample used in 1960. Furthermore, from 1960 to 1980, wives' earnings increased at a decreasing rate with the husbands' years of schooling. This pattern is reversed starting in 1990. From 1990 onwards, wives' earnings increased at an increasing rate with the husbands' years of schooling. These results are available upon request.

**Table 3** Earnings regressions—different measures of education

	1960	1970	1980	1990	2000	2010
Panel A: Wife's education as continuous variable						
Husband's education	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.47	1.19	1.16	1.56	1.83	2.08
Wife's education	0.03*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.06*** (0.00)	0.07*** (0.00)	0.08*** (0.00)
	2.89	3.58	4.40	6.36	7.21	8.33
$R^2$	0.35	0.26	0.20	0.32	0.35	0.42
$N$	146,920	40,522	355,088	519,840	638,511	121,576
Panel B: Husband's education as dummy variables						
High school grad	0.05*** (0.00)	0.03*** (0.01)	0.05*** (0.00)	0.04*** (0.00)	0.05*** (0.00)	0.06*** (0.01)
	4.86	3.03	4.70	4.34	5.48	6.72
Some college	0.07*** (0.00)	0.06*** (0.01)	0.07*** (0.00)	0.08*** (0.00)	0.10*** (0.00)	0.12*** (0.01)
	7.76	6.57	7.37	8.66	9.99	12.20
College	0.09*** (0.01)	0.07*** (0.01)	0.09*** (0.00)	0.13*** (0.00)	0.16*** (0.00)	0.17*** (0.01)
	8.96	7.43	9.89	13.76	16.81	18.35
Post college	0.09*** (0.01)	0.08*** (0.01)	0.09*** (0.00)	0.15*** (0.00)	0.17*** (0.00)	0.21*** (0.01)
	8.89	8.00	9.90	16.16	19.07	23.05
$R^2$	0.34	0.27	0.20	0.33	0.37	0.44
$N$	146,920	40,522	355,088	519,840	638,511	121,576

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for race, geographic region, industry, and occupation. The omitted categories include white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

main analysis appear in Table 4.<sup>13</sup> The estimates here were slightly larger than those presented in Jepsen (2005); however, the difference was never more than 0.004. The results for full-time working wives in Table 2 and those in Table 4

converged over time. By 2000, they were at parity.<sup>14</sup> The coefficients diverged in 2010, with returns to spousal schooling being larger for husbands than wives. However, the estimates remained closer in size than in any year from 1960 to 1980.

<sup>13</sup> The results from this study are not directly comparable to those in Jepsen's (2005) analysis. The author used an age range of 18–64, allowed individuals to be enrolled in school, and used a slightly different set of independent variables in the earnings equations. Specifically, Jepsen (2005) included potential experience instead of age and had fewer industry and occupation dummy variables. Additionally, Jepsen's (2005) definition of full-time work was working at least 35 h in a week and working at least 45 weeks during the year, as opposed to 40 weeks used in this paper. The difference in the definition of full-time work occurred because the weeks worked variable in the IPUMS dataset was recorded as an interval, with one of the intervals ranging from 40 to 47 weeks.

<sup>14</sup> While the sample used here consisted of full-time working wives, no sample selection correction was performed. This is because the log of annual earnings was used as the dependent variable (recall, a consistent measure of wage cannot be constructed). Annual earnings change because of changes in wages and/or labor supply. For proper identification, sample selection correction methodologies (such as Heckman's two-step procedure) require a variable in the first stage regression that affects participation and not earnings. Since earnings here consist of wages and labor supply, this type of variable is not clear. Anything that affects participation would most likely affect hours worked and, therefore, annual earnings. A variable typically included in the first stage and excluded in the second is number of

**Table 4** Earnings regressions—husbands

	1960	1970	1980	1990	2000	2010
Wife's education	0.03*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	2.66	2.53	2.05	1.86	1.91	2.22
$R^2$	0.35	0.28	0.21	0.32	0.34	0.41
$N$	756,566	165,405	919,941	987,513	1,090,197	193,006

The sample includes full-time working husbands (with spouse present) aged 25–55 with wives aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, geographic region, industry, and occupation. The omitted categories include less than high school, white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

### Age, Occupation, and Industry

The educational shifts, increased age at first marriage, and reduced fertility discussed previously suggest that the returns to spousal education should be larger and grow more for relatively younger women who are in the process of building their careers. To this end, Eq. (1) was re-estimated after separating the full-time working sample into the following age groups: women aged 25 to 35, 36 to 45, and 46 to 55. The results are in Table 5.

For each decade of data, Table 5 shows that the returns to spousal education were relatively larger for younger women. In 1960, returns were 1.87% for women aged 25 to 35 and 1.45% for those aged 46 to 55. By 2010, the estimates were 2.59 and 1.56% for the youngest and oldest age groups, respectively. Table 5 also shows an increase in the returns

to spousal education starting in 1970 or 1980 for each age group. However, this growth was larger for the younger samples. For example, between 1970 and 2010, the returns to spousal education increased from 1.68 to 2.59% for those wives aged 25 to 35, whereas women aged 46 to 55 experienced an increase from 1.00 to 1.56%.

A reduced gender gap in occupation allowed for marital sorting not only on college attendance, but also on eventual occupation (e.g. Goldin 2006). In fact, the data here suggest that in 1960, 53% of full-time working women with at least a college degree worked in occupations associated with education or a library and 15% worked in office/administrative support. By 2010, only 24% of women with at least a college degree worked in education/library occupations. The next top occupations included management (15%) and healthcare practitioner (13%). For 1960 and 2010, the most common occupation for full-time working, college educated men was management (20% in 1960 and 24% in 2010). With men and women increasingly more likely to obtain similar occupations, the gender wage gap also shrank (e.g. Goldin 2006). This change in marital sorting suggests that the return to spousal education would be larger, and grow faster over time, for those wives working in the same occupation as their husbands do. Furthermore, Benham (1974) argued that returns to spousal education should be positive because of information sharing in marriages. Arguably, workers benefit from information-sharing more when the information is related directly to an individual's career development. Therefore, the cross-productivity argument also suggests that it is reasonable to expect higher returns to spousal education when spouses work in the same occupation or the same industry. To this end, Eq. (1) was re-estimated. However, instead of including industry and occupation dummy variables, the estimation was conditioned on whether the

Footnote 14 (continued)

children. Therefore, the Heckman two-step procedure was conducted here when including the number of children and the number of children under 5 years old in the first stage regression. Results from the second stage regression showed that the effect of spousal education on wives' annual earnings equaled 0.018 in 1960, 0.016 in 1970, 0.015 in 1980, 0.018 in 1990, 0.020 in 2000, and 0.018 in 2010. Therefore, the main results from the analysis hold with this sample selection correction procedure. However, the number of children and the number of children under five years old do affect annual earnings. Equation (1) was re-estimated after including these two variables. With each decade of data, these two variables were jointly significant. The results from Table 2 are little changed when including these two variables. The estimated coefficients equaled 0.015 in 1960, 0.012 in 1970, 0.012 in 1980, 0.015 in 1990, 0.018 in 2000, and 0.019 in 2010. Estimates were similar when also including age of the oldest and youngest child in the home in the regressions. Since including these variables did not change the estimated returns to spousal schooling in any meaningful manner, they were not presented in the main results here to maintain comparability to Jepsen's (2005) analysis.

**Table 5** Age cohorts

	1960	1970	1980	1990	2000	2010
Ages 25–35	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)
	1.87	1.68	1.52	2.03	2.22	2.59
$R^2$	0.34	0.27	0.21	0.35	0.38	0.45
$N$	46,804	12,675	163,455	215,422	200,889	33,413
Ages 36–45	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.71	1.21	1.17	1.75	2.03	2.12
$R^2$	0.34	0.26	0.19	0.33	0.38	0.45
$N$	64,096	15,826	118,089	203,159	261,304	45,398
Ages 46–55	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)
	1.45	1.00	1.03	1.19	1.47	1.56
$R^2$	0.38	0.28	0.20	0.30	0.35	0.42
$N$	36,020	12,021	73,544	101,259	176,318	42,765

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, geographic region, industry, and occupation. The omitted categories include less than high school, white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\*  $p < 0.05$ . \*\*  $p < 0.01$ . \*\*\*  $p < 0.001$

spouses worked in the same occupation or industry. Results are in Table 6.

When focusing on occupation, it is clear from Table 6 that, aside from 1960, the return to a spouse's education was larger when both worked in the same occupation. Interestingly, this was not the case with industry of employment. In every year, the wife's return to spousal education was larger when spouses worked in different industries. It is not completely unsurprising to find that working in the same occupation is more important than working in the same industry. Within an industry, there are many different types of occupations, and information that helps one type of occupation might not be useful to another. For example, the professional network available to a research analyst may not be helpful to an accountant working in the same industry who is looking for a new job. In fact, most couples who work in the same industry work in different occupations. In 1960, 58% of couples who worked in the same industry worked in different occupations. This percentage grew every year; by 2010, it equaled 68%.

### Marital Characteristics

Given the changes in marriage, marital sorting, and fertility described throughout this paper, it is reasonable to expect different returns to spousal schooling for women based upon

different characteristics of the marriage. First, estimates may differ based upon whether the wife has more or fewer years of schooling than the husband. Second, due to time constraints involved with raising children, results may differ by the presence of children in the house. Finally, estimated returns may differ based upon whether the woman is in her first marriage or a higher order marriage (i.e. second marriage or above). To this end, Eq. (1) was re-estimated using various sub-samples of full-time working wives. Results are in Table 7.

Panel A of Table 7 separates the sample by whether the wife had different years of schooling than the husband. The return to spousal education was somewhat larger for wives in marriages where the husband had completed more years of education. Panel B delineates the sample by the presence of children. Results show that the effect of the husband's education was slightly larger when the couple had no children. This finding is consistent with the idea that those couples without children can spend more time in the labor market and have a greater incentive to invest in human capital.

Results in Panel C separate the sample into those wives in their first marriage and those in a higher order marriage. Data on order of marriage was only available for 1960, 1980, and 2010. Regardless of decade, the coefficient associated with husband's schooling was larger for those wives

**Table 6** Occupation and industry of employment

	1960	1970	1980	1990	2000	2010
Same occupation	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.04*** (0.00)
	2.31	2.01	2.28	2.87	3.24	3.68
$R^2$	0.17	0.18	0.15	0.30	0.34	0.38
$N$	28,257	7121	52,956	71,204	82,238	15,666
Different occupation	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)
	2.42	1.83	1.52	2.10	2.29	2.70
$R^2$	0.23	0.15	0.12	0.22	0.25	0.30
$N$	115,624	35,144	296,451	440,880	540,958	102,515
Same industry	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)
	2.00	1.61	1.60	2.10	2.04	2.62
$R^2$	0.16	0.18	0.13	0.26	0.28	0.33
$N$	46,391	11,279	98,027	131,908	152,841	29,736
Different industry	0.03*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
	2.64	2.10	1.63	2.27	2.64	3.05
$R^2$	0.24	0.16	0.12	0.23	0.26	0.30
$N$	100,284	28,188	251,380	380,176	470,355	88,445

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, and geographic region. The omitted categories include less than high school, white, and the Northeast

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

in higher order marriages. It is difficult to draw conclusions from this finding. For wives in higher order marriages, these results suggest that the first marital partner was a poor match. With a higher quality match in the second marriage, it is reasonable to expect a higher return to spousal education due to both the cross-productivity and assortative mating effects. For wives in their first marriage, the estimated coefficient could be smaller because of two opposing forces. Some wives are in marriages that will eventually end in divorce. These lower-quality marriages will pull the coefficient closer to zero. Some wives, however, are in marriages that will not end in divorce. These relatively high-quality marriages will pull the coefficient away from zero.

### Characteristics of Husband and Wife

It may be possible that the relationship between the husband's schooling and the wife's earnings differs by individual characteristics of each marital partner. The various characteristics explored in this subsection are education and race of the wife and the earnings distribution of the

husband. To this end, Eq. (1) was re-estimated using the sample of full-time working wives. The results appear in Tables 8 through 10.

Table 8 presents regression results after estimating Eq. (1) separately by the wife's education level. The coefficient associated with the husband's schooling was always positive. Generally, from 1960 to 1990, aside from those wives with more than a college degree, the relationship between the husband's schooling and the wife's earnings weakened as the wife increased her level of education. This pattern changes in the latter decades. In 2000 and 2010, the returns to spousal schooling generally increased as wives received higher levels of education. This finding of higher returns to spousal schooling for women with more education in the latter decades is intuitive. The gender gap in college major shrank during the period studied here (Goldin 2006; Kim and Sakamoto 2017; Van Bavel et al. 2018), which means that marital sorting can occur not only on college attendance, but also on field of study. Furthermore, the sharing of productive information should be easier when spouses specialize in the same field.

**Table 7** Marital characteristics

	1960	1970	1980	1990	2000	2010
Panel A: Different years of schooling						
Husband's educ > wife's educ	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	2.52	1.64	1.66	1.94	2.13	2.15
$R^2$	0.32	0.25	0.18	0.28	0.32	0.38
$N$	40,702	11,299	116,357	152,811	160,357	25,501
Husband's educ < wife's educ	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	2.21	1.76	1.62	1.85	1.96	1.89
$R^2$	0.38	0.31	0.22	0.35	0.37	0.42
$N$	64,467	15,531	107,896	154,144	201,396	45,826
Panel B: Presence of children						
No children	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.69	1.46	1.49	1.97	2.16	2.12
$R^2$	0.38	0.29	0.21	0.34	0.35	0.40
$N$	54,958	11,884	104,347	155,071	200,445	36,516
Has children	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.59	1.11	1.13	1.52	1.76	2.02
$R^2$	0.32	0.26	0.19	0.32	0.37	0.45
$N$	91,962	28,638	250,741	364,769	438,066	85,060
Panel C: Number of marriages						
1st marriage	0.02*** (0.00)		0.01*** (0.00)			0.02*** (0.00)
	1.53		1.14			1.96
$R^2$	0.34		0.20			0.45
$N$	122,600		287,760			95,906
Higher order marriage	0.02*** (0.00)		0.02*** (0.00)			0.02*** (0.00)
	2.29		1.79			2.39
$R^2$	0.38		0.19			0.39
$N$	24,320		67,328			25,670

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, geographic region, industry, and occupation. The omitted categories include less than high school, white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

The temporal pattern exhibited by the coefficients in Table 8 matches the main finding in the paper for four of the five educational categories. For wives with at least a high school degree, the returns to spousal schooling increased over time. This was particularly true of wives with a college degree or more. For those with less than a high school education, the relationship between the husband's schooling and the wife's earnings actually weakened over time. Again,

this finding is intuitive. The own return to higher education increased substantially during the period studied here, particularly since the 1980s (e.g. Levy and Murnane 1992). Therefore, given increasingly higher returns to schooling, and given documented increases in educational homogamy (Mare 1991; Schwartz and Mare 2005), it is reasonable to expect an increase in the return to spousal schooling for wives with higher levels of education.

**Table 8** Education of wife

	1960	1970	1980	1990	2000	2010
Less than high school	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
	2.01	1.53	1.59	1.44	1.32	1.28
$R^2$	0.33	0.20	0.09	0.15	0.13	0.16
$N$	63,745	12,805	64,665	55,549	52,010	5518
High school	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.40	1.09	1.13	1.64	1.68	1.99
$R^2$	0.22	0.16	0.13	0.18	0.18	0.22
$N$	58,354	19,178	163,651	187,455	185,908	26,196
Some college	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.11	0.92	1.10	1.59	1.78	1.94
$R^2$	0.17	0.15	0.13	0.20	0.21	0.26
$N$	15,810	5163	69,990	158,816	213,403	38,272
College graduate	0.00 (0.00)	0.00 (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	0.27	0.33	0.55	1.42	1.89	2.20
$R^2$	0.15	0.13	0.12	0.18	0.22	0.26
$N$	5968	2018	32,379	78,602	122,979	31,209
After college	0.00 (0.00)	0.01* (0.01)	0.01*** (0.00)	0.02*** (0.00)	0.03*** (0.00)	0.02*** (0.00)
	0.07	1.38	1.16	2.52	2.83	2.31
$R^2$	0.15	0.15	0.13	0.18	0.21	0.25
$N$	3043	1358	24,403	39,418	64,211	20,381

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for race, geographic region, industry, and occupation. The omitted categories include white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\hat{\beta}} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

Table 9 presents estimates separately for Caucasian and African American wives.<sup>15</sup> Regardless of race, the relationship between the husband's education and the wife's earnings increased over time starting in 1970 for Caucasian wives and 1980 for African Americans. From 1960 to 1980, the return to spousal schooling was larger for African American wives. The reverse was true from 1990 to 2010. The racial differences in returns to spousal schooling may be

related to differences in the trends in marriage, divorce, and educational homogamy. Stevenson and Wolfers (2007) noted that, while marriage rates for both races increased during the early 1900s, African Americans had higher rates of marriage than Caucasians did. Throughout the 1940s and 1950s, however, this pattern changed. Caucasians married at higher rates than their African American counterparts did. Marriage rates also started decreasing for both races; however, the decrease was substantially larger for African Americans. Stevenson and Wolfers (2007) also showed that the percentage ever being divorced increased for both races, and this increase was larger for Caucasians than African Americans. In terms of marital sorting, Eika et al. (2018) showed that African Americans consistently had lower levels of educational homogamy than Caucasians did. Furthermore, while

<sup>15</sup> Equation (1) was also estimated separately based upon the nativity of the wife. The results are available upon request. The coefficient associated with spousal schooling was larger for native-born, full-time working wives relative to their foreign-born counterparts. Furthermore, while the coefficient grew over time for native born women, it was relatively stable for the foreign-born group.

**Table 9** Race of wife

	1960	1970	1980	1990	2000	2010
Caucasian	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	1.48	1.12	1.24	1.77	2.01	2.13
$R^2$	0.26	0.23	0.20	0.33	0.37	0.43
$N$	131,800	35,387	304,498	456,600	551,587	103,433
African American	0.02*** (0.00)	0.02*** (0.00)	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
	2.19	2.01	1.47	1.59	1.71	1.77
$R^2$	0.48	0.40	0.20	0.37	0.35	0.42
$N$	13,835	4488	39,704	42,357	52,813	8620

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, geographic region, industry, and occupation. The omitted categories include less than high school, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\hat{\beta}} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

both races experienced an increase in educational homogamy from the 1960s until the 1980s, the increase was much faster for African Americans.

Table 10 shows results from estimating Eq. (1) separately by quartile of the husbands' earnings distribution in each year. The husbands' earnings distribution came from the earnings of husbands married to the full-time working wives used throughout the analysis. To allow for non-working husbands, zero earnings were included. The distribution was then separated into quartiles, and Eq. (1) was re-estimated separately for each. Results suggest that the returns to spousal schooling were larger for wives in the bottom and top quartiles of the husbands' earnings distribution, with larger returns for those wives in the first. Table 10 also shows that the coefficient associated with the husband's schooling increased over time for each quartile of the distribution starting in 1970 or 1980.

## Conclusions

This paper studies the relationship between the husband's education and his wife's earnings from 1960 to 2010 using data from the U.S. Census and American Community Survey. Results show that for full-time working wives, the return to spousal education was between 1.3 and 2% per completed year of schooling. For part-time working wives, the association between earnings and spousal education was negative;

however, this was due to a negative labor supply response associated with the husbands' educational attainment.

The magnitude of the coefficient for full-time working wives is in line with other studies of the relationship between the husband's education and the wife's earnings. Most estimates in the literature ranged from 1.5 to 3.4% (Wong 1986; Huang et al. 2009; Mano and Yamamura 2011). Therefore, the estimates presented here are on the lower end of this range. Tiefenthaler (1997) and Amin and Jepsen (2012) reported larger estimates, 5 to 8%. The only other study using U.S. based data is Groothuis and Gabriel (2010); the results from that study are not comparable to the ones presented here because the authors allowed for an interaction between spousal and own education in their model.

This study finds that the magnitude of the relationship between spousal schooling and own earnings was smaller for full-time working women than their male counterparts. This is consistent with the earlier literature. Wong (1986), Tiefenthaler (1997), Huang et al. (2009), and Groothuis and Gabriel (2010) studied the relationship between spousal schooling and own labor earnings for each gender. Only Huang et al. (2009) found that women experience a larger return to spousal schooling than men do. The Huang et al. (2009) paper is also the only one to use a fixed-effects methodology (specifically, a twins-level fixed-effect).

When focusing on full-time working wives, the return to spousal education increased over time. In fact, the relationships between spousal education and own labor earnings are now near parity for both genders. Additional results show that the returns to the husband's schooling were larger and



**Table 10** Earnings distribution of husbands

	1960	1970	1980	1990	2000	2010
Quartile 1	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
	1.69	1.42	0.97	1.18	1.21	1.42
$R^2$	0.40	0.26	0.15	0.30	0.35	0.43
$N$	35,544	9700	84,103	132,717	173,816	30,695
Quartile 2	0.01*** (0.00)	0.00** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
	0.82	0.48	0.71	0.69	0.78	0.90
$R^2$	0.24	0.20	0.18	0.26	0.29	0.36
$N$	38,763	12,629	85,099	120,915	138,194	30,331
Quartile 3	0.01*** (0.00)	0.00 (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
	0.64	0.06	0.53	0.62	0.90	0.54
$R^2$	0.22	0.23	0.19	0.27	0.31	0.35
$N$	38,170	7046	97,113	133,541	173,167	31,598
Quartile 4	0.01*** (0.00)	0.01** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
	0.95	0.58	0.63	0.96	1.22	1.35
$R^2$	0.23	0.24	0.20	0.29	0.33	0.37
$N$	34,443	11,147	88,773	132,667	153,334	28,952

The sample includes full-time working wives (with spouse present) aged 25–55 with husbands aged 25–55, neither spouse is enrolled in school during the reference period, neither spouse is employed in the military, is self-employed, or is an unpaid family worker

All regressions include a quadratic in age and dummies for education, race, geographic region, industry, and occupation. The omitted categories include less than high school, white, the Northeast, management occupations, and the agriculture industry

Robust standard errors in parentheses. The percentage change in earnings appears below the standard error.

The percentage change is calculated as  $(e^{\beta} - 1) * 100$ . All regressions use sample weights

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

have grown more for relatively younger women who are in the process of building their careers. During the last half of the 20th century, female educational attainment increased relative to their male counterparts, age at first marriage increased, fertility declined, the gender gap in field of study, occupation, and earnings shrunk, and female attachment to the labor force strengthened (Goldin 1992, 2006; Stevenson and Wolfers 2007; Kim and Sakamoto 2017; Van Bavel et al. 2018). Additionally, assortative mating with regards to education and earnings increased (Mare 1991; Schwartz and Mare 2005; Gonalons-Pons and Schwartz 2017; Eika et al. 2018). These findings are, therefore, consistent with both the cross-productivity and assortative mating effects. Some researchers argued that enhanced productivity is a natural by-product of educational homogamy, and it may not be possible to isolate one effect from the other. However, even if assortative mating does not lead to true increases in labor market productivity, the results presented here are still consistent with a number of important demographic changes that have occurred over the last 60 years.

Whether this trend of increasing returns to spousal schooling for full-time working wives will continue is yet to be determined. Goldin and Mitchell (2017) noted how recent birth cohorts have not experienced the same increase in labor force participation at younger ages as in the past. Therefore, the returns to spousal schooling for younger women may not increase to the same extent as shown here. However, with younger women remaining strongly attached to the labor market and experiencing smaller employment effects from childbirth, Goldin and Mitchell (2017) stated that women will continue to work longer than before and have steeper age-earnings profiles. This may lead to continued increases in returns to spousal education later in a woman's working life.

It is difficult to judge how the US compares to other countries in terms of changes in the returns to spousal schooling over time. As Goldin and Mitchell (2017) noted, rates of female labor force participation in the US are low compared to other OECD countries, and the US ranking in this area has decreased over time. Additionally, Stevenson and Wolfers

(2007) stated that rates of marriage, divorce, cohabitation, and fertility are different for the US relative to Canada and some European countries. Importantly, Stevenson and Wolfers (2007) noted how the US has a relatively lower mean age at childbirth when compared to Canada and some European nations. With a higher age at childbirth and a higher degree of labor force participation, it is reasonable to expect that female returns to spousal schooling would be larger for these other nations relative to the US. Furthermore, if these trends persist, then the female returns to spousal schooling for other nations may grow at a faster rate. Exactly how these different demographic changes in other countries interact to influence female returns to spousal schooling over time, relative to the US, would be an interesting area for future research.

A key limitation to this study is that the analysis does not explicitly account for temporal changes in selection into marriage and women's selection into employment. Relative to earlier decades, marriages in recent years are more positively selected along the dimensions of education and earnings (Van Bavel et al. 2018). Furthermore, the divorce risk for high-education, high-earning women relative to low-education, low-earning women has decreased (Van Bavel et al. 2018). Women also have strengthened their attachment to the labor force over time (e.g. Goldin 2006). Therefore, full-time working wives in the latter decades may be inherently different from their counterparts in earlier years. These complex demographic changes and unobservable differences across cohorts could be affecting the estimates presented here.

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## Compliance with Ethical Standards

**Conflict of interest** The author declares that there is no conflict of interest.

**Ethical Approval** This study uses publicly available, secondary data from the US Census and American Community Survey. For this type of study, formal consent is not required.

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**Nicholas A. Jolly** is an associate professor of economics at Marquette University. He received his Ph.D. in economics from the University of Connecticut. Dr. Jolly's major research focus is on individual and family adjustments to financial shocks such as involuntary job losses and work-limiting health conditions.