Labour supply and education within households

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Why are married women's work hours related to their husbands' education levels and what do patterns in this relationship tell us about labour supply decisions within households? Three hypotheses are offered to explain why a woman's work hours might be related to her husband's education, even controlling for his wage rate. Data for a single cohort of women suggest that women's work hours are positively related to spousal education at the time of marriage but also fall more rapidly over time after marriage among those with the most educated husbands. Repeated cross-sectional data indicate that the latter effect appears to have increased since 2000. Overall, the results provide evidence consistent with both marital sorting on the basis of work preferences and a causal effect of husbands' long-run earnings on women's labour supply. Little support is found for the argument that spousal education measures non-market productivity.

1. Introduction

> A woman, in any rank of life, ought to know whatever her husband is likely to know, but to know it in a different way. His command of it should be foundational and progressive; hers, general and accomplished for daily and helpful use… A man ought to know any language or science he learns, thoroughly – while a woman ought to know the same language, or science, only so far as may enable her to sympathize in her husband's pleasures, and in those of his best friends.
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> John Ruskin, "Of Queens' Gardens" (1865)

After expanding rapidly during the 1980s, labour force participation among married women stagnated during the 1990s and began to fall during the last decade and a half. This pattern does not appear to have been caused by economic factors, since women's wages grew rapidly throughout this period and the opportunity costs of labour market time, in the form of the cost of child care and housekeeping, are likely to have fallen. Instead, some have pointed to the possibility that changes in preferences for household production, including raising children, have been at least partly responsible for the slowdown in labour supply among married women. An influential 2003 *New York Times* article by Lisa Belkin described a trend among highly-educated women of withdrawing from the labour market after marriage. However, subsequent empirical research has found little support for this so-called "opt-out revolution" Rather, women have become steadily less likely to exit the labour market upon childbirth over recent decades, regardless of their education level (Goldin 2006; Percheski 2008; Antecol 2011; Fortin 2015), although there is some evidence that fertility has increased lately

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among educated women (Vere 2007; Shang and Weinberg 2013). A follow-up *New York Times* article a decade later even conceded that "The Opt-Out Generation Wants Back In" (Warner 2013).

One potential explanation is that the observed changes in women's labour market behaviour have been driven by changes in how responsive the women are to their husbands' characteristics. At first glance, this seems an unlikely proposition, since husbands' wage rates have had an increasingly weak effect on married women's labour supply (Blau and Kahn 2007) and household production (Connelly and Kimmel 2007) in recent decades. There is little evidence, however, that other spousal characteristics have become similarly unimportant.

A husband's education is known to be strongly related to his wife's labour supply, even though a number of factors might underlie this relationship. As well as measuring his human capital, a man's education level is likely to reflect many non-economic attributes, such as his ability to perform household tasks and his taste for a traditional arrangement of roles within the household. Women may be more likely to work if they have husbands who place little value on household production or who are very productive at home. Conversely, they may be less likely to work if their husbands are particularly attached to their jobs or have high future earnings. In either case, women's labour supply will be related to the education of their husbands, even after controlling for the current wage rate of the latter.

The relationship between a woman's labour supply and her husband's wage rate has changed shape in recent years from and is no longer downward sloping but instead has an inverse U shape (Bredemeier and Juessen 2013). Might the relationship between labour supply and spousal education have undergone similar changes? Rather than being a function of women's education, might the opt-out revolution instead reflect bigger declines in labour supply after marriage among women with highly-educated husbands compared to similar women with less educated husbands?[1]

This aim of this paper is to examine why a married man's education has an effect on his wife's labour market behaviour, after controlling for his wages, and whether this can explain the changing pattern of labour supply among married women. Does education reflects a man's non-market human capital, his preferences regarding the household division of labour or his expected lifetime income? Each of these

[1] Indeed, although little noted, most of the women referred to in Belkin's article and subsequent media reports were married to equally highly-educated men.

explanations yields a different prediction regarding the direction of the relationship and how it should vary over the course of a marriage. These predictions are then tested using 30 years of data on a single cohort of American women from the National Longitudinal Survey of Youth (NLSY) 1979, as well as four cross-sections of data from the Current Population Survey (CPS) spanning the same time period (specifically, 1980-2010).

2. Previous work and hypotheses

Although studies of female labour supply routinely include husbands' education as an explanatory variable, very few have focused on the magnitude and direction of its effect, once wages are controlled for. Pencavel (1998) used 1990 Census data and uncovered a negative relationship between a husband's education and his wife's work hours, which was stronger for those couples with children aged under 6 years. In contrast, using a sample of Chinese twins to control for omitted variable bias, Huang *et al*. (2009) found that a man's education affects his wife's wages but not her work hours.

Pencavel speculated that once wages have been held constant, more education indicates greater non-market productivity, in the form of better health or better child-raising ability. Pencavel presumably believed that women substitute time on both market and household work with leisure time when their husbands are more educated (given the negative labour market effects of spousal education he reported). In light of evidence suggesting that, all else equal, women with educated husbands tend to replace housework with market work at a similar rate to which they replace housework with leisure (Hersh and Stratton 1994), it may be more reasonable to think that women would switch from household work to market work when their husbands are more productive in the household.[2] The possibility that a woman's labour supply decisions might be affected by her husband's education because education reflects non-market productivity will be referred to throughout the paper as the "productivity hypothesis".

A second explanation for the labour market effects of spousal education derives from the fact that men and women do not match randomly in the marriage market. Many papers have documented the fact that women tend to match with men of the same education level in the United States and that marriages have become more strongly (positively) correlated over the past half-century (Mare 1991; Pencavel 1998; Schwartz

[2] Hersh and Stratton's estimates suggest that having a husband with a post-school education increases weekly leisure time by 1.65 hours, holding work time constant, but (using a reparameterisation) increases weekly labour supply by 1.84 hours, holding leisure constant.

and Mare 2005). Other papers have found a similar pattern regarding matching on the basis of income (Schwartz 2010) and claim that changes over time in the shape of the relationship between married women's hours and their husbands' wage levels are driven by the extent of assortative matching on wages (Bredemeier and Juessen 2013). If a woman's preferences for work are not fully captured by her education and other control variables and if women with a strong attachment to the labour market tend to marry more educated men, spousal education will be positively correlated with a woman's work hours. However, this does not reflect a causal effect of husband's education on work hours during marriage, merely selection on the basis of women's work preferences. The argument that spousal education simply reflects a wife's own labour market attachment will be termed the "sorting hypothesis".

Finally, it might be the case that spousal education affects a woman's labour supply because it reflects a husband's future labour market prospects. In this case, even after controlling for a man's current wage, his education level may have a negative effect on his wife's labour supply because it implies that he will have higher earnings in the future (and that his current wage is a relatively bad draw from his lifetime wage distribution, compared to a person with the same wage but less education). This argument will be termed the "earnings hypothesis".

The sorting hypothesis refers to the relationship between hours and spousal education at the time of marriage. In contrast, the productivity and earnings hypotheses should only manifest themselves over time after marriage – and especially in conjunction with child birth – as married couples adjust their work hours optimally in response to each other's market and non-market human capital.

3. Data

In order to produce evidence on the labour supply effects of spousal education, the empirical analysis uses data from two sources: the CPS and the NLSY 1979. The CPS provides representative cross-sectional data over multiple decades and allows a broad analysis of how the relationship between labour supply and spousal education has evolved. In contrast, the NLSY provides longitudinal data on a single cohort of individuals, with more detailed information on flows in and out of marriage and on preferences. A full explanation of how the two datasets were constructed is provided in Appendix 1.

NLSY data

The NLSY 1979 is a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979.[3] These individuals were interviewed annually until 1994 and are currently interviewed on a biennial basis. This study uses data for 1979-2008, although to focus on the decisions of prime-aged couples, the labour supply regression samples are restricted to women aged 25-54 (the oldest respondent in the sample is 50) with husbands aged 25-54.

Hourly wages were constructed from the annual earnings and hours worked by a respondent and his/her spouse during the year prior to each interview. All monetary values are expressed in 2000 dollars, using the National Income and Product Account price index for personal consumption expenditures. For those who did not work in a given year, had missing income or work hours data, received self-employment income or had a wage rate less than $2 or greater than $200, the wage rate is interpolated.[4]

The own and spouse education variables used in the analysis consist of four dummy variables, capturing whether a person's highest attained level of education was Grade 11 or less, Grade 12, some college but not a degree, or a college degree or higher. These categories were constructed from the NLSY data on highest schooling grade completed, with anyone who reported at least 16 years of schooling assumed to have obtained a college degree.

Other variables that are used in the labour supply regressions include own and spouse age; percentile score on the Armed Forces Qualification Test (AFQT); family rent, dividend and interest income; Census region of residence; urban status; and presence of a child aged under 6 in the household.

The NLSY intermittently asked a series of eight questions designed to elicit respondents' attitudes towards the roles of women. In the 1979, 1982, 1987 and 2004 interviews, respondents were asked to evaluate the following statements on a four-point scale: "a woman's place is in the home, not in the office or shop", "a wife who carries out her full family responsibilities doesn't have time for outside employment", "a working wife feels more useful than one who doesn't hold a job", "employment of wives leads to more juvenile delinquency", "employment of both parents is necessary

[3] Hence, these women were aged 38-46 at the time Belkin wrote her article in 2003, making them only a few years older than most of the women she interviewed (who were predominantly in their mid-30s).

[4] Imputing missing wage observations using regression models instead made little difference to the results presented in the following section.

to keep up with the high cost of living", "it is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family", "men should share the work around the house with women, such as doing dishes, cleaning and so forth" and "women are much happier if they stay at home and take care of their children". A response may be coded as 1 (strongly disagree), 2 (disagree), 3 (agree) or 4 (strongly agree).

Figure 1 plots the average response to each question by sex and education level, using data from the survey wave closest to the year a respondent was 21. Other than Question 3 (on the usefulness of working wives), men consistently display more conservative attitudes than women with the same level of education. More education is strongly (and monotonically) associated with more liberal responses to all questions, except Questions 3 and 5 (on the need for both parents to work).

Means for some of the key variables used in the NLSY labour supply regressions are presented in Table 1. Each observation here represents a person-year combination. The first two columns report means for the married women in the sample; the last two columns report means for the wives of the married men in the sample. Since women tend to marry at younger ages than men, the former sample has a greater average marriage length and a larger fraction of remarried women.

CPS data

Data from the March CPS are also used in the next section to estimate the relationship between labour supply and spousal education. To increase the sample size, three years of data were pooled for each decade: 1978-1980, 1988-1990, 1998-2000 and 2008-2010. For convenience of elucidation, these samples are referred to as "1980", "1990", "2000" and "2010". The CPS sampling weights for the March supplement are used throughout the analysis, adjusted so that each year is weighted equally. As with the NLSY data, data are restricted to married individuals aged 25-54 with a spouse present who is also aged 25-54. Also as in the NLSY, hours worked in the previous year is used as the measure of labour supply, in this case constructed by multiplying usual hours worked per week and weeks worked in the previous year.

Own and spouse's hourly earnings are constructed using wage and salary income in the previous year (again expressed in 2000 dollars using the National Income and Product Account price index) and annual hours worked. Non-labour income is defined as the sum of interest, dividend and rental income. Those with wages less than $2 or

greater than $200, those who worked no hours or were self-employed and those with allocated earnings data are assigned imputed wages, equal to the predicted values from a series of wage regressions. Following the approach of Blau and Kahn (2007), separate imputation regressions were run for each combination of sample period, gender and whether a person worked less than 20 weeks (including zero weeks) or 20 or more weeks in the previous year.

The same four categories of education are constructed as in the NLSY sample, with Jaeger's (1997) suggested taxonomy used to assign years of schooling to each person in the 2000 and 2010 samples first, due to changes the CPS made to its education coding scheme.

Although the CPS has not historically recorded whether a person is living with a romantic partner outside of marriage, the Census Bureau's Partners of the Opposite Sex Sharing Living Quarters (POSSLQ) definition provides an imperfect method for identifying such couples (Casper and Cohen 2000). Under POSSLQ, a cohabiting couple exists whenever there is a pair of unrelated adults (aged 15 or over) of the opposite sex living together in a household in which there were no other adults present. This definition was used to create a sample of unmarried cohabitants in each period.

Under the CPS sampling plan, households are interviewed in the same four calendar months in two consecutive years. This means that half of the sample in any year can (theoretically) be matched to the previous year. Using the approach outlined by Madrian and Lefgren (2000), these longitudinal matches were constructed. Only married couples who lived together in two consecutive years will be included in this sample, meaning that newlyweds and divorcing couples will be excluded. However, since the CPS is a survey of dwellings, couples who move house or are temporarily separated will also be excluded from the longitudinally-matched sample.

Table 2 presents means for some of the primary variables in the CPS sample. Hours worked by married women increased sharply in the 1980s, much more gradually in the 1990s and fell slightly in the 2000s. Meanwhile, there was a dramatic increase in education among married women, with the fraction of women with a college degree more than doubling between 1980 and 2010. Although not shown in the table, there has also been a modest increase in the degree of assortative matching of couples by education over the past three decades. In 1980, 53% of couples had the same education level; by 2010, this had risen to 58%, with over half the increase occurring during the 2000s.

4. Results

The three explanations for why spousal education affects labour supply that were outlined in Section 2 – the productivity hypothesis, sorting hypothesis and earnings hypothesis – generate different predictions for the direction of the relationship and how it should vary over time and over the course of a given marriage. In this section, the longitudinal data from the NLSY 1979 and cross-sectional data from three decades of the CPS are used to test these predictions.

Results for a single cohort

To determine whether spousal education has an effect on labour supply among married women, after controlling for own education and wage variables, the following equation for person *i* in year *t* was initially estimated using the NLSY sample:

$$n_{it} = a_0 + a_1 \ln w_{it} + a_2 \ln \overline{w}_{it} + \sum_{j=2}^{4} a_{3j} I(e_i = j) + \sum_{j=2}^{4} a_{4j} I(\overline{e}_i = j) + \mathbf{x}'_{it}\boldsymbol{\alpha} + u_{it}, \qquad (1)$$

where n is annual hours worked, w and $\overline{w}$ are own and spouse hourly wage offer, respectively, and the $I(\cdot)$ terms are indicator variables for each level of own or spouse education. As noted in the previous section, four education categories are considered – less than high school, high school graduate, some college, college graduate – and the first of these is used as the reference category. The additional control variables in **x** include family non-labour income, quadratics in own and spouse age and dummy variables for remarriage, Census region (4 categories), metropolitan area and year (19 categories).

The first column of Table 3 presents the results of tobit estimation of Equation 1. Spousal education is found to have an inverse U-shaped effect on hours, controlling for own education and own and spouse wages. Relative to those women whose husbands do not have a high school diploma, women whose husbands have Grade 12 work about 146 extra hours each year. Acquiring more education past this point does not result in a man's wife working more. Instead, a woman's annual hours fall by 40 when her husband has a college degree rather than a school diploma.[5]

[5] Alternative specifications using the probability of working and annual hours conditional on working as measures of labour supply are reported in Table A1. These reveal that different types of labour supply adjustment appear to underlie the inverse U-shaped relationship in Table 3. The positive marginal effect of a husband having Grade 12 is generated by women entering the labour market, while the negative effect beyond Grade 12 is mainly produced by women cutting back on hours.

The sorting hypothesis should hold even at the time of marriage, whereas the other two hypotheses are likely to take effect only gradually, over the course of a marriage. In order to do examine this, the education dummy variables in Equation 1 are interacted by the number of years since marriage, *t*:

$$n_{it} = b_0 + b_1 \ln w_{it} + b_2 \ln \overline{w}_{it} + \sum_{j=2}^{4} b_{3j} I(e_i = j) + \sum_{j=2}^{4} b_{4j} I(\overline{e}_i = j) + b_5 t$$
$$+ \sum_{j=2}^{4} b_{6j} I(e_i = j) \times t + \sum_{j=2}^{4} b_{7j} I(\overline{e}_i = j) \times t + \mathbf{x}'_{it}\boldsymbol{\beta} + \upsilon_{it}. \qquad (2)$$

When Equation 2 is estimated using tobit estimation in the second column of Table 3, a very different pattern is found from before. Husband's education has a strong positive effect on married women's hours at the time of marriage and the relationship is now monotonic. Over the course of their marriages, however, women tend to withdraw from the labour market, with those women married to college graduates cutting back by 32 hours more each year than those with husbands who do not have a high school diploma. The fact that spousal education has an increasingly *negative* effect on women's labour supply over time is inconsistent with the productivity hypothesis. However, the inverse U-shaped relationship found in the second column of Table 3 is consistent with a combination of the sorting hypothesis operating *across* marriages and the earnings hypothesis operating over time *within* marriages.

To illustrate the patterns seen in the second column of Table 3, Figure 2 plots the relationship between predicted women's hours and husbands' education at various stages of marriage: among newlyweds, among those at the mean years of marriage (9.73 years) and among those with 20 years of marriage. The left-hand panel sets all variables other than spousal education equal to their sample means. The upward-sloping curve at the time of marriage flattens over time and gives way to an inverse U-shaped relationship. Although the slope of the curve is rather flat at the mean length of marriage (reflecting the weak results in Table 3), a highly significant downward slope is found above Grade 12 after 20 years of marriage. Since most women tend to marry men with the same education level (and the degree of assortative mating has increased over time), it is useful to consider the effects on labour supply of changing the education of *both* spouses. In the right-hand panel, women's education is set equal to their husbands'. A stronger upward-sloping relationship is found among newlyweds, although again hours decline over time at the top end, until after 20 years women's hours are significantly lower in college-educated couples than in couples with Grade 12 only.

To examine whether a husband's education reflects a woman's preference for working either before or during marriage, in the third column of Table 3, measures of each are added as regressors. The woman's average work hours in the years prior to marriage is used as a measure of work preference before marriage.[6] To obtain a measure of work preference during marriage, factor analysis was used to form a single factor from the eight questions on attitudes towards gender roles.[7] Questions 3, 5 and 7 load negatively on the factor, while the others load positively, indicating that a high factor score indicates a preference for a traditional household arrangement. Both variables are highly significant and have the expected effect on work hours; however, their inclusion only lowers the coefficients on the spousal education variables by around a fifth, suggesting that unmeasured preferences may be largely responsible for the observed pattern.[8]

In the last column of Table 3, a household fixed effect (*i.e.* a separate dummy for each marriage a person has) is added to Equation 2, to control for all observed and unobserved time-invariant factors that influence the division of labour within a household. The main spousal education effects drop out of this regression, but the negative effects of the interacted spousal education variables remain, at least for college-educated husbands. Again, this runs counter to the predictions of the productivity hypothesis.

Table 4 repeats the specifications from Table 3 using the sample of women married to male participants in the NLSY. Once again, a U-shaped relationship between a women's work hours and her husband's education is found, reflecting a monotonic relationship at the time of marriage and larger post-marriage labour supply reductions for those with more highly-educated husbands. However, the magnitudes of these effects are smaller than in Table 3. In the third column, the husband's average work hours before marriage and index of attitudes towards female roles are added. In contrast to Table 3, only the latter is significant (and then only marginally) and the inclusion of the two variables reduces the main effects of spousal education by only around a tenth, suggesting that spousal education does not capture the effects of a husband's

[6] Women who were not observed before marriage are dropped.

[7] The iterated principal factor method was used on data from the survey wave closest to the year a respondent was 21, with separate specifications for men and women.

[8] These results are confirmed by a regression for husband's education (measured by years of schooling), in which a wife's work hours in the year prior to marriage and attitude towards gender roles are both found to be significant, even controlling for other characteristics (including the woman's education).

preferences. When household fixed effects are added in the final column, the coefficient on the interacted spousal college dummy is remarkably similar to that in Table 3.

In Table 5, a series of robustness checks are performed. Controls for the presence of dependent children in the household were excluded from the specifications in Tables 3 and 4, partly because the decision to have children is endogenous to a woman's labour supply behaviour, but also because children reflect an important dimension of a household's (or an individual's) preference for non-market production.[9] Nonetheless, to provide evidence on the extent to which fertility decisions are responsible for the effect of spousal education on hours, a dummy variable for the presence of a child under 6 was added to the model (using female respondents) in the first column of Table 5. This has little effect on the results.

In the second column, the child dummy is interacted with own and spousal education. While the own education interaction terms are insignificant, women are found to cut back on hours more at child birth when they have college-educated husbands. Nonetheless, even controlling for the interacted child variables, the interaction of spousal education and years since marriage continues to have a significant negative effect on work hours. Hence, childless women also reduce hours over time when they are married to college-educated men, suggesting that not all labour supply adjustment coincides with childbirth.

In the final column of Table 5, the earnings hypothesis is tested directly, using the sample of women married to male NLSY respondents. Under this hypothesis, couple's decisions should be driven by a husband's likely income in the future. To measure this, a man's total earnings in all future periods was regressed on all the control variables in Equation 2, as well as the decile of his AFQT score, which assesses a person's aptitude regarding basic mathematics and reading comprehension and which many studies have used as a measure of underlying ability (Cawley *et al*. 2001; Barrow and Rouse 2005).[10] The predicted values from this regression were then added to Equation 2, both on their own and interacted with years since marriage. The interacted term is found to have a negative and highly significant effect on a woman's work hours. Moreover, the interacted spousal education variables become insignificant. This suggests that the

[9] Indeed, Belkin (2003) noted that maternity leave often provides a convenient route out of an unloved job. As one woman she interviewed put it: "Timing one's quitting to coincide with a baby is like timing a breakup to coincide with graduation… It's just a whole lot easier than breaking up in the middle of senior year."

[10] The AFQT was administered during the first round of interviews in 1979.

earnings hypothesis is responsible for the declines in female labour supply seen after marriage.

Results for multiple cohorts

A limitation of the NLSY is that it only provides information on a single cohort. In order to examine whether the relationship between work hours and spousal education has changed over past decades, it is necessary to use repeated cross-sectional data. Accordingly, Table 6 reports the results of tobit estimation of Equation 1 using the four CPS samples described in the previous section. Due to data availability, the dummy variables for remarriage are now dropped from the set of control variables; however, dummy variables for own and spouse's race/ethnicity are now added and a more detailed classification of region is used.[11]

A woman's own education level is found to have a positive effect on her hours in every time period. Having a husband with a high school diploma raises women's work hours, although further increases in spousal education result in fewer hours, echoing the pattern found with the NLSY data (in Tables 3 and 4). Raising a husband's education from Grade 12 to college degree resulted in his wife working 165 fewer hours per year in 1980. This amount rose to 247 in 2000, before falling back to 189 hours in 2010. Although not reported, the results are robust to the inclusion of controls for number and age of dependent children.[12]

To illustrate how the labour market effects of spousal education have evolved over time, Figure 3 plots the predicted work hours for each period from the regressions in Table 6. The solid black line holds every variable except spouse education constant at its mean value over the full sample. Changes in the other coefficients in the model were responsible for a large upward shift in labour supply during the 1980s and a slight decrease in the 2000s. To examine the effects of assortative matching, the dashed black line in Figure 3 plots predicted women's hours when both spouses are equally educated. After 1990, there is a notable downturn in the hours schedule among college graduates, since the marginal increase in hours resulting from a woman having a college degree is

[11] Using own and spouse deciles in the wage distribution rather than log wages, in order to allow a more flexible relationship between labour supply and market productivity, was found to have little effect on the results for spousal education in any of the CPS models.

[12] The result is driven completely by hours adjustment among workers, with spousal education having no effect in a labour force participation probit model. This is consistent with Antecol's (2011) finding that educated women have increasingly cut back on hours after child birth but not withdrawn from the labour market at a greater rate than in previous periods.

outweighed by the decrease in hours resulting from her spouse having a college degree. The coefficients in Table 6 suggest that this college labour supply penalty has been relatively stable over the past two decades, at around 90-100 hours.

Figure 3 shows that changes in the shape of the relationship between hours and spousal education did not contribute to the decline in women's labour supply in the 2000s. This is confirmed by a Oaxaca decomposition of changes in annual hours over the periods 1980-1990, 1990-2000 and 2000-2010 (reported in Table A3). However, according to the decomposition, the shift towards more educated (and better-paid) spouses did contribute somewhat to the reduction in hours seen during the 2000s. Increases in women's own education and wage levels during the 2000s were predicted to lead to *higher* hours.

A problem with the regressions in Table 6 is that since the prevalence of marriage has fallen over the past thirty years, the sample of married women in 2010 is more highly selected than the 1980 sample. This will produce biased estimates if unobserved determinants of a woman's propensity to marry are correlated with her work orientation. One method of correcting for this is to remove those women from the earlier samples who would be unlikely to marry in 2010.[13] Following Blau and Kahn (2007), married women are ranked by their estimated probability from a probit model for selection into marriage, separately for the 1980, 1990 and 2000 samples. Own age, education, race/ethnicity, region and city status are used as explanatory variables in the probit models. A fraction of the highest ranked married women are then selected for the regression sample, ensuring that in each period the proportion of all women who are chosen is equal to the proportion of married women in 2010. The results from this restricted sample are presented in Table A2. The selection correction is seen to have little effect on the coefficients on spousal education.

Table 7 presents the results of estimating Equation 1 for the sample of unmarried cohabitants. A striking result here is that partner's education has a monotonic positive effect on hours, even controlling for own education (except at the college level in 1990). The grey lines in Figure 3 plot the predicted hours for the cohabitant sample in each period, while everything except education is held equal at its average value across the sample of married women. Again, the solid line allows only partner's education to vary,

[13] An alternative method of correcting for selection into marriage is to add unmarried cohabitants to the sample of married women, so that all cohabiting couples are included in each period, regardless of marital status. This was also found to have little effect on the results for spousal education.

while the dashed line sets own education equal to partner's education. Unmarried women living with a partner work more than equally-educated married women, although the gap has closed considerably over the past three decades. The relationship between hours and partner's education also flattened between 1980 and 2010 to more closely reflect the situation for married couples.[14]

Compared to married couples, unmarried cohabiting couples are more likely to break up, to be in the early stages of a relationship and to have unstable employment histories (Seltzer 2000; Oppenheimer 2003). These facts suggest that the earnings hypothesis is likely to operate more weakly on unmarried couples, which is consistent with the observation that labour supply is always positively related to partner's education among this sample.

To obtain explicit evidence about the effects of the preference hypothesis among married women, the coefficients on the education variables would ideally be allowed to vary with length of marriage, as in Equation 2. Since the CPS did not consistently include information on years since marriage, it is impossible to estimate Equation 2 directly with this dataset. However, by first-differencing Equation 2, the following equation is generated:

$$\Delta n_{it} = b_5 + b_1 \Delta \ln w_{it} + b_2 \Delta \ln \overline{w}_{it} + \sum_{j=2}^{4} b_{6j} I(e_i = j) + \sum_{j=2}^{4} b_{7j} I(\overline{e}_i = j) + \Delta \mathbf{x}'_{it} \boldsymbol{\beta} + \Delta \upsilon_{it}, \qquad (3)$$

where Δ represents the change in a variable from $t-1$ to t. Since hours worked in the previous year *is* available in the longitudinally-matched CPS sample described in the previous section, this equation may be estimated. The spousal education variables in Equation 3 capture the effects of the productivity and earnings hypotheses only.

Table 8 reports the results of estimation of Equation 3. The pattern is less clear cut than in the NLSY data. There is not a monotonic relationship between change in hours and spousal education and most of the coefficients on husband's education are insignificant. However, since 1990 there has been a negative relationship between hours growth and spousal education past Grade 12.[15] Compared to having a husband with a

[14] Both observations presumably reflect the fact that many women who would previously have married now choose to live together outside marriage, so that the cohabitant sample increasingly resembles the married sample.

[15] The non-monotonicity is possibly due to the small number of people without a high school diploma in more recent years. Only 7% of husbands were high school dropouts in 2010, which was half the fraction in 1980.

high school diploma only, having a husband with a college degree is associated with a woman working 59 fewer hours for every year of marriage in 2000 and 36 fewer hours in 2010 (statistically significant in both cases). These effects dominate the effects of own education and are consistent with both a withdrawal from the labour market among women with highly educated husbands in the early 2000s and a resurgence in labour market attachment among these women ten years later, as documented by both *New York Times* articles on the opt-out revolution.

The results in Table 8 are broadly consistent with the predictions of the earnings hypothesis – women reduce their work hours most rapidly during marriage when their husband is most educated. Furthermore, they suggest that this effect has become more pronounced since 2000. Since much of the decline in labour supply during marriage is likely to occur when women give birth, the education variables are interacted by a dummy variable for whether a dependent child of either spouse aged under 6 is present. The estimated results (presented in Table A4) largely reinforce those in Table 8. Women whose husbands have a college degree reduce their work hours by more when they have young children compared to women whose husbands only have some college education. This child penalty grew from 59 hours in 1980 to 203 hours in 2000, before falling back slightly to 165 hours in 2010. In contrast, there is no evidence that educated women cut back their hours when they have a young child any more than other women do.

5. Conclusion

Textbook models of labour supply within households typically assume that the wage rates of both spouses play key roles in a married woman's decision of how much to work. Women's education is also likely to influence their labour supply as it reflects differences in lifetime income or wealth. However, even after controlling for all these factors, a married woman's labour supply might be affected by her *husband's* education. In this paper, three possible hypotheses are put forward to explain why a man's education could exert an influence on his wife's work hours. Data for a single cohort of married women from the NLSY 1979 indicate that, all else equal, women work more at the time of marriage when their husbands are highly educated. However, over time, the wives of educated men reduce their hours more rapidly than other women. Cross-sectional data from the CPS for 1980-2010 support the latter finding and suggest that the hours penalty associated with a college-educated husband has increased

since 1990.

Overall, the results are consistent with the presence of assortative matching on the basis of preferences for work as well as intra-household labour supply decisions that are related to a husband's likely future earnings. Little support is found for the argument that spousal education measures a husband's non-market productivity.

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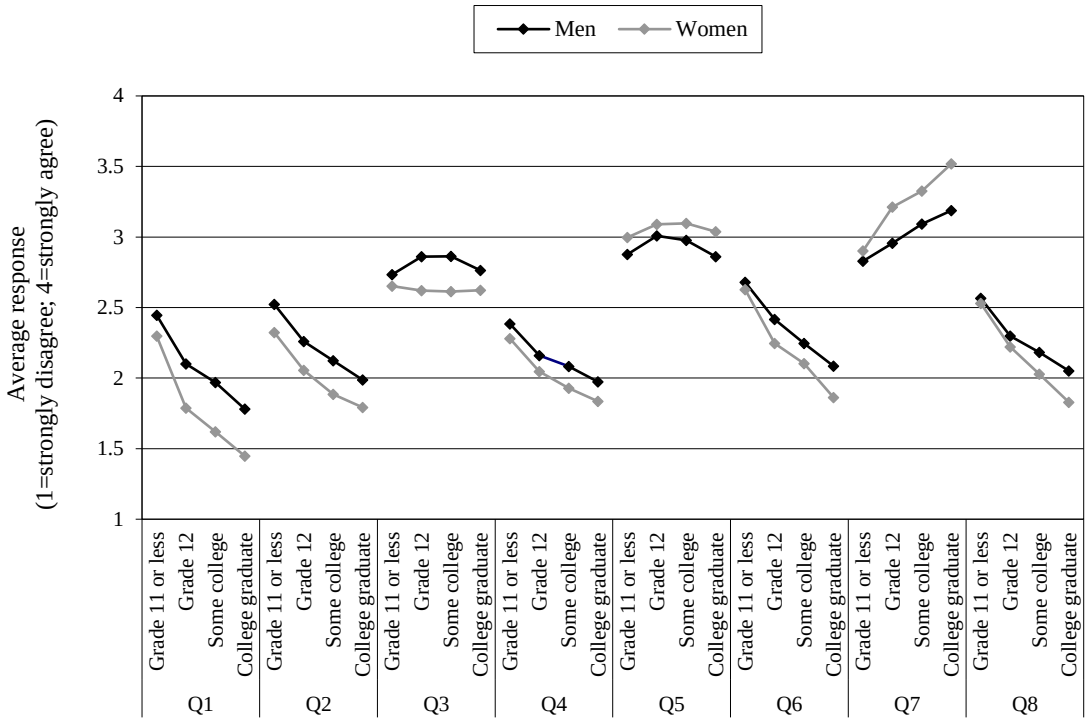
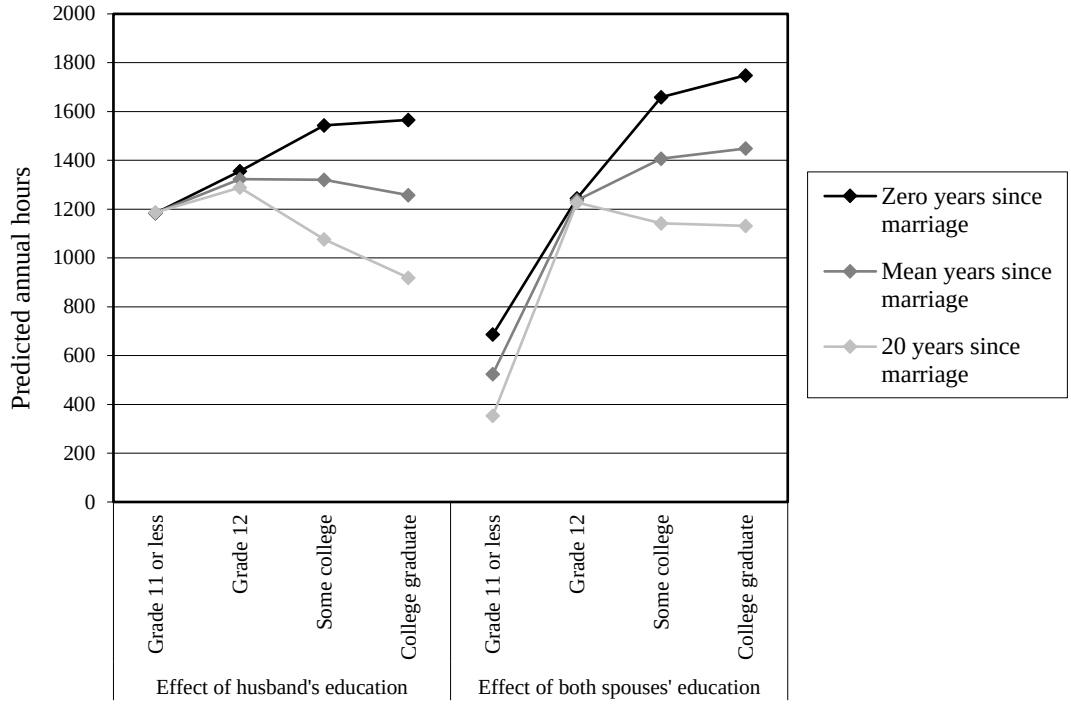
Figure 1
Average responses to female roles attitude questions at age 21 by education and sex



Q1: "A woman's place is in the home, not in the office or shop."
Q2: "A wife who carries out her full family responsibilities doesn't have time for outside employment."
Q3: "A working wife feels more useful than one who doesn't hold a job."
Q4: "Employment of wives leads to more juvenile delinquency."
Q5: "Employment of both parents is necessary to keep up with the high cost of living."
Q6: "It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family."
Q7: "Men should share the work around the house with women, such as doing dishes, cleaning and so forth."
Q8: "Women are much happier if they stay at home and take care of their children."

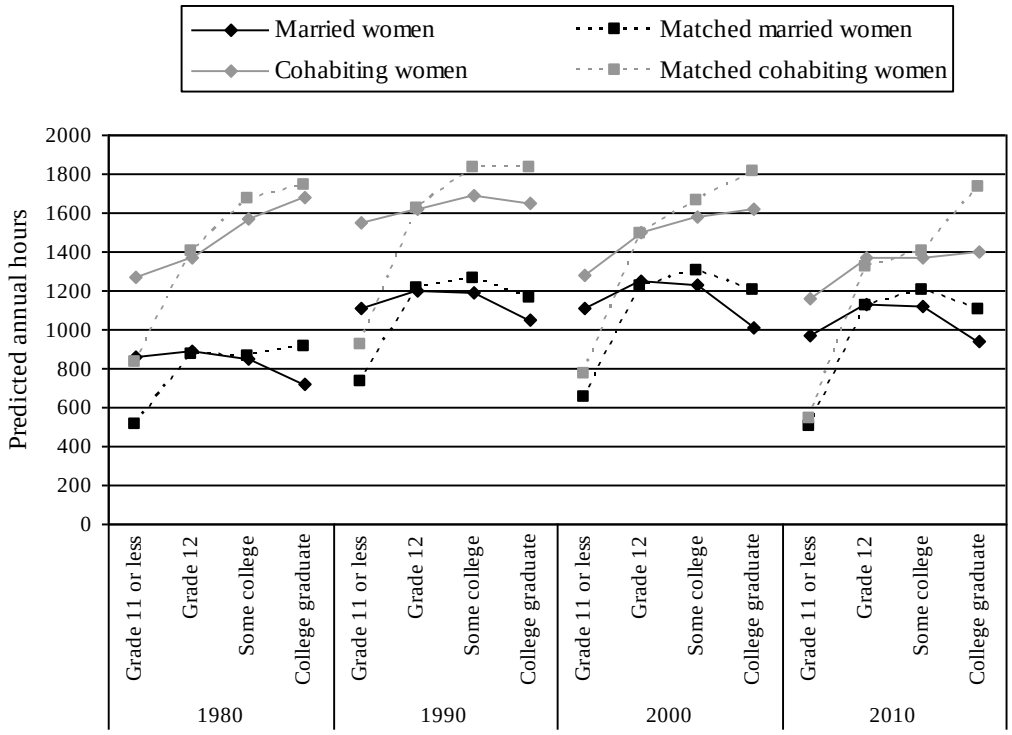
Notes: The data points represent means across individuals weighted by NLSY sampling weights. A person's response is taken from the survey closest to the year they were aged 21, although they may be as young as 19 or as old as 23.

Figure 2
Predicted annual hours by spousal education level at different stages of marriage



Notes: The data points are the predicted annual work hours from the second column of Table 3, holding all other variables equal to their means across all married women in the sample.
In the left-hand panel, women's education is set equal to its mean for married women in the full sample; in the right-hand panel, women's education is set equal to that of their husbands.

Figure 3
Predicted annual hours by spousal education level for married and cohabiting women



Notes: The data points are the predicted annual work hours from Tables 6 (for married women) and 7 (for cohabitants), holding all other variables equal to their means across all married women in the full sample.
In the matched series, women's education is set equal to that of their husbands; in the other series, women's education is set equal to its mean for married/cohabiting women in the full sample.

Table 1
Means for NLSY regression sample

Variable	Female respondents		Wives of male respondents	
	Own value	Spousal value	Own value	Spousal value
Annual work hours	1390.491	2196.348	1685.300	2329.468
Wage (in 2000 dollars)	16.302	19.198	14.652	24.621
Age	33.934	36.271	33.856	34.934
Grade 11 or less	0.026	0.087	0.039	0.029
Grade 12	0.469	0.446	0.400	0.485
Some college	0.266	0.228	0.280	0.217
College graduate	0.238	0.239	0.281	0.268
Female roles attitude question 1	1.706	–	–	1.955
Female roles attitude question 2	1.986	–	–	2.125
Female roles attitude question 3	2.596	–	–	2.801
Female roles attitude question 4	1.981	–	–	2.122
Female roles attitude question 5	3.086	–	–	2.972
Female roles attitude question 6	2.141	–	–	2.276
Female roles attitude question 7	3.302	–	–	3.089
Female roles attitude question 8	2.107	–	–	2.233
Remarried	0.207		0.171	
Years since marriage	9.731		9.002	
Number of observations	26,849		12,651	

Notes: Each observation represents a person-year combination.
The female roles attitude questions are measured at age 21.
Appendix 1 describes the construction of the dataset.

Table 2
Means for CPS regression sample

Variable	1980	1990	2000	2010
Annual work hours	935.072	1232.580	1357.134	1337.841
Wage (in 2000 dollars)	9.752	11.380	13.541	15.252
Spouse's wage (in 2000 dollars)	18.678	19.159	20.071	21.531
Age	37.108	37.158	38.900	39.624
Spouse's age	39.548	39.349	40.815	41.419
Own education:				
Grade 11 or less	0.198	0.123	0.085	0.077
Grade 12	0.475	0.441	0.334	0.264
Some college	0.166	0.208	0.283	0.279
College graduate	0.161	0.228	0.298	0.380
Spouse's education:				
Grade 11 or less	0.220	0.140	0.096	0.089
Grade 12	0.359	0.368	0.317	0.303
Some college	0.170	0.198	0.262	0.253
College graduate	0.251	0.294	0.325	0.355
Number of observations	60,850	58,688	49,382	72,877

Notes: Means use CPS sampling weights, adjusted so that each year is weighted equally.
Appendix 1 describes the construction of the dataset.

Table 3
Results for annual hours equation using female respondents

Variables	(i)	(ii)	(iii)	(iv)
Own education coefficients				
Grade 12	607.047***	386.885***	247.890*	
	(89.069)	(129.009)	(136.101)	
Some college	790.561***	612.953***	408.764***	
	(90.405)	(130.180)	(137.894)	
College graduate	907.279***	680.425***	516.704***	
	(95.040)	(133.766)	(140.242)	
Grade 12 × years since		19.188*	-4.503	2.752
marriage		(10.452)	(12.751)	(8.139)
Some college × years		14.236	-9.014	-3.636
since marriage		(10.429)	(12.966)	(8.400)
College graduate ×		18.223*	-5.003	-0.259
years since marriage		(10.953)	(13.274)	(8.942)
Spouse education coefficients				
Grade 12	142.666**	172.034**	170.268**	
	(60.675)	(85.979)	(83.614)	
Some college	145.175**	359.378***	295.889***	
	(66.889)	(90.123)	(87.623)	
College graduate	99.784	382.033***	332.640***	
	(69.771)	(93.431)	(90.416)	
Grade 12 × years since		-3.484	-5.280	-0.316
marriage		(6.814)	(6.655)	(5.159)
Some college × years		-23.430***	-17.116**	-9.696*
since marriage		(7.511)	(7.416)	(5.727)
College graduate ×		-32.443***	-30.811***	-26.697***
years since marriage		(7.687)	(7.705)	(6.285)
Years since marriage		-16.610	-14.916	
		(10.560)	(12.848)	
Hours before marriage			0.312***	
			(0.029)	
Attitude to female roles			-144.884***	
			(18.765)	
Household dummies	No	No	No	Yes
(Pseudo) R-squared	0.007	0.007	0.009	0.558
Number of observations	26,849	26,849	22,338	26,849

Notes: Tobit estimation is used in columns (i)-(iii). All models also include controls for own and spouse log wage, household non-labour income, quadratics in own and spouse age and dummy variables for remarriage, region (4 categories), metropolitan area and year (19 categories).

Standard errors are clustered by household and are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 4
Results for annual hours equation using wives of male respondents

Variables	(i)	(ii)	(iii)	(iv)
Own education coefficients				
Grade 12	235.876***	443.585***	423.851***	
	(48.742)	(78.027)	(83.251)	
Some college	313.746***	485.055***	469.932***	
	(51.285)	(80.246)	(85.558)	
College graduate	370.450***	575.325***	563.160***	
	(55.282)	(83.003)	(88.126)	
Grade 12 × years since		-20.483***	-17.591**	-9.643
marriage		(6.417)	(7.270)	(6.648)
Some college × years		-15.953**	-13.570*	-10.998
since marriage		(6.603)	(7.491)	(6.775)
College graduate ×		-21.628***	-19.132**	-9.395
years since marriage		(6.932)	(7.810)	(7.146)
Spouse education coefficients				
Grade 12	115.315**	153.798**	102.638	
	(53.838)	(72.963)	(78.866)	
Some college	140.324**	156.164**	109.215	
	(58.046)	(77.963)	(82.726)	
College graduate	84.093	200.352**	136.035	
	(59.978)	(78.770)	(84.348)	
Grade 12 × years since		-3.539	1.032	-9.718
marriage		(6.797)	(9.718)	(8.893)
Some college × years		-1.592	0.857	-7.527
since marriage		(7.312)	(10.098)	(9.161)
College graduate ×		-14.815**	-8.497	-25.838***
years since marriage		(7.515)	(10.270)	(9.572)
Years since marriage		11.765	4.770	
		(6.563)	(10.506)	
Hours before marriage			0.016	
			(0.019)	
Attitude to female roles			-21.939*	
			(12.987)	
Household dummies	No	No	No	Yes
(Pseudo) R-squared	0.003	0.004	0.003	0.599
Number of observations	12,651	12,651	11,763	12,651

Notes: Tobit estimation is used in columns (i)-(iii). All models also include controls for own and spouse log wage, household non-labour income, quadratics in own and spouse age and dummy variables for remarriage, region (4 categories), metropolitan area and year (19 categories).

Standard errors are clustered by household and are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 5
Additional results for annual hours equation

Variables	Female respondents		Wives of male respondents
	(i)	(ii)	(iii)
Own education coefficients			
Grade 12	403.372***	440.324***	448.026***
	(123.931)	(158.457)	(79.394)
Some college	629.231***	599.548***	493.496***
	(124.978)	(159.175)	(81.595)
College graduate	666.457***	595.025***	579.033***
	(128.704)	(163.016)	(84.570)
Grade 12 × child under 6		-59.430	
		(148.032)	
Some college × child under 6		50.259	
		(151.075)	
College graduate × child under 6		116.414	
		(155.259)	
Grade 12 × years since marriage	16.783*	15.653	-21.246***
	(10.178)	(10.786)	(6.639)
Some college × years since marriage	12.539	13.792	-16.718**
	(10.159)	(10.789)	(6.745)
College graduate × years since marriage	19.973*	22.498**	-22.114***
	(10.663)	(11.278)	(7.111)
Spouse education coefficients			
Grade 12	161.997*	168.553*	165.137**
	(83.427)	(93.477)	(79.662)
Some college	340.227***	441.785***	171.173**
	(87.145)	(97.170)	(86.733)
College graduate	355.079***	481.868***	251.813**
	(90.230)	(98.938)	(100.560)
Grade 12 × child under 6		-6.413	
		(89.612)	
Some college × child under 6		-158.858*	
		(95.866)	
College graduate × child under 6		-201.934**	
		(100.761)	
Grade 12 × years since marriage	-2.943	-3.323	2.777
	(6.622)	(6.975)	(7.469)
Some college × years since marriage	-21.374***	-25.099***	8.778
	(7.313)	(7.659)	(8.097)
College graduate × years since marriage	-27.755***	-32.147***	5.420
	(7.434)	(7.813)	(8.892)
Years since marriage	-18.443*	-16.914	12.042*
	(10.371)	(11.159)	(6.898)
Predicted future earnings (000s)			-0.262
			(0.175)
Predicted future earnings (000s) × years since marriage			-0.050***
			(0.012)
Child under 6	Yes	Yes	No
(Pseudo) R-squared	0.010	0.011	0.004
Number of observations	26,742	26,742	12,096

Notes: Tobit estimation is used. All models also include controls for own and spouse log wage, household non-labour income, quadratics in own and spouse age and dummy variables for remarriage, region (4 categories), metropolitan area and year (19 categories).

Standard errors are clustered by household and are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 6
Results for annual hours equation using cross-sectional data

Variables	1980	1990	2000	2010
Own education coefficients				
Grade 12	330.353***	387.528***	422.536***	466.999***
	(16.217)	(17.291)	(23.417)	(21.524)
Some college	363.639***	444.45***	530.060***	556.365***
	(20.985)	(20.110)	(24.937)	(22.591)
College graduate	533.644***	494.550***	650.860***	631.068***
	(23.413)	(21.853)	(27.149)	(24.218)
Spouse education coefficients				
Grade 12	26.216	91.445***	146.827***	154.918***
	(16.065)	(16.463)	(21.867)	(19.617)
Some college	-12.753	83.765***	119.195***	145.396***
	(19.641)	(18.857)	(23.397)	(20.977)
College graduate	-138.753***	-58.823***	-100.546***	-30.626
	(20.686)	(19.872)	(25.226)	(22.415)
Pseudo R-squared	0.009	0.010	0.008	0.009
Number of observations	60,850	58,688	49,382	72,877

Notes: Tobit estimation is used. All models also include controls for own and spouse log wage, household non-labour income, quadratics in own and spouse age and dummy variables for own and spouse race/ethnicity (4 categories), region (9 categories), metropolitan area and year (3 categories).
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 7
Results for annual hours equation for unmarried cohabiting women

Variables	1980	1990	2000	2010
Own education coefficients				
Grade 12	477.149***	629.777***	501.363***	576.245***
	(100.911)	(59.376)	(60.690)	(56.488)
Some college	550.273***	773.669***	590.168***	641.884***
	(116.905)	(69.946)	(64.239)	(59.158)
College graduate	507.245***	806.670***	695.518***	953.305***
	(126.316)	(79.161)	(73.583)	(65.735)
Spouse education coefficients				
Grade 12	100.431	65.196	219.329***	205.495***
	(97.430)	(53.963)	(56.805)	(51.954)
Some college	296.456***	131.997**	297.125***	213.452***
	(110.746)	(63.526)	(62.669)	(56.354)
College graduate	408.955***	100.468	341.974***	237.301***
	(112.013)	(70.447)	(69.398)	(62.269)
Pseudo R-squared	0.009	0.013	0.011	0.010
Number of observations	981	2,690	3,733	5,986

Notes: Tobit estimation is used. All models include the same controls as in Table 6. Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 8
Results for change in annual hours equation

Variables	1980	1990	2000	2010
Own education coefficients				
Grade 12	26.574	26.281	-45.676	-18.625
	(16.262)	(19.788)	(28.517)	(28.963)
Some college	-8.015	13.953	-55.698*	0.356
	(21.061)	(22.564)	(29.714)	(30.017)
College graduate	1.000	7.417	-23.348	10.004
	(23.048)	(23.655)	(31.009)	(30.860)
Spouse education coefficients				
Grade 12	-8.538	-1.316	40.695	42.975
	(16.139)	(18.961)	(26.696)	(26.321)
Some college	30.172	-10.042	27.516*	6.834
	(19.720)	(21.355)	(27.775)	(27.918)
College graduate	18.636	-4.660	-17.810	6.757
	(20.234)	(21.756)	(28.759)	(28.596)
R-squared	0.009	0.003	0.011	0.009
Number of observations	13,103	13,520	11,739	11,683

Notes: All models also include a full set of person dummies and the annual changes in own and spouse log wage and household non-labour income and dummy variables for year (2 categories).
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Appendix 1: Data description

NLSY data

This study uses NLSY data for 1979-2008 and excludes the military over-sample and the low-income white over-sample, which were discontinued in 1986 and 1991, respectively. The samples only include the observations on respondents after age 25 and while they are married with a spouse aged 25-54. This leaves 3,008 female survey respondents with complete information on all variables, as well as 3,000 women who are married to male survey respondents. The two samples comprise 25,878 and 19,122 person-year observations, respectively.

The NLSY questionnaire contains detailed information on the timing of past changes in marital status, allowing the creation of a complete marital history for each person. Hours worked by a respondent during the year prior to each interview is available. For spouses of respondents, hours worked was constructed by multiplying reported values for weeks worked in the previous year and hours usually worked during these weeks. Annual wage and salary earnings for respondents and their spouses and family other income (from interest, dividends *etc*.) were expressed in 2000 dollars, using the National Income and Product Account price index for personal consumption expenditures.

Own and spouse hourly wages were constructed by dividing annual earnings by annual hours worked. For those who worked zero hours during a year, had missing earnings or work hours data, received self-employment income or had a wage less than $2 or greater than $200, a wage rate is either interpolated using information on the person's wage in previous and future years or filled forwards/backwards. For respondents or respondents' spouses who never report a valid wage, the predicted value from a set of log wage regressions is used instead. The regressions were performed separately for each combination of gender and whether the person worked 20 weeks in the past year and included as regressors own and spouse's age, age squared and education, as well as region (4 categories) and metropolitan area.

For each respondent and respondent's spouse, the maximum value ever reported for highest schooling grade completed is taken. Four education categories are constructed from this: Grade 11 or less, Grade 12, some college but not a degree (defined as Grades 13-15) or a college degree or higher (Grade 16 or above).

CPS data

Data were taken from the March supplements of the Current Population Survey for 1978-1980, 1988-1990, 1998-2000 and 2008-2010. Households were dropped if either spouse was a member of the armed forces, was not aged 25-54 or had allocated data for annual weeks worked or hours worked per week. The CPS person weights were adjusted so that the sum of the weights in each year was equal. Annual hours worked were created by multiplying the number of weeks worked in the previous year and the number of hours usually worked each week.

Each individual was classified into four race/ethnicity groups: white non-Hispanic, black non-Hispanic, Hispanic, or other. Values for highest grade completed in 1998-2000 and 2008-2010 were assigned using Jaeger's (1997) correspondence. The same four education categories as in the NLSY sample were then defined for husbands and wives using this.

An individual's wage and salary earnings were calculated for each year. Since separate variables were included for wage and salary income on respondents' main and secondary jobs for 1988-1990 onwards, the sum of these was used. Blau and Kahn's (2007) strategy for dealing with top coding was employed. Specifically, since the CPS top code for secondary earnings actually fell from $99,999 in 1988-1990 to $25,000 in 1998-2000, the later top code was imposed on all years for consistency. All top-coded observations for wage and salary earnings were then multiplied by 1.45. All earnings and income variables were converted into 2000 dollars using the National Income and Product Account price index for personal consumption expenditures.

Hourly wage was defined as wage and salary income divided by annual hours worked. The wage was imputed for individuals who were not employed, had allocated values for earnings, work weeks or work hours, or whose calculated wage was less than $2 or greater than $200 (in 2000 dollars). The imputed wage value was the predicted value from separate log wage regressions for each combination of gender, period and whether the person worked 20 weeks in the previous year. The regressors used were own and spouse age, age squared, education (4 categories) and race/ethnicity (4 categories), as well as region (9 categories), metropolitan area and year (3 categories).

Appendix 2: Additional regression tables

Table A1
Results with alternative labour supply measures

Variables	Participation probit	Hours among workers
	(i)	(ii)
Own education coefficients		
Grade 12	0.441***	319.847***
	(0.089)	(51.696)
Some college	0.647***	390.292***
	(0.093)	(52.723)
College graduate	0.731***	485.346***
	(0.102)	(56.290)
Spouse education coefficients		
Grade 12	0.236***	-16.271
	(0.068)	(32.015)
Some college	0.223***	-2.591
	(0.077)	(36.537)
College graduate	0.213***	-53.899
	(0.081)	(40.362)
(Pseudo) R-squared	0.067	0.056
Number of observations	26,849	21,851

Notes: Probit estimation is used in column (i). All models also include controls for own and spouse log wage, household non-labour income, quadratics in own and spouse age and dummy variables for remarriage, region (4 categories), metropolitan area and year (19 categories).
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A2
Results for annual hours equations controlling for selection into marriage

Variables	1980	1990	2000	2010
Own education coefficients				
Grade 12	296.105***	353.928***	395.986***	466.999***
	(18.765)	(19.213)	(25.335)	(21.524)
Some college	331.822***	410.244***	501.687***	556.365***
	(499.320)	(22.035)	(26.843)	(22.591)
College graduate	499.320***	460.843***	627.007***	631.068***
	(26.246)	(23.754)	(29.002)	(24.218)
Spouse education coefficients				
Grade 12	24.958	101.199***	148.322***	154.918***
	(18.123)	(17.937)	(23.076)	(19.617)
Some college	-25.147	92.196***	123.220***	145.396***
	(21.878)	(20.369)	(24.573)	(20.977)
College graduate	-141.563***	-63.211***	-109.547***	-30.626
	(22.799)	(21.342)	(26.404)	(22.415)
Pseudo R-squared	0.008	0.010	0.008	0.009
Number of observations	50,165	52,210	46,067	72,877

Notes: All models include the same controls as in Table 6. Probit models are used to select a consistent fraction of married couples in each period, as described in the text.

Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A3
Decomposition of decadal changes in annual hours

Variables	1980-1990		1990-2000		2000-2010	
	Δx	$\Delta \beta$	Δx	$\Delta \beta$	Δx	$\Delta \beta$
Own wage	69.165	89.057	102.048	-416.006	51.140	148.290
Spouse's wage	1.189	102.339	-8.524	114.010	-15.287	-11.329
Own education	24.101	9.222	18.991	7.772	16.559	-5.096
Spouse's education	-5.095	2.975	-1.455	1.100	-5.173	6.097
Non-labour income	-2.604	1.667	-2.862	5.372	1.264	-1.022
Own age	2.730	71.670	5.973	205.179	3.437	-214.738
Spouse's age	-3.058	-155.669	3.565	-807.901	3.903	157.901
Own race/ethnicity	-1.099	-4.684	1.433	-15.907	-1.945	-49.040
Spouse's race/ethnicity	1.078	29.780	-2.458	2.244	-1.400	9.866
Region/metropolitan area	-1.119	-7.839	0.370	-34.128	-1.300	-6.591
All variables	85.492	212.017	116.909	7.645	51.185	-70.478
Total change	297.509		124.554		-19.293	

Notes: Δx denotes the effect of changes in characteristics between periods, using the equation for the start period; $\Delta \beta$ denotes the effect of changes in coefficients, holding the characteristics fixed at their average values for the end period. Coefficients are taken from linear regression estimates of Equation 1 for each period.

For own and spouse education and race/ethnicity and for region, Δx and $\Delta \beta$ are averaged over all choices of reference category, as proposed by Yun (2005).

Table A4
Results for annual hours equation with child interactions

Variables	1980	1990	2000	2010
Own education coefficients				
Grade 12	347.168***	399.250***	373.531***	402.530***
	(17.600)	(19.106)	(26.338)	(24.816)
Some college	390.162***	460.011***	489.781***	476.188***
	(23.458)	(22.609)	(28.158)	(25.968)
College graduate	556.627***	526.684***	610.596***	532.384***
	(26.191)	(24.504)	(30.473)	(27.620)
Grade 12 × child under 6	-60.329	-54.901	160.442***	121.010***
	(36.797)	(38.114)	(51.063)	(46.146)
Some college × child	-54.492	-22.994	156.750***	216.242***
under 6	(45.172)	(42.824)	(53.311)	(47.253)
College graduate × child	-34.476	-31.376	202.833***	331.318***
under 6	(48.875)	(44.805)	(55.950)	(48.574)
Spouse education coefficients				
Grade 12	33.021*	88.251***	144.996***	148.558***
	(17.439)	(18.352)	(24.704)	(22.506)
Some college	22.441	107.261***	131.038***	149.683***
	(21.882)	(21.279)	(26.430)	(24.034)
College graduate	-65.752***	18.932	-19.334	33.902
	(22.854)	(22.293)	(28.243)	(25.494)
Grade 12 × child under 6	-72.884**	-27.232	-47.827	-6.415
	(36.325)	(36.039)	(47.798)	(42.509)
Some college × child	-113.199***	-97.930**	-79.928	-17.754
under 6	(42.386)	(40.301)	(50.509)	(44.886)
College graduate × child	-171.956***	-224.105***	-283.347***	-182.382***
under 6	(43.897)	(41.079)	(52.588)	(46.031)
Child under 6	-698.050***	-499.062***	-570.683***	-659.295***
	(33.350)	(34.774)	(45.485)	(39.550)
Pseudo R-squared	0.014	0.014	0.011	0.011
Number of observations	60,850	58,688	49,382	72,877

Notes: Tobit estimation is used. All models include the same controls as in Table 6. Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.