Dynamic Effects of Educational Assortative Mating on Labor Supply*

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Abstract

This paper examines the link between spousal educational gap and the labor supply behavior of married women over the life-cycle. Using data from the 1965-2011 March Current Population study and the National Longitudinal Study of Youth 1979 (NLSY79), we document that within married couples, if the wife's education exceeds her husband's (accounting for her demographics, her husband's education, and his income), the wife is substantially more likely to be employed compared to if she is less educated than her husband (up to 14.5 percentage points). Using data from the NLSY79, we formulate and structurally estimate a dynamic life-cycle model of endogenous marriage and labor supply decisions in a collective framework. We establish that the dependencies between a husband's educational attainment and a wife's labor supply decision, at the time of marriage, produce dynamic effects due to human capital accumulation and implied wage growth. Returns to experience account for 52 percent of the employment gap observed between women who had married "down" and those who married "up". Counterfactuals also indicate that, alone, the endogenous changes in assortative mating patterns across cohorts are able to explain a sizable proportion (roughly 25 percent) of the observed rise in married women's labor force participation.

Keywords: educational assortative mating, female labor supply, human capital

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1 Introduction

This paper examines how the spousal education gap, i.e., the wife's relative education, compared to her husband's, affects her labor supply behavior over the life-cycle. A husband's income is an important determinant of his wife's labor supply; however, that factor alone is not enough to explain the difference in the employment rates of married women across the spousal education gap. This paper highlights the role of labor supply and wage dynamics in explaining this fact. We argue that the matching decision in the marriage market sets in motion a process whose effects on women's labor participation decision persist over the life-cycle, due to the accumulation of human capital and the expectation of higher future wages. We use a structurally estimated model to empirically examine the joint decisions and the extent to which path dependence effects could generate the observed difference in employment rates between women who married "up" (e.g., women whose husbands have a higher level of education than they do) and those who married "down" (e.g., whose husbands have a lower level of education than they do). Understanding the dynamics in labor supply behavior and the matching decisions in the marriage market is crucial for public policy. Furthermore, while there is an active literature assessing a wide range of tax and benefit policies that are designed to influence labor supply behavior, in this literature, the empirically significant relationship between marriage and labor supply decisions is under-explored. Ignoring the latter

The past six decades have witnessed some major transformations. The employment rate of married women sharply increased, roughly doubling between 1965 and 2000. Over the same period, the reversal of the gender education gap has occurred (**??**). What is interesting but not surprising is that the reversal of the gender gap in education quickly translated into a reversal of the education gap within couples (Figure **??**).

Contrasting the labor supply behavior by spousal education gap, the following feature emerges. When the wife's education exceeds her husband's, the wife is significantly more likely to be employed compared to if she is less educated than her husband. This is evident

in Figure **??**. It is not unexpected. According to standard static household models of labor supply (**??**), the efficient time allocation between market work and home production depends on the wage differential between the spouses. Put differently, ceteris paribus, the higher the husband's income, implied by his higher educational attainment, the lower the likelihood of the wife to be employed. This employment gap should therefore be interpreted as a husband's income effect and should be eliminated when differences in husband's income are accounted for.

Using March CPS 1965 to 2011 data, we show that regardless of husband's income, when wife's education exceeds her husband's, the wife is significantly more likely to be employed (up to 14.5 percentage points) compared with if it were to be the reverse. One potential concern is that women who marry up tend to have unobservable characteristics that keep then out of the labor force. We address this concern on multiple dimensions using data from NLSY79 such as ability, attitudes, and expectations. We find no evidence that for selection that could explain the observed patterns[1].

The persistent association with spouses' education gap suggests a potentially sizeable role for path dependence and "lock-in" effects. At the time of marriage, women act on rational expectations. A low (high) wage differential between the spouses, which is the case when a female marries down (up), leads to higher (lower) likelihood of employment for the wife. This dependency between husband's education/income and wife's labor force participation produces dynamic effects due to human capital accumulation and the related wage growth. The intertemporal linkage occur through returns to work experience. Employment in the current period increases her experience and leads to higher future expected wages, thus reducing the incentives to leave the labor market even when the initial incentive to work is no longer relevant.

We formalize a dynamic model of endogenous marriage formation (and dissolution) and labor supply, introducing heterogeneity in both females and males. Each period, agents

[1]See Appendix D for additional evidence and robustness checks

choose whether to get married/divorce and whether to work. Individuals face five forms of uncertainty: employment (job offer), wages, probability of meeting a potential partner, match quality, and fertility. Fertility is exogenously given. The probability of a job offer in the current period depends on employment state in the previous period, inducing persistence in employment state over time. In the model, returns to human capital accumulation/experience are a result of employment. An individual's wage is determined by his/her observed human capital − schooling and experience, but also by ability, which is observed to the potential partner but not to the researcher.

Gains from marriage stem from the joint consumption of a public good, match specific quality, and children. Each period, with an exogenous probability, a single individual meets a potential partner. Once a potential partner is drawn, the potential couple then draws a match quality component of the partnership. The couple then decides whether to marry or whether to remain single and continue to search. To describe the problem that the couple faces when they are making this decision we use the collective household model in a dynamic framework with no commitment as in **?**. If they decide to get married, their match quality random component follows a Markov process during the course of their relationship. The model creates substitution between partner's income and match quality and between ability and education.

The dynamic model and a static version of it are estimated by simulated method of moments using a sample of white females who completed at least high school from the National Longitudinal Survey of Youth 1979 (NLSY79). The dynamic model provides a very good fit to the data, better than its static counterpart (Figures **??**-**??** and Tables **??**-**??**). In particular, the model replicated the assortative mating on educational attainment, and the wide variation in labor supply across the different education groups observed in the data. The model also captures the trade-off between formal education and ability in the marriage market. To assess the importance of the dynamic labor supply effects, we consider a counterfactual economy in which returns to work experience are ruled out, e.g. no wage

growth. The findings support our hypothesis. Notably, returns to experience account for 52 percent of the employment gap observed between women who had married "down" and those who had married "up".

In an alternative counterfactual, we evaluate how changes in the educational distribution between cohorts contribute to changes in marriage choices, and in turn married women's labor supply. Replacing the NLSY79 cohort's educational attainment distribution by the 1945 cohort's, the proportion of married down women drops by 12 percentage points while of married equal remain unchanged. Remarkably, these resulting endogenous changes in assortative mating patterns alone are able to explain a large proportion, 25 percent, of the observed difference in married women's employment rate across these two cohorts.

The literature analyzing married women's labor supply decisions is voluminous and we will not be attempting to fully review it here (see **?** for an excellent survey). There is also an extensive body of literature that examines female's labor force participation dynamics (see for example **?**). Dependencies between an individual's past and current labor supply decisions are well established and date back to **?**. These can be generated by positive wage-based rewards for human capital accumulated via labor market experience (**???**), as well as habit persistence (**?**). However, to the best of our knowledge this is the first paper estimating a dynamic model that considers the different employment profiles associated with the spousal education gap. We show that there are substantial dynamic labor supply effects produced by the spousal education gap, through the returns to the accumulation of labor market experience.

Our paper also contributes to a growing empirical literature estimating dynamic intra-household allocations and marital behavior using a collective formulation. Estimating such models with endogenously evolving state variables has the burden of considerable computational complexity. **?** make an important contribution in extending the collective model with no commitment to an inter-temporal setting[2]. The authors document how labor sup-

[2] **?** explicitly model non-marital cohabitation as an intermediate stage between marriage and singlehood. They estimate a dynamic model of household formation and dissolution as well as fertility and labor supply.

ply evolves around periods of transitions in and out of marriage and there is no distinction of individuals by education levels to simplify the computational burden. Our focus is on the life-cycle aspect of work decisions and on understanding the mechanism that leads to different outcomes. In addition, for our study, it is important to distinguish individuals by education, as different education groups exhibit different behaviors in the data.

The paper is organized as follows. Section 2 illustrates the main facts that motivate the paper, in particular married white female employment behavior and its association with spousal education gap[3]. Section 3 develops the dynamic model. Section 4 presents the estimation method. Section 5 follows with results. Section 6 provides counterfactual analysis. Section 7 concludes. The Appendix presents additional evidence and robustness checks.

2 Stylized Facts

2.1 Trends in Educational Assortative Mating

From 1964 to 2011, the educational attainment of both men and women increased substantially, in 1964 only 12% (8%) of men (women) had completed college compare to 30% (32%) in 2011[4]. Nevertheless, it is important to note that women's college graduation rates continued to rise steadily throughout, while male's graduation rates started to stagnate in the early 80s and remained constant since around 2000. Therefore, in the mid-1980s women's educational attainment began to surpass men's (**??**) (see figures **??** and **??**). The reversal of the gender gap in education among men and women quickly translated into a reversal of the education gap among husbands and wives.

? estimate a search and matching model of the marriage market and household labor supply.

[3]For comparison, some evidence is also presented for white married males. Non-white and white marriage markets function differently. While studying black married females' labor supply is very interesting, it is beyond the scope of this paper.

[4]Level of schooling is an ordinal variable that takes on one of five values: 1=High school dropouts (HSD), 2=High school graduates (HSG), 3=Some college education (SC), 4=College graduates (CG) and 5=Post-college studies (PC).

Throughout the section, we use CPS data[5]. Figure **??**(a) depicts the cross sectional proportion of wives in same, higher and lower educational bracket than their husbands'. What stands out in the figure is the fact that the drop in the proportion of females marrying up (marrying a more educated male) is closely mirrored by the climb in the percentage of those marrying down (marrying a man with lower education)[6]. Studies focusing on homogamy rates (wife and husband with same educational attainment) overlook a significant phenomenon that took place in the last decades. A cohort analysis, figure **??**(b), reveals a similar trend of marrying down for women, starting from the birth cohort of 1910 and continuing for 76 years to the cohort of 1986[8].

Table **??** shows the distribution of wives by their husbands' level of education. Women tend to marry within the same or adjacent educational category rather than categories further away from their own. Therefore, the term marrying down (up) refers mostly to an education gap with the partner of one category. Panels (2) and (3), compare the distribution for pre (1940-45) and post WWII (1960-65) cohorts. Late Baby Boomers females (panel (3)) were more likely than the pre-WWII (panel (2)) female cohorts to marry down, across education categories (with the exception of HS graduate females).

2.2 Couples' Education Gap and Female's Employment

The employment rate of married women, age 25-55, increased from 1965 to 2011 for all education categories (Figure **??**). The increase was pronounced for the HS graduate[9] and some college groups, and relatively small for the post-graduate group. While all married women are working more, note that females marrying down or equal have, historically

[5]Full description of the data file can be found in **??**

[6]The mean absolute value of the education gap among couples[7] is also plotted in figure **??** (read off the y axis on the right) where we see that it persists stable from 1975 onwards.

[8]What is interesting here is that the turning as well as the crossing points of the marrying down and marrying up lines coincide with the findings of **?** in their analysis on the reversal of the college gender gap - this is a statistical artifact. The proportion of females marrying down starts to increase rapidly with the Early Baby Boomers (1948 cohort) - this is the cohort for which female college graduation rates began to rise steeply. By the cohort of early 1960s, Late Baby Boomers, the gap had diminished and began to reverse - this is consistent with trends in the gender gap in college graduates rates (**?**).

[9]See Figure**??**

and still today, higher employment rates. Table **??** presents wives' employment rates by wives' and husbands' education group. We observe the asymmetry between the upper right (women marrying down) and the lower left (women marrying up or equal) of the table[10]. The asymmetry is most pronounced among the college graduate and post-graduate women. Employment rate for post-graduate female marrying some college is 80%, compared with 66% if she marries a post-graduate male - a 14% difference. For college graduate female, the employment rate is 24% lower if you married a post-graduate husband comparing to a HS graduate husband. For the some college female, the employment rate is 62% if she is married to a HS graduate vs. 44% if she married to a post-graduate male - an 18% difference. From this table it is clear that the employment rate of women married down is about 20% higher when compared to the rate of women married up. The increase in the number of married down women over the last fifty years can explain a portion of (or be a result of) the increase in female employment over the same period.

Table **??** presents the marginal effects[11] of the logit model of wife employment as a function of standard controls and two indicator variables, the first equals one if the wife is more educated than her husband and the second is set to equal one if the husband is more educated than the wife, leaving the homogamous couples as the reference group. Estimates reported in column (1) are signed as expected and significant: employment probability increases with education, and age. The estimated effects of the wife's relative education associated variables are consistent with the patterns shown above. Being in a marriage where the wife is more educated is positively and significantly related to her employment, whereas the opposite is true for those marrying up compared to women in a homogamous marriage. The marginal effects (-0.05 for married up versus 0.05 for married down) differ substantially, and their confidence intervals do not overlap. **?** argued that the fertility decision is endogenous, so we excluded the presence of children as a control in the first estimation. These controls were

[10]The same phenomenon is not observed among husbands, see Table **??**

[11]The marginal effects are obtained by calculating the average of the marginal effects for each individual in the sample. In assessing the individual marginal effects for dummy variables, we compute the difference in the probability when the variable equals, alternatively, one and zero.

added in column (2) to examine the extent of their effect on our main variable of interest. The estimates on married up and married down are almost identical to those in column (1). The presence of children in general, and young in particular is associated with a decline in the likelihood of being employed.

The most straightforward explanation for this phenomenon is the correlation between education and income. This draws from the literature that discusses the assignment of market and non-market work within the family (**????**). The division of labor between spouses is based on their relative productivities in paid and unpaid work, with productivity being effectively measured by the wages they could obtain in the market. Higher educated husbands have higher market earnings and therefore their wives will spend less time in paid work and more on home production. Table **??** re-establishes the asymmetry phenomenon even for women married to husbands with annual earnings at the top 10%, as well as for those with husbands' annual earnings at the median (results hold for the other deciles - see Table **??** in the Appendix). The husband's "income" effect appears unlikely to account for the wide variation in employment rates[12]. So in column (3) we include a set of dummy variables for husband's annual income decile[13]. The marginal effects fall to 3.6 percentage points for married down, and 2.9 percentage points for married up but remain statistically significant. Put differently, the wife being more educated spouse vs. less educated than her husband is associated with a remarkable increase of 12 percent in her likelihood of being employed with respect to the mean of the dependent variable.

Table **??** hinted that the effect could be stronger for the higher education groups. We run the logit model on female employment separately for each female education group (Table **??**). Indeed, the effects are by far largest for the college graduate, and post-graduate females compared to females holding a some college degree, and trivial for the HS graduate. For college graduate females the marginal effects of married down and married up are of 8.5 and

[12]It is not an unexpected result since recent papers have shown that women's labor supply became less responsive to their husbands' wages over the sample period (**?**).

[13]To allow for a non-linear impact.

6.3 percentage points, respectively.

Alternatively, since the data is cross sectional, one can argue that husband's current income is likely to suffer from transitory measurement error or life cycle bias. **?** in his classic paper postulated differential labor supply responses to permanent and transitory income[14]. We re-estimated the model, adding the husband's education[15] as a long run determinant of the level of permanent income as it is less likely to suffer from bias than current income while being highly correlated with current income. From Table **??**, column (4) it appears that, holding everything else equal, husband's education/potential income plays a role and is significantly associated with the likelihood of being employed. Though the effects are not monotonic, we should note that the probability of being employed decreases when the husband is a college graduate or post graduate, compared to a husband holding a some college degree. Moreover, the married up and married down effects are similar to those displayed in column (3) and remain highly significant (4.2 percentage points for married up and 2.5 percentage points for married down). In column (5) we include both, husband's current income decile and education category, here the current income is likely to pick up the effect of income shocks. The marginal effects for marrying up and down are again very similar, though slightly smaller (3.8 versus 4.2 percentage points for married up and 2.2 versus 2.5 percentage points for married down).

In column (6), we add MSA specific intercept terms (MSA fixed effects) to capture unobserved heterogeneity that remains constant over time. Results are practically identical and indicate that these differences are not driven by a systematic MSA specific factors[16]. The size of the marginal effects in our preferred specification (column (6)) imply that being the more educated spouse (vs. being the less educated spouse) is associated with an increase of 12 percent in the wife's likelihood of being employed with respect to the mean of the

[14] **?** in his classic paper noted that a transitory reduction in income due to the husband's brief spell of unemployment has a stronger effect on his wife's labor supply than a permanent one.

[15] Four education group dummies, HS dropout is the omitted category

[16] Results are similar when married Black females are included.

dependent variable[17]. The estimates are robust to a variety of specifications that address alternative explanations, as shown in Appendix D.1 and D.2.

3 Model

Overall, the findings presented thus far confirm the explanatory power of the Becker/Gronau time allocation model to a fair extent. However, the persistence of the results associated with wife's relative education point to a more complex structure. Particularly, there are dynamic aspects to the Becker/Gronau predictions that arise out of inter-temporal dependence of actions and these are likely to be missed by the static approach. The primary incentive to work or not to work early in the marriage could also be producing considerable long term labor supply effects. The findings cannot be explained by selection in marriage or by differential in marital stability, as shown in Appendix D. Interestingly, while a positive selection on ability into "marrying down" within each education group would explain the higher employment rates of married down women, we find that the opposite is true.

Evidence, then, seems to strongly suggest that lock-in effects are at work (induced by human capital accumulation/experience), resulting in a persistent employment status. For intuition, consider a woman that married down. Consistently with standard economic models, a wife's labor supply early in marriage is a response to the husband's expected permanent income. In this respect, conditional on the husband's permanent potential income, the higher the wife's expected earnings the more likely she is to engage in paid work. The decision to work allows the accumulation of human capital. Higher work experience translates to higher wages with time through returns to experience. This increases the opportunity cost for leaving the labor market, producing a positive lock-in effect. Therefore, the propensity to leave the labor market is low. The opposite story unfolds for a woman marrying up, who

[17]The wife's hours worked per week equation was estimated using a traditional selectivity bias correction analysis (**?**). Marrying down (marrying up) is not associated with a significant effect on hours worked per week. The relative education position of the female within the couple seems to have an effect on the likelihood to be employed (extensive margin) but not on the intensity of work (intensive margin).

expecting a wealthier husband interrupts her labor market participation.

To address the above issues the following are required. First, a model of marriage is needed. In addition, the framework must include labor supply decisions. This motivates the following model that builds on the approach in **?**. In the model, in each period, agents make decisions regarding marital status, marriage or divorce, and employment. Individuals start off with a schooling level, S, and an ability endowment, φ_1 (a random draw from a normal). Fertility follows an exogenous process. Therefore, from the age at which formal education is completed, at each period, a single individual maximizes the present value of her/his utility over a finite horizon by choosing the following: (1) whether or not to work ($d \in \{0, 1\}$). Each agent is endowed with one unit of time allocated to work d, and leisure $l = 1 - d$; (2) marital status ($m \in \{0, 1\}$) − whether to marry (if she/he meets a potential partner) or continue search. When married, the individuals choose whether to stay married or separate. We assume no search for a partner while married.

3.1 Preferences

Individual j ($j = H$ - Husband, W - Wife) from household i has a periodical utility that depends on his/her private leisure, l, public good consumption, x, total number of children, N, and match quality (if married), Q. The utility function of an individual is given by,

$$U_{itj} = \frac{\left(\frac{x_{it}}{1+\xi}\right)^{\chi}}{\chi} + \alpha_{1j} l_{itj} + \alpha_{2j} N_{it} + m_{it} Q_{it} + \alpha_{3j} m_{it} N_{it} \tag{1}$$

where χ governs the intertemporal elasticity of substitution, and $\xi(m_{it}; N_{it})$[18] is the consumption deflator depending on the marital status and the total number of kids. Utility from children may differ if married ($m = 1$).

[18] $\xi(m_{it}; N_{it}) = 0.7 * m_{it} + 0.4 * N_{it}$ where 0.7 weight is given for an adult, and 0.4 to a child (OECD scale).

3.2 Home Production Technology

There is a public good, x_{it}, that is produced using the domestic labor supplies of the partners as inputs. The intra-household production technology is a function of the partners' number of housework hours and the amount of goods purchased in the market for the production of the public good. At period t, the public good is produced according to the following technology:

$$x_{it} = \left(\left(1 + \sum \gamma_{1k} N_{it}^k\right)(\delta_j l_{itj} + \delta_{-j} l_{it-j} m_{it})^{\varsigma} + \left(1 + \sum \gamma_{2k} N_{it}^k\right)(w_{itj} + w_{it-j} m_{it})^{\varsigma}\right)^{1/\varsigma} \quad (2)$$

where $(w_{itj} + w_{it-j} m_{it})$ is the amount of market purchased goods, given by the individual's wage, and his spouse's wage if married[19]. $(\delta_j l_{itj} + \delta_{-j} l_{it-j} m_{it})$ are the effective housework hours, defined as a function of the individual leisure (and his partner leisure if married). The productivity of labor (l_{itj}) in the home production, δ_j, is gender-specific. γ_{1k} and γ_{2k} govern the extent to which the number of children in each age group shifts the productivity of housework hours and of market goods, respectively. The home production function is of constant elasticity of substitution type and the parameter ς determines the elasticity of substitution between the housework time inputs and market good inputs in the production technology. This specification allows for concavity and some complementarity between the two inputs depending on the value of ς.

3.3 Fertility and Children

The number of children of age group k[20] evolves according to:

$$N_{it}^k = N_{it-1}^k + n_{it}^k - o_{it}^k \quad (3)$$

[19] We abstract from borrowing and savings decisions, so that in each period the labor income is used to purchase goods, which acts as an input into the home production technology (**??**)

[20] Children are aged 0-5, or 6-18.

where $n_{it}^k = 1$ if a child enters age group k at time t and zero otherwise; $o_{it}^k = 1$ if a child exits age group k at time t and zero otherwise. The probability of having another child is a function of the female's employment state in the previous period (d_{it-1W}), her marital status (m_{it}), her age and age squared interacted non-linearly with her education[21] ($S_{iW}AGE_{itW}$, $S_{iW}AGE_{itW}^2$), husband's education[22] (S_{iH}, if married), and the total current number of children (N_{it}). The probability of having an additional child is given by (as in **?**):

$$\begin{aligned} Pr(N_t = N_{t-1} + 1) \quad = \quad & \Phi(\lambda_1 d_{it-1W} + \lambda_2 m_{it} + \sum_S \lambda_3^S S_{iW} AGE_{itW} \\ & + \sum_S \lambda_4^S S_{iW} AGE_{itW}^2 + \lambda_5 S_{iH} + \lambda_6 N_{it}) \end{aligned} \tag{4}$$

where Φ is the standard normal distribution function.

3.4 Labor Market

We adopt the Mincerian/Ben-Porath wage function for each individual j = H, W where experience is endogenously determined, such that:

$$ln\, w_{itj} = \varphi_{i1j} + \varphi_{2j} K_{it-1j} + \varphi_{3j} K_{it-1j}^2 + \sum_S \varphi_{4j}^S S_{ij} + \epsilon_{itj} \tag{5}$$

where K_{it-1j} is actual work experience accumulated by the individual. From the time at which formal education is completed, work experience evolves according to $K_{itj} = K_{it-1j} + d_{itj}$. S_{ij} denotes the predetermined individual's level of schooling. ϵ_{itj} is a gender specific zero-mean, finite-variance and serially independent error, which is uncorrelated with K and S, $\epsilon_j \sim N(0, \sigma_{\epsilon_j}^2)$. The constant term, φ_{i1j}, denotes permanent individual ability endowment (similarly to fixed effect) that is known to the individual and to his potential partner[23].

We introduce frictions to the model. In each period t the individual receives at most

[21] $S_{iW} \in \{HSG, SC, CG, PC\}$
[22] $S_{iH} \in \{HS, HSG, SC, CG, PC\}$
[23] Ability is assumed to be a random draw from a normal ($\varphi_{1j} \sim N(0, 1/2)$).

one job offer. The offer arrival rates follow a logistic distribution and depend on the labor market state variables (previous period employment status, d_{it-1j}, schooling ,S_{ij}, as well as, accumulated work experience, K_{it-1j}):

$$Prob_{itj}^{job\ offer} = \frac{exp\left(\rho_{1j} d_{it-1j} + \sum_S \rho_{2j}^S S_{ij} + \rho_{3j} K_{it-1j}\right)}{1 + exp\left(\rho_{1j} d_{it-1j} + \sum_S \rho_{2j}^S S_{ij} + \rho_{3j} K_{it-1j}\right)} \tag{6}$$

We implicitly assume that in each period the individual may lose his job with a probability that is negatively correlated with his accumulated experience and education. In the empirical estimation, since men's employment rate is essentially close to 100 percent, we assume that men always work, i.e., $Prob_{itH}^{job\ offer} = 1$.

3.5 Marriage Market and Match Quality

Every period, with probability p, a single individual meets a potential partner characterized by a level of schooling, ability, and experience. Once a potential partner is drawn, the potential couple then draws a match quality of the partnership, Q. In particular, Q consists of an education level specific measure of 'compatibility', θ^S, and of a bliss shock, Q^b,

$$Q = 1\{homogamous\}\theta^S + Q^b \tag{7}$$

where θ^S[24], is enjoyed by the couple when both are holding the same educational attainment; and Q^b will be normally distributed so that $Q^b \sim N(0, \sigma_Q^2)$. The couple then decides whether to marry or whether to remain single and continue search. The problem that the couple faces when they are making this decision is detailed in the household's problem section. If they decide to get married, their match quality random component follows a Markov process during the course of their relationship, so that in each period they draw a new bliss component conditional on this component's value in the previous period. As in **?**,

[24] $S \in \{HSG, SC, CG, PC\}$

as well as **?**, we have a finite number of bliss values $Q^b \in \left\{Q_1^b, ..., Q_M^b\right\}$[25]. The probability of Q_q^b increasing to Q_{q+1}^b in the next period is given by P_Q^+ if $q <$ M. The probability of Q_q^b decreasing to Q_{q-1}^b in the following period is given by P_Q^- if $q > 1$.

The timing of events within a period is illustrated in timeline shown in Figure **??**.

3.6 Household's Problem

This is a finite horizon problem. Agents stop making choices in period T[26] and each period face five forms of uncertainty: job offer arrival rates, wages, probability for a potential partner and its characteristics if single, match quality, and fertility. At the beginning of each period t, once uncertainty is realized, we assume that the marital status and the labor decisions are endogenously and simultaneously made. An agent makes choices given a vector of underlying state variables Ω_{it}. The vector contains twelve state variables: couple's schooling, age[27], accumulated experience, ability, previous work status, the number and age of the children, match quality, and the wife's Pareto weight (discussed later),

$$\Omega_{it} = \left[S_H,\, S_W,\, AGE_{itW},\, K_{iHt},\, K_{iWt},\, \varphi_{1iH},\, \varphi_{1iW},\, d_{it-1W}, N_{it},\, AGE_{it}^N,\, Q_{it},\, \mu_{tW}\right]$$

Single Household

We now characterize the value of being single at time t. We solve the model backwards starting with the decision problem in period T and Ω_{iT}. The value of being single for individual j in household i, can be determined by the solution of the following problem:

$$V_{iT}^{0j}\left(\Omega_{iT}\right) = \max_{d_{iTj}} \; U_{iTj}\left(x_{iT},\, l_{iTj},\, N_{iT}^k\right) + \beta V_{iT+1}^j\left(\Omega_{iT+1}|\Omega_{iT}\right) \tag{8}$$

[25] A discrete approximation of the continuous distribution is performed and the values are governed by the zero mean and σ_Q^2. We use a grid of five, equally-spaced, support points. See **?** for further details.

[26] In the empirical estimation, the terminal period is set to $T = 45$ since the evidence in the data shows that marriage, employment, and fertility profiles remain stable after 45 years of age.

[27] Since we assume that men always work, husband's age and experience are perfectly correlated. In the empirical estimation we will therefore consider only his experience in the state vector.

s.t.

$$x_{iT} = \left(\left(1 + \sum \gamma_{1k} N_{iT}^{k}\right)(\delta_j l_{iTj})^{\varsigma} + \left(1 + \sum \gamma_{2k} N_{iT}^{k}\right)(w_{iTj})^{\varsigma}\right)^{1/\varsigma}$$

$$l_{iTj} + d_{iTj} = 1, \quad j = W,\, H$$

where β is the discount factor and a linear approximation is used to estimate the terminal value function at the terminal period, V_{iT+1}^{j}[28].

Taking the solution for period T, in recursive form, the single individual's problem in any period t can be written as:

$$V_{it}^{0j}(\Omega_{it}) = \max_{d_{itj}} U_{itj}\left(x_{it},\, l_{itj},\, N_{it}^{k}\right) + \beta \mathbb{E}\left[V_{it+1}^{j}(\Omega_{it+1}|\Omega_{it})\right] \tag{9}$$

s.t.

$$x_{it} = \left(\left(1 + \sum \gamma_{1k} N_{it}^{k}\right)(\delta_j l_{itj})^{\varsigma} + \left(1 + \sum \gamma_{2k} N_{it}^{k}\right)(w_{itj})^{\varsigma}\right)^{1/\varsigma}$$

$$l_{itj} + d_{itj} = 1, \quad j = W,\, H$$

where $\mathbb{E}$ the expectations operator and V_{it+1}^{j} is the value function of agent j in period $t+1$.

Married Couple

The couple maximizes the weighted sum of spouses' utilities in marriage. The couple does not have access to commitment technology, therefore the problem can be characterized using a Pareto problem with participation constraints and in each period the problem is

$$\begin{aligned} \max_{\{d_{itW}, d_{itH}, m_{it}\}} \quad & \mu_{tW}\left\{U_{itW}\left(x_{it},\, l_{itW},\, N_{it}^{k},\, Q_{it}\right) + \beta \mathbb{E}\left[V_{it+1}^{W}(\Omega_{it+1}|\Omega_{it})\right]\right\} \\ & + (1-\mu_{tW})\left\{U_{itH}\left(x_{it},\, l_{itH},\, N_{it}^{k},\, Q_{it}\right) + \beta \mathbb{E}\left[V_{it+1}^{H}(\Omega_{it+1}|\Omega_{it})\right]\right\} \end{aligned} \tag{10}$$

[28] Terminal value function for a single individual is

$$V_{iT+1}^{j}(\Omega_{iT+1}) = \tau_{1j} S_{ij} + \tau_{2j} K_{iT+1j} + \tau_{3j} d_{iTW} + \tau_{4j} N_{iT+1}, \quad j = W,\, H$$

s.t.

$$x_{it} = \left(\left(1 + \sum \gamma_{1k} N_{it}^k\right)\left(\delta_W l_{itW} + \delta_H l_{itH}\right)^{\varsigma} + \left(1 + \sum \gamma_{2k} N_{it}^k\right)\left(w_{itW} + w_{itH}\right)^{\varsigma}\right)^{1/\varsigma}$$

$$\begin{aligned} U_{itW}\left(x_{it},\, l_{itW},\, N_{it}^k,\, Q_{it}\right) + \beta \mathbb{E}\left[V_{it+1}^W\left(\Omega_{it+1}|\Omega_{it}\right)\right] &\geq V_{it}^{0W}(\Omega_{it}) \\ U_{itH}\left(x_{it},\, l_{itH},\, N_{it}^k,\, Q_{it}\right) + \beta \mathbb{E}\left[V_{it+1}^H\left(\Omega_{it+1}|\Omega_{it}\right)\right] &\geq V_{it}^{0H}(\Omega_{it}) \\ l_{itj} + d_{itj} = 1, \quad j = W,\, H & \end{aligned}$$

where $V_{it}^{1j}(\Omega_{it}) \equiv U_{itj}\left(x_{it},\, l_{itj},\, N_{it}^k,\, Q_{it}\right) + \beta \mathbb{E}\left[V_{it+1}^j\left(\Omega_{it+1}|\Omega_{it}\right)\right]$ is the value of being married for agent j that comes from the solution of the couple's problem in (9). Marriage is consensual. Therefore, each partner's value from marriage should be at least as high as the value of being single, $V_{it}^{0j}(\Omega_{it})$. Note that when $\beta = 0$, individuals are not forward-looking and the model simplifies to a static structural model - no explicit reference to the future consequences of current decisions.

The household problem does not have a closed form solution and is again solved numerically using backward induction. To compute agent j's value from being married we solve the couple's problem in two steps. First, the time allocation problem is solved, ignoring the participation constraints and using the Pareto weight from the previous period, μ_{it}. When a couple first meets, the initial Pareto weight is determined by a Nash bargaining problem that assigns both partners equal bargaining weight. Hence, in the terminal period T the planner solves the following problem:

$$\begin{aligned} \max_{\{d_{iTW},\, d_{iTH},\, m_{iT}\}} \quad & \mu_{TW}\left(U_{iTW}\left(x_{iT},\, l_{iTW},\, N_{iT}^k,\, Q_{iT}\right) + \beta V_{iT+1}^W\left(\Omega_{iT+1}|\Omega_{iT}\right)\right) \\ & + \left(1 - \mu_{TW}\right)\left(U_{iTH}\left(x_{iT},\, l_{iTH},\, N_{iT}^k,\, Q_{iT}\right) + \beta V_{iT+1}^H\left(\Omega_{iT+1}|\Omega_{iT}\right)\right) \quad (11) \end{aligned}$$

s.t.

$$x_{iT} = \left(\left(1 + \sum \gamma_{1k} N_{iT}^k\right)\left(\delta_W l_{iTW} + \delta_H l_{iTH}\right)^{\varsigma} + \left(1 + \sum \gamma_{2k} N_{iT}^k\right)\left(w_{iTW} + w_{iTH}\right)^{\varsigma}\right)^{1/\varsigma}$$

$$l_{iTj} + d_{iTj} = 1, \quad j = W,\, H$$

where again a linear approximation is used to estimate the terminal value function at the terminal period, V^{j}_{iT+1}[29]. Given the current μ_{iT}, from the solution of the above problem the value of a married agent j, V^{1j}_{iT}, can be computed.

In the following step, we check whether the individual participation constraints are satisfied for the optimal time allocation. Three events can occur: *(1)* The participation constraints are satisfied for both partners, in which case they remain married or decide to marry if they just met and individual j's value is V^{1j}_{iT}. *(2)* The participation constraints are binding or violated for both partners and it is optimal to divorce[30] or not marry if they just met. Partner j's value is then V^{0j}_{iT}. *(3)* The participation constraint is violated for j but satisfied for $-j$, i.e., the former is better off single and the latter married. In this case, the couple will renegotiate and the weight[31] on the utility of the partner preferring to remain single, μ_j, is increased to the point where he is indifferent between being single or married. At this new Pareto weight, if participation constraints are satisfied for both they remain married (or marry). Individual j's value is the new V^{1j}_{iT}. Otherwise, the couple separates and the value for agent j is V^{0j}_{iT}.

Once the continuation values have been defined, to determine agent j's value from being married in an arbitrary period t we solve the couple's problem by solving the problem recursively using the same two step procedure described above.

4 Estimation

The model is estimated using the Simulated Method of Moments (SMM) . The objective of the method is to find the parameter vector $\hat{\vartheta}$ that minimizes the quadratic distance between

[29] Terminal value function for a married individual is

$$\begin{aligned} V^{j}_{iT+1}\left(\Omega_{iT+1}\right) \quad = \quad & \tau_{1j}S_{ij} + \tau_{2j}K_{iT+1j} + \tau_{3j}d_{iTW} + \tau_{4j}N_{iT+1} + \tau_{5j}S_{i\_j} \\ & + \tau_{6j}K_{iT+1\_j} + \tau_{7j}m_{iT+1} + \tau_{8j}m_{iT+1}N_{iT+1} + \tau_{9j}m_{iT+1}Q_{iT}, \quad j = W,\, H \end{aligned}$$

[30] In the event of divorce women retain custody of their children and the husband does not pay any child support.

[31] For the Pareto weights, μ, we use an equally-spaced grid of 11 points.

a set of empirical (Ψ_D) and simulated moments ($\Psi(\hat{\vartheta})$). Formally the SMM estimator $\hat{\vartheta}$ solves:

$$\hat{\vartheta} = \arg\min_{\vartheta} \left[\Psi_D - \Psi(\hat{\vartheta})\right]' W \left[\Psi_D - \Psi(\hat{\vartheta})\right]$$

where ϑ is the vector of parameters of our interest; W is the weighting matrix and the weight assigned to each element of the vector $[\Psi_D - \Psi(\hat{\vartheta})]$ is the inverse estimated standard deviation of the particular data moment. Under the assumptions that the variables are stationary and ergotic, $\hat{\vartheta}$ is consistent (**?**).

The following lists the set of empirical moments (Ψ_D) that we aim to match : average employment rate for women by age, education, relationship status, number of kids, and spouse's relative education (down, equal, up); employment transition rates by age, relationship status, and number of kids; wages by gender, education, experience, spouse's relative education; wage variances by gender; average probability of giving birth by age, and education; average number of children at the age of 40 by education; percentage of married females by age, and education; transition rates between marital states by age, and education.

The parameters to estimate (ϑ) are: the seven parameters in the utility function (χ, α_{1j}, α_{2j}, α_{3j}); the twelve parameters that determine the probability of having a child ($\lambda_1, \ldots, \lambda_6$); nine parameters of the marriage marriage market and match quality (p, θ^S, μ_Q, σ_Q^2, P_Q^+, P_Q^-); the seven parameters of the household production function (γ_{1k}, γ_{2k}, δ_{-j}, δ_j, ς); the fifteen parameters that determine the wage process for females and males (φ_{2j}, φ_{3j}, φ_{4j}^S, $\sigma_{\epsilon_j}^2$); the thirteen parameters of the probability to receive a job offer for women and men (ρ_{1j}, ρ_{2j}, ρ_{3j}^S); the parameters in the terminal utility function ($\tau_{1j}, \ldots, \tau_{9j}$). The discount factor β is set to 0.97.

Given the individual's education, a potential partner is drawn from a conditional distribution according to the actual distribution for the NLSY79 cohort (born 1960-65). In particular, we use CPS data to generate the actual distribution of spouses' level of education and potential experience[32]. Each individual can only draw a potential spouse with an educa-

[32]We define years of potential experience as the difference between age and years of schooling.

tional level two level below, two levels above, or at the same level of educational attainment. This restriction is not essential but is based on the consideration of geographic proximity, and that individuals search/meet potential spouses in similar circles.

The model is estimated using 1979-2008 waves of the NLSY79. In solving the dynamic programming problem, we focus on women with at least a high school degree. The details of data construction are described in **??**. Most women had completed schooling by the time of marriage: among all women in our sample 92% reported "Not Enrolled" at the time of marriage and only 4% returned to school (relatively late in the marriage). Therefore, to simplify matters the initial sample is made of representative single agents reflecting the distribution of education levels observed in the data[33]. We solve the model for each agent in each period. To allow agents to follow a rich set of paths, we simulate 1000 agents for each level of schooling from the year schooling was completed until 45 years of age and produce the targeted moments.

5 Estimation Results

5.1 Parameter Estimates

Parameter estimates and their standard errors are reported in **??**. A subset of the parameters are fundamental to understanding differences in employment profiles between the different marriage categories.

Identification of the parameters determining productivity, and preferences for working and children, rely on the set of moments describing labor supply by family status and labor market transitions, by education level. Our estimated value for ς is 0.78, a reasonable degree of substitution between market goods and housework inputs. Woman's preference for working depend on her family status. It is accounted for by the shifters to the marginal

[33]High school graduate start at the age of 18, some college at 22, college graduate at 23, and post college at 25.

housework productivity. Mothers find it more costly to take up work, particularly if children are young ($\gamma_{1,0-5} > \gamma_{1,6-18} > 0$). Young and older children have similar a similar effect on marginal market goods productivity, $\gamma_{2,0-5}$ and $\gamma_{2,6-18}$ are similar in magnitude.

The wage-related parameters are identified from the wage profiles for the women in the sample and husband's earnings. We only observe wages for those who work, but the solution to the optimization problem provides the sample selection rules. The coefficients show familiar features. As compared to lower levels, a university education carries a substantial wage premium. An extra year of experience translates to a reasonable about 5 and 6 percent increase in wages[34], for females and males, respectively. Men exhibit higher returns to education and work experience.

Female's job arrival rate is identified from data moments on transitions into and out of employment, again, by education level. As we would expect, the arrival rate increases with education and is higher when on the job. The estimate on work experience in the job arrival rate function is negative but small. This is because the dynamics of work experience, underlying the dynamics of job arrival rate is loosely identified from the profile of employment with age.

The transition probabilities that define the dynamics of the match quality Q are important in the model. These, as well as the other match quality parameters, are identified from the profile of marriage rate with age and also the empirical transition matrix between marital statuses, by education level. The probability of a positive and negative match quality shock are estimated to be 22 and 24 percent, respectively. Preference parameters for assortative mating, θ^S, confirm that compatibility is valued, and more so among the more educated.

5.2 Model Fit

We now turn to presenting evidence on the within-sample fit of the model. The baseline dynamic model does a remarkable job of reproducing the profiles observed in the data. In

[34] **?** estimates the return to one extra year of full-time work for women at between 3 and 5 percent.

this section we also look at how would the static version of the model (i.e., discount factor, $\beta = 0$, individual maximizes today's utility with no regard to the future. Therefore, the individual's choice reduces to static discrete choice.) would fare in trying to reproduce some important patterns. The same moments were used for the estimation of the static[35] and the dynamic baseline model.

Figure **??** depicts the fit of the models to the marriage choice proportions by education group. Each of the profiles implied by the estimated models has the right shape and matches the levels of the data closely. Table **??** demonstrates that the dynamic framework has no trouble generating the assortative mating profiles at first marriage. The baseline model's prediction follows the data very closely. The static model however over-predicts the proportion of those marrying down. In a static framework one is short-sighted and does not perceive the option value of waiting: a marriage is consented to as soon as a single agent meets a partner and marriage would imply a higher current period utility (versus lifetime expected utility) for both partners than remaining single. Hence, marriage is rather "more random" than preferential and the sorting patterns reflect more closely the education distribution in the population. For example, a college graduate female in both frameworks is more likely to meet a male with less than a college degree than a male with a post college degree. However, in the dynamic framework, the female perceives the option value of waiting for a better match and in some cases chooses to continue search.

The dynamic model does a fine job of reproducing the married women's employment age profile for each education level, see Figure **??**. The static model fails to capture the humped shape, most pronounced for some college and college graduate women, and tends systematically to under-predicts early in life and over-predicts later in life. This arises because in the static framework individuals don't have the strong incentives to participate when young to accumulate experience. The dip in employment reflects the impact of child bearing on labor supply.

[35]Parameter estimates are not presented here and are available upon request.

Most notably, in Table **??**, the dynamic model replicates almost exactly the large disparities in married women's labor supply conditional on their educational attainment and their relative position in education. It slightly under-predicts the employment rate for high school graduates that are married up or equal. Focusing on the group with the most remarkable employment gap, college graduates, in the data we observe a 20 percentage points gap (50% vs. 79%) when comparing those married up and down. The dynamic model generates a gap of 18 percentage points (61% vs. 79%). The feature of the model that drives the higher labor market attachment of the married down women is the return to experience. Nevertheless, the static model provides a poor fit. While the model predictions capture the general pattern of response to husband's relative education, it under-predicts[36] the employment rate gap between married up and down, e.g., only 3 percentage points (74% vs. 77%) for the college graduates. In Figures **??**-**??**, we show wage profiles by experience, gender and education. For women and for men, the trends and the levels are well fitted by both estimated model.

Overall, for the key moments, the baseline dynamic model fits the data remarkably well. It also provides a much better fit to the data than the static version.

Table **??** provides additional assessment of the fit of the baseline model along various dimensions, for the four education groups. The results show a good match in terms of fertility rates. The dynamic model is also reproducing the differences in women's employment rates across marital status and the different fertility levels. Because children significantly increase the value of home production, the degree of specialization in home production is increasing as a function of the number of kids.

Table **??**, confirms the evidence of selection on ability into marrying up, down and equal that are presented in Appendix D.4, using the NLSY79. More specifically, we find that for both genders, conditional on educational attainment, those that marry down (up) have lower (higher) AFQT average scores compared to those married equal. While these moments were not targeted in the estimation, the model generates ability moments and thus provides

[36]Except for the HS graduates.

additional checks of the model. Table **??**, panel A and B, report average ability by education and by relative position in education for women and men, respectively. Although we cannot compare these ability moments to AFQT moments from the data, it is reassuring that the mechanism in the model duplicates the feature observed in the data.

6 Counterfactuals

6.1 Returns to Experience

As discussed earlier, we consider wage returns to experience and its dynamic effects as strong candidates for explaining the gap in labor supply observed among married women across the three categories of husband's relative education. We now turn to assess the magnitude of the effects of wage growth (wage returns to experience). While its difficult to make an assessment using reduced forms techniques, our model allows us to construct counterfactual profiles, by comparing profiles with and without returns to experience for women (i.e., a female's life-cycle wage profile is flat conditional on her educational level). We compare outcomes from the simulation assuming that experience does not lead to any wage growth for females, i.e., $\varphi_{2W} = \varphi_{3W} = 0$, with the baseline outcomes predicted by the dynamic model given the estimated parameters. Hence, the differences in behavioral outcomes should be accounted for by the lack of returns to experience.

The simulation results are reported in Figures **??**-**??** and Tables **??**-**??**. Without the prospect of wage growth, the marriage market is affected. Its taking longer for women from all education groups to marry (Figure **??**). The consequence of this on the level of marriage rate by the age of 45 is minor, except for those holding a post-graduate degree. In the model, this arises from higher rejection rate from the men's part. Because lifetime expected value from working is lower and women's labor force attachment will be lower, men opt for waiting for a female with a higher lifetime value from working. Indeed, the model predicts higher rates of marrying down, especially for the college and the post-college graduate females

(Table **??**). It is most clear for the post-graduate females: holding everything else constant, with a lower value from working, females are "less" attractive to men from their own group yet still desired but those with less than a post graduate degree, the marriage rate will be lower and more women will marry down.

In Figure **??**, the profiles reflect the lower labor market attachment arising from the lack of incentive to invest in human capital accumulation when young in the absence of wage growth. We also note that lower-educated women respond to the absence of returns to experience to a greater extent. The simple reason is that low-educated workers are more likely to be on the margin of the employment decision than high skilled workers, and therefore are more responsive to changes in the incentives to work[37].

The effect of experience is also very important for understanding the employment rate gap within the same education group across the three marriage categories. The model without wage growth still predicts an employment gap between the married up group and the married down group, yet more modest (Table **??**): 3.5% vs. 5.4% for HS graduate, 4.2% vs. 12.1% for some college, 8.6% vs. 18% for college graduate, and 3.1% vs. 11.4% for post-graduate (gap between equal and down). The return to experience explains 52% of the gap between the group that is married up and down. Married down women have the incentive to work more given the lower earning husbands. Everything else equal, the female that is married down experiences a smaller wage differential between her and her husband's, making her more likely to work than the females experiencing larger wage differentials, those with equally or higher educated husbands. However, given the flat wage profile, the opportunity cost of not participating or leaving the job market is much lower. Then, when the married down female's husband is hit with a positive wage spell, she is more likely to decide to not participate since she does not perceive higher forgone earnings compared to if she were to participate and accumulate experience.

[37]These predictions are in line with the empirical analysis of **??**. They provide estimates of the elasticity of LS by skill group that confirm that low-skilled LS is much more elastic than high-skilled workers.

6.2 Divorce

Divorce has been shown to matter for a variety of outcomes. **?** find that the higher probability of divorce faced by the younger cohorts of women is able to explain a large proportion of the observed increase in female labor force participation, compared to the older cohorts[38]. To assess the importance of divorce as a driver for female labor force participation, we perform a counterfactual simulation assuming no divorce[39] and compare with the baseline results.

Because of the higher "spousal insurance" married women face in the absence of divorce, the incentive to work and accumulate experience as a form of self-insurance is lower. Indeed, figure **??** exhibits lower employment rates over the life-cycle. The magnitude of the increase for the less educated (HS graduates and some college) in more pronounced than that for the college and post-college graduates. This reflects the fact that the latter groups face lower divorce rates than the former (see Table **??**) and therefore would be less affected by changes in the divorce risk. Turning to the employment rates for women that marry up and down, the counterfactual predicts significantly lower overall difference between the two groups: the mean difference under no divorce is 11.5 percentage points compared to 5.5 percentage points in the baseline model. The results therefore suggest that divorce plays a role in the employment rate gap observed between married up and down.

6.3 Schooling Distribution

The model is estimated based on data for the 1965 cohort from the NLSY79. One of the key forces driving the decision to marry is the education distribution of potential wives and husbands, which are determined outside the model. We substitute the schooling distributions for 1965 cohort with the one of 1945, keeping all parameters fixed at the estimated values. Any differences in behavioral outcomes are attributable to this modification.

[38] See also **?** and **?** for the relationship between divorce and female labor force participation.

[39] One should approach this exercise with precaution. When divorce is not allowed, bargaining weight within the couple remains constant over the course of marriage and is not re-negotiated.

Table ?? presents the prediction of the sorting profile. Since the education gender gap in the population is larger for the 1945 cohort, women are less likely to marry down, overall from 33 percent to 21 percent, while homogamy rate is largely unaffected - the data exhibits the same pattern (see Figure ??). Note that the employment profiles for women married up, equal and down hold unchanged (see Table ??). The striking differences in labor supply behaviors along with lower proportion of married down women translate into lower employment profiles compared to the baseline cohort (see Figure ??). Put differently, the changes in the education distribution predicted a 12 percentage points increase in the proportion of married down women (21% to 33%) while homogamy rates stay constant, and an overall increase of 6.8 percentage points in employment rates for married women aged 30-40. In the data employment rate increased by roughly 10 percentage points for the same age group between 1945 and 1965 cohort. Furthermore, the associated change in the proportion of women marrying down, in isolation, is able to account for 2.5 out of the 6.8 percentage points difference. Marriage sorting patterns have life-cycle consequences and are critical to the understanding of female labor supply.

7 Conclusion

In this paper, we show that spouse's relative educational attainment produces dynamic labor supply effects on married women. Our reduced form results suggested that if the wife's educational attainment is higher than that of her husband, her likelihood of being employed is associated with an up to 14.5 percentage points higher employment rate compared to when the wife's educational attainment is lower than that of her husband.

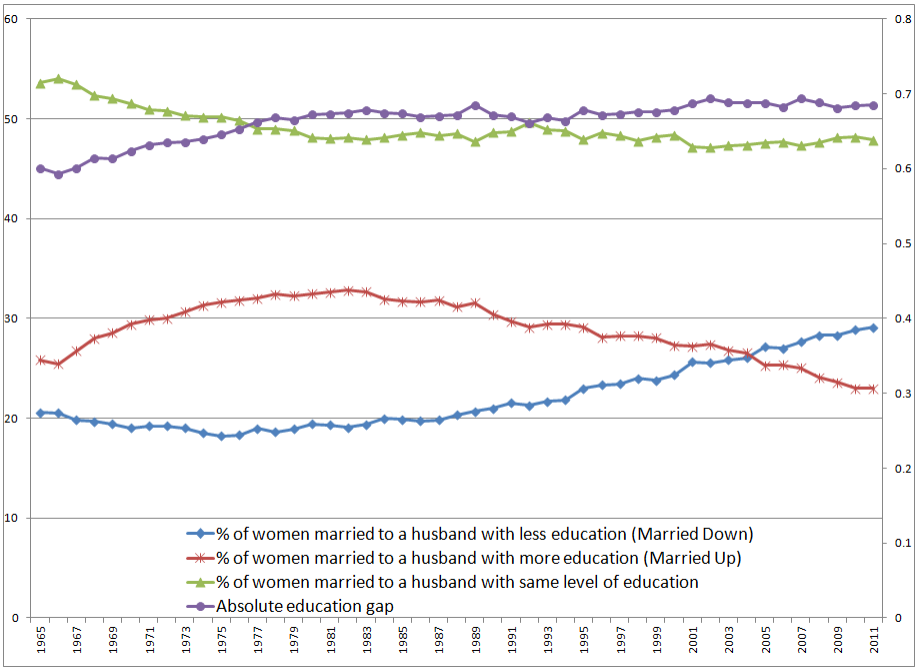
We have formulated a dynamic model of endogenous marriage and labor supply decisions in a collective framework. The model was structurally estimated using data from the NLSY79. The results indicate that the model captured the profiles of labor supply, and marriage decisions displayed by the data. The estimates were used to gauge the importance

of wage growth on the labor supply behavior of women in the three marriage categories (up, equal, down). In particular, when the wage returns to experience are ruled out in the estimated model and everything else kept equal, the predicted employment gap between those married up and down drops substantially. Returns to experience alone account for 52 percent of the employment gap.

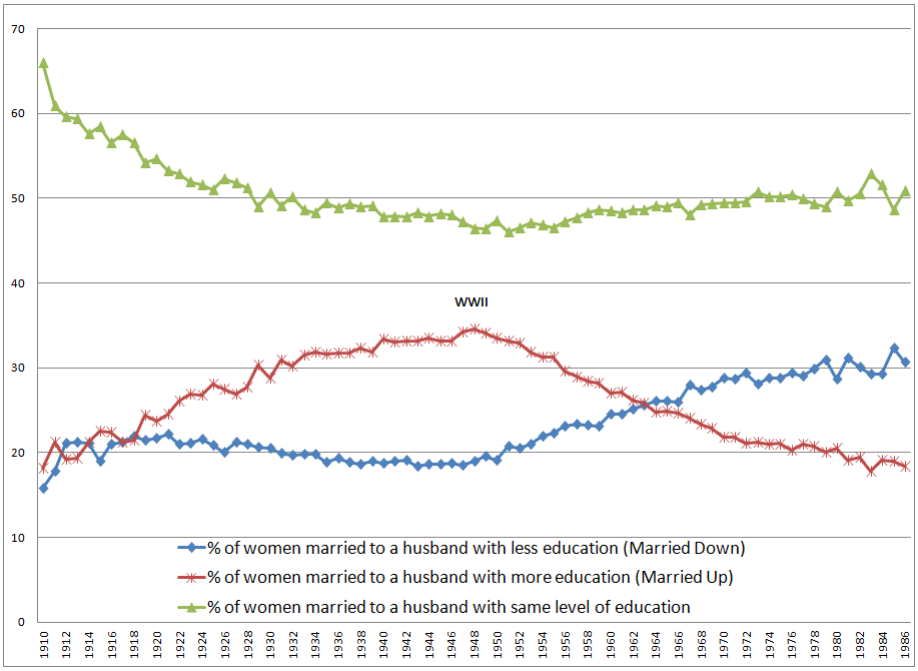
While previous research on female labor supply emphasized the importance of returns to experience, this paper points to the importance of husband's relative education within couples and wage returns to experience in creating dynamic labor supply effects. The model makes a significant contribution and include important features and open further lines of inquiry. One important extension would be the examination of the effects of spouse's relative education on savings and asset accumulation dynamics. Also, recent models have emphasized that investment in education generates returns in the marriage market (**??**). In the future, it may also be important to endogenize the education decision.

Figure 1: Marriage Patterns

(a) Cross Sectional



(b) Birth Cohorts

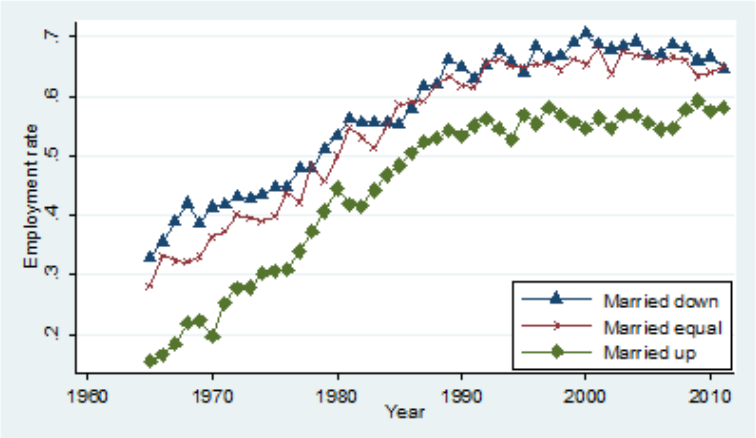


Source - March CPS 1965 - 2011.

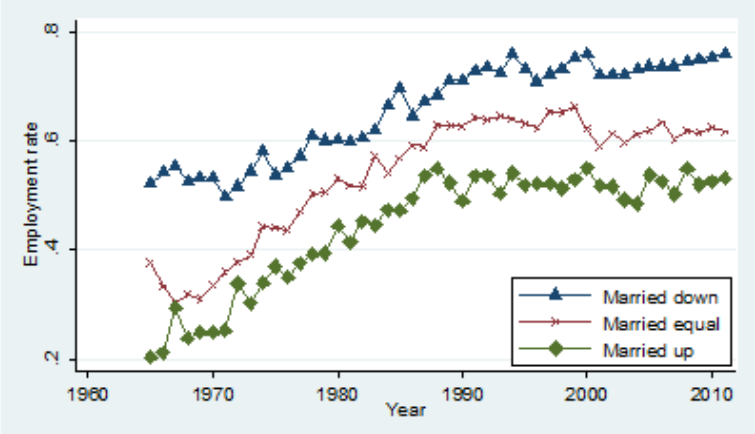
Notes - Married white women, ages 25 - 55.

Figure 2: Employment Rate by Wives' Education and Match

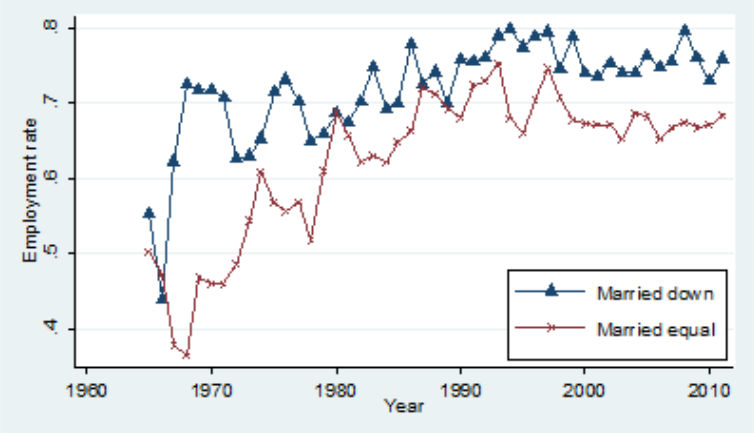
(a) Some College



(b) College Graduate



(c) Post-Graduate



Source - March CPS 1965 - 2011.

Notes - Married white women, ages 25 - 55. Proportion working at least 20 weekly hours.

Figure 3: Timing of Shocks and Decisions

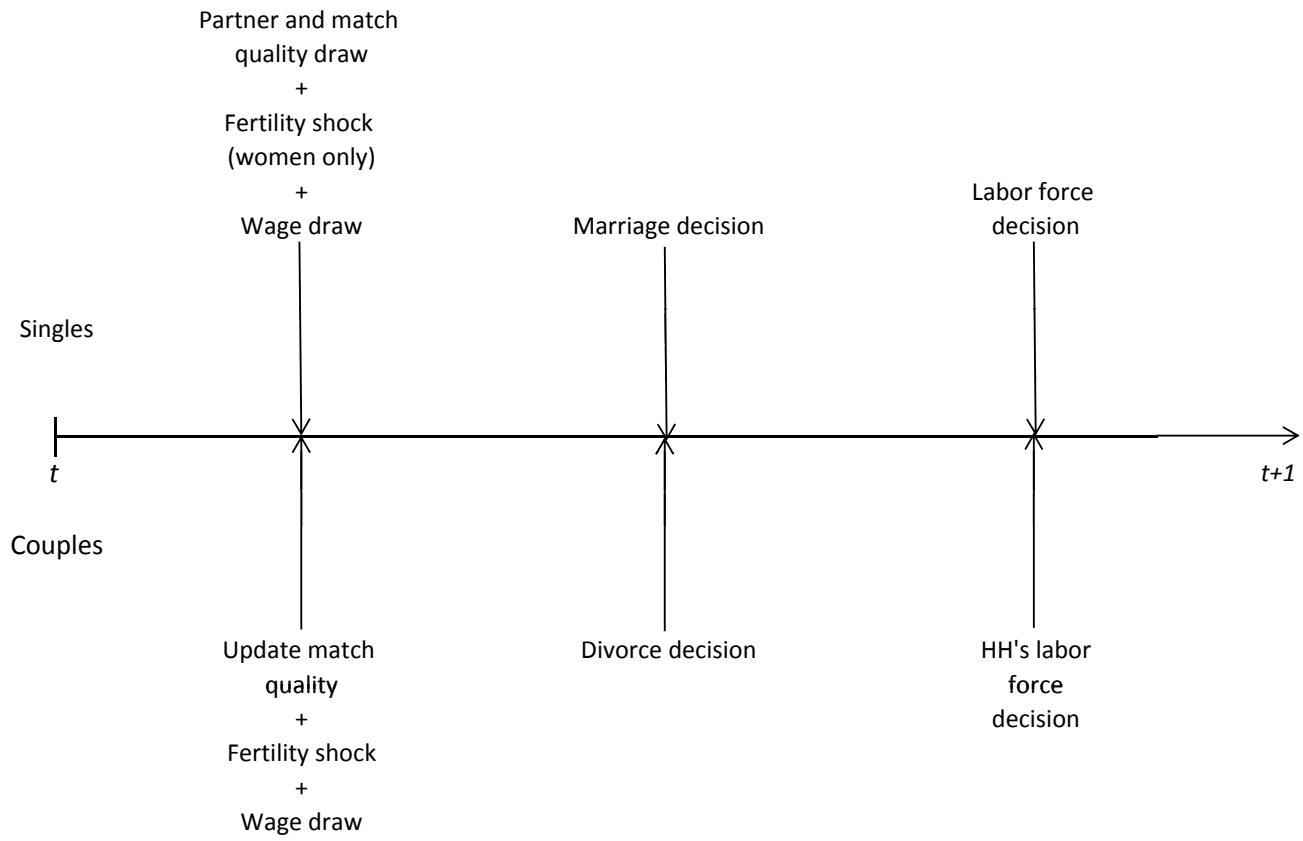


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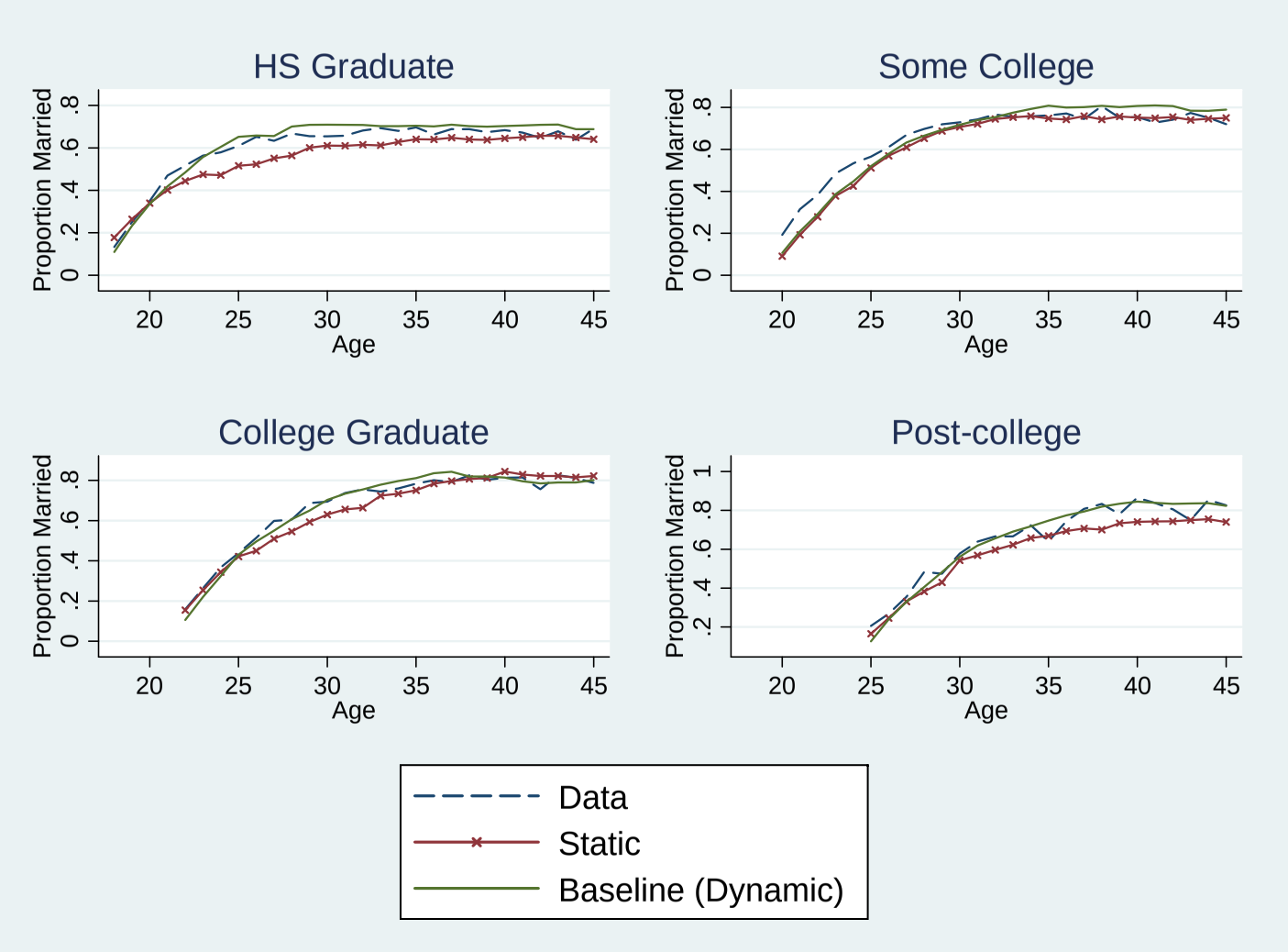
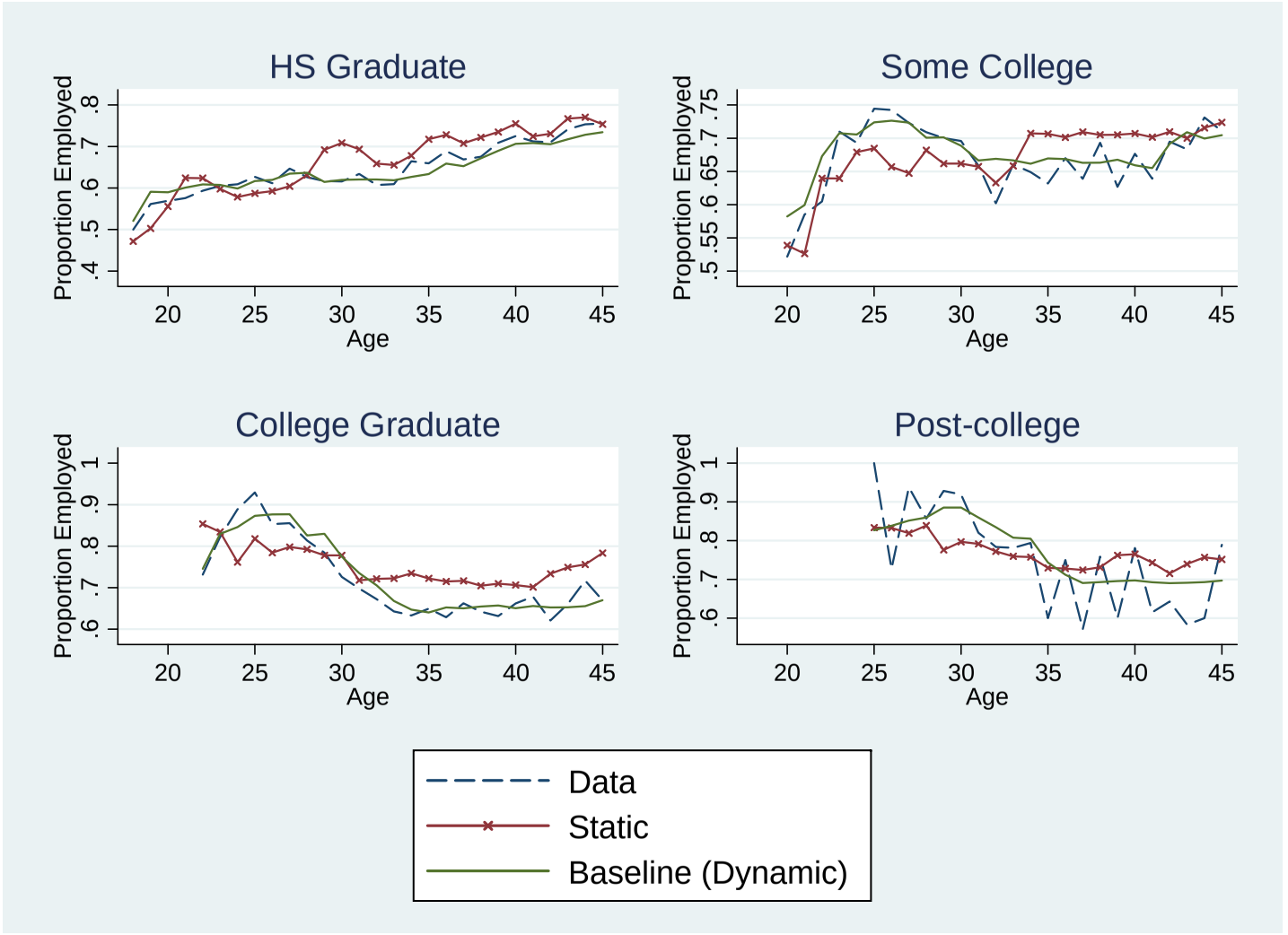
Figure 4: Fit of Marriage Rates by Education



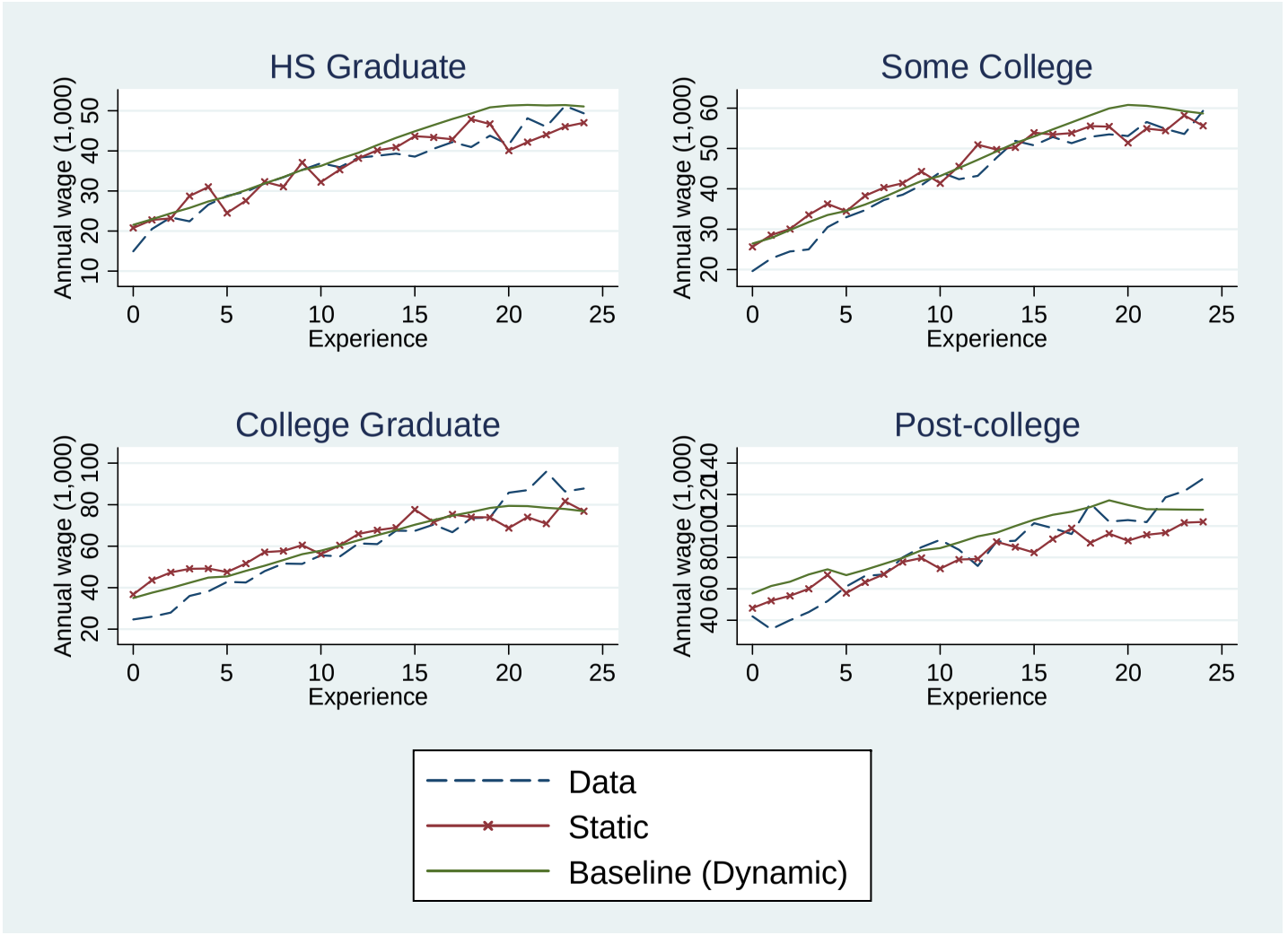
Notes -

Figure 5: Fit of Employment Rates - Married Women by Education



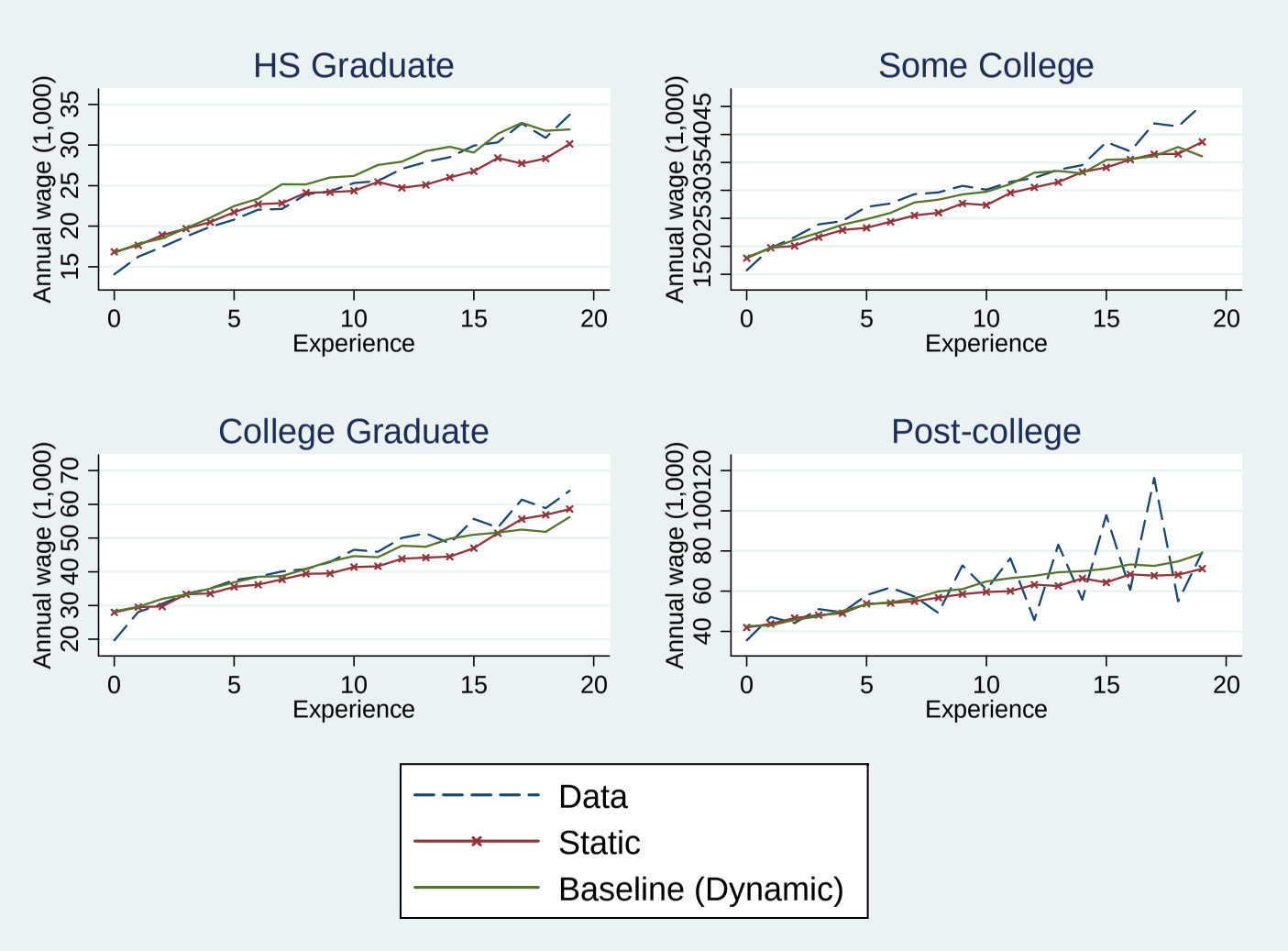
Notes -

Figure 6: Fit of Earnings by Education - Men



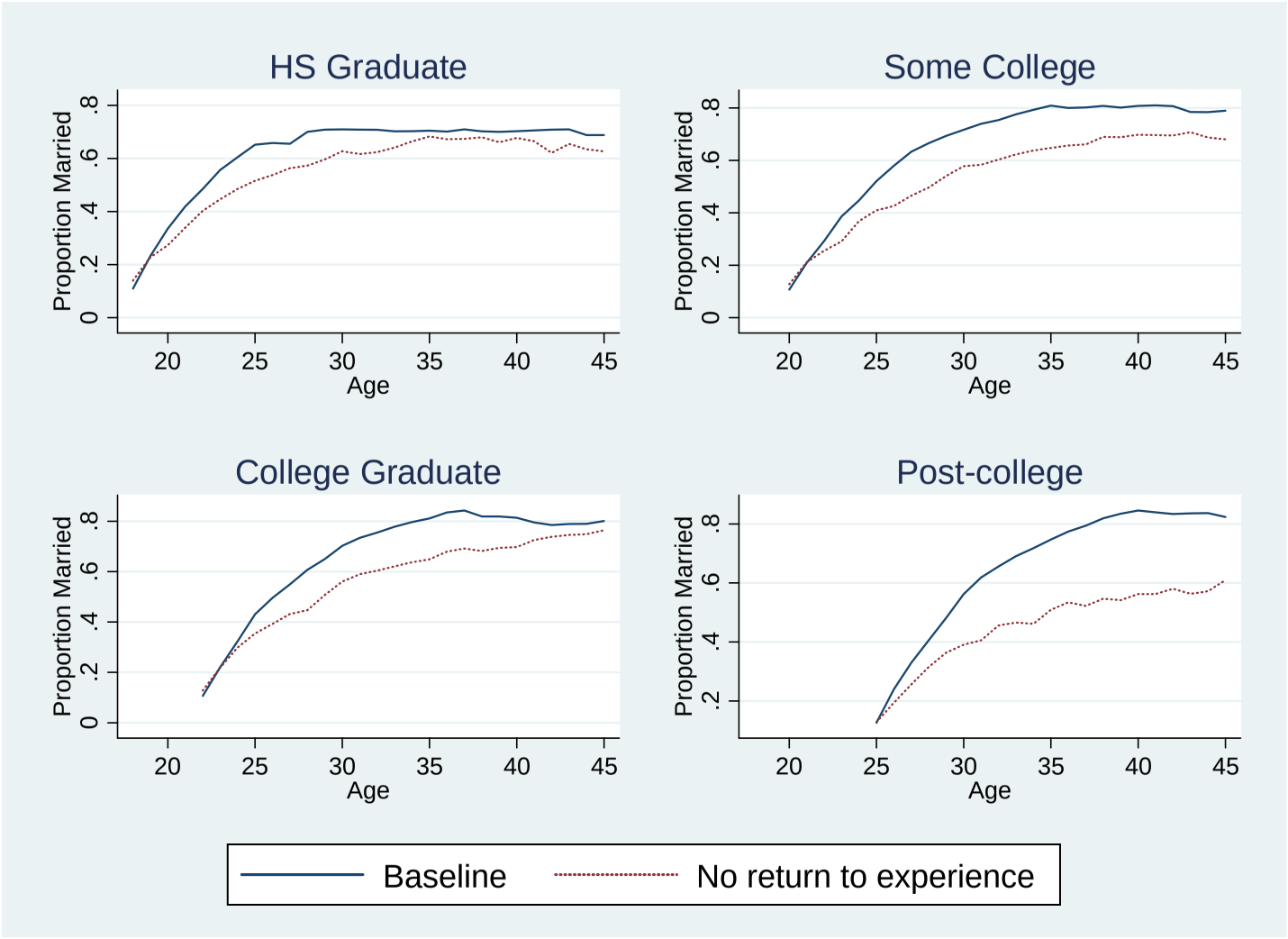
Notes -

Figure 7: Fit of Earnings by Education - Women



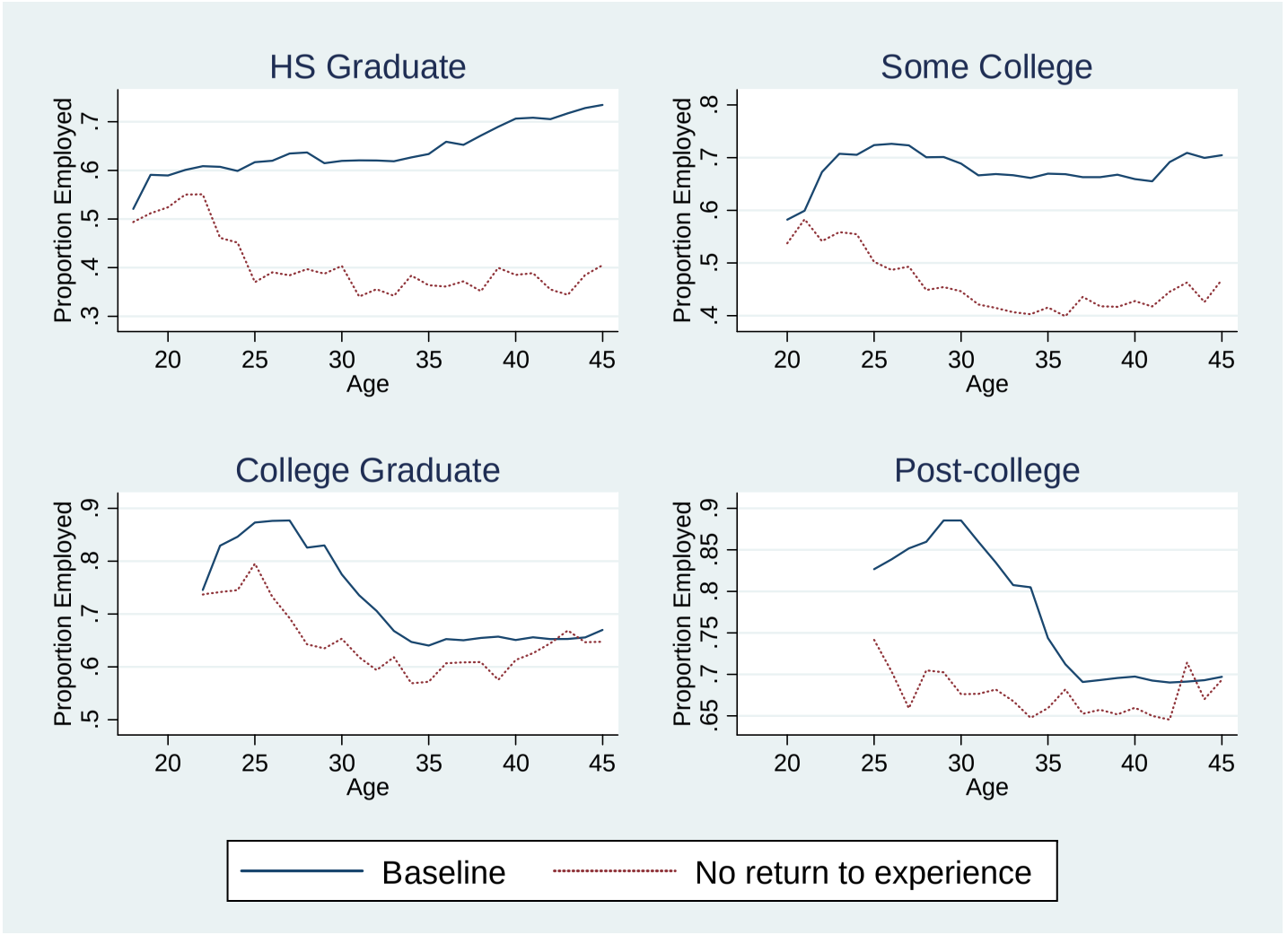
Notes -

Figure 8: Women Marriage Rate - Baseline and No Returns to Experience



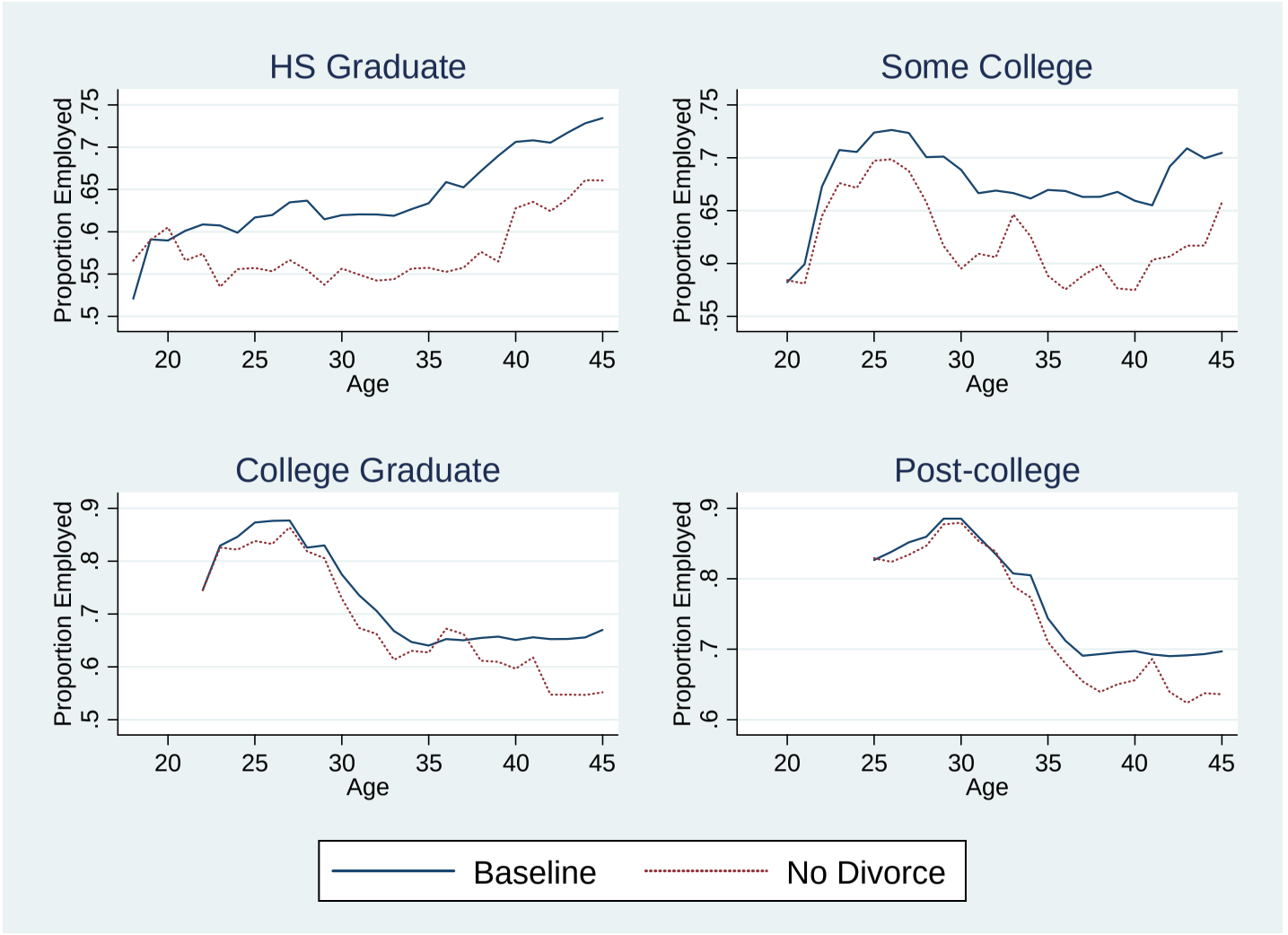
Notes -

Figure 9: Married Women Employment Rate - Baseline and No Returns to Experience



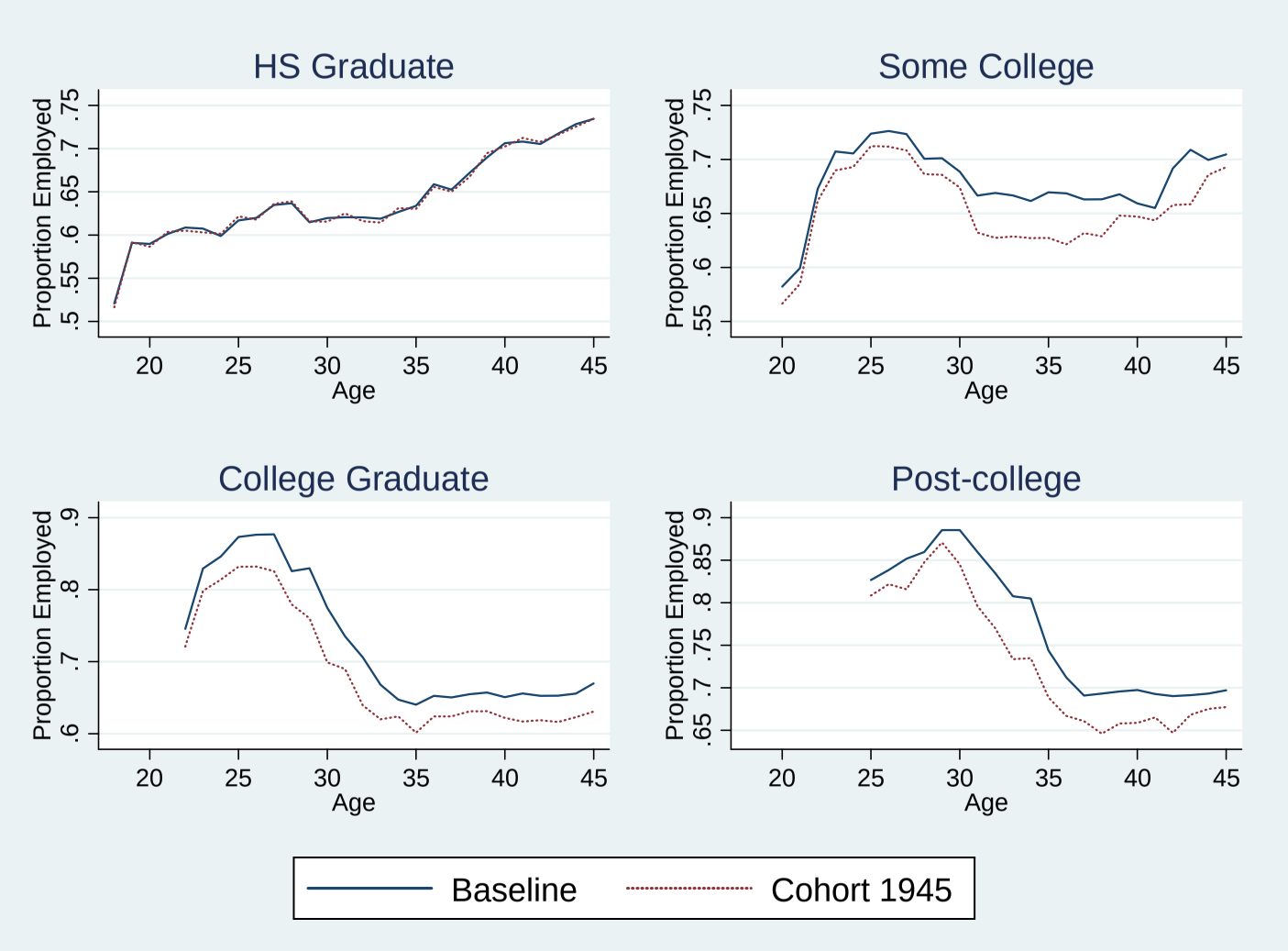
Notes -

Figure 10: Married Women Employment Rate - Baseline and No Divorce



Notes -

Figure 11: Married Women Employment Rate - Baseline and Cohort 1945



Notes -

Table 1: Husbands' Education Distribution by Wive's Educational Attainment

	(1) All sample				
Men Education Group	Women Education Group				
	HSD	HSG	SC	CG	PC
High School Dropout (HSD)	65.32	17.27	5.9	1.87	1.05
High School Graduate (HS)	25.49	50.36	25.57	12.15	7.82
Some College (SC)	7.13	20.43	38.27	19.36	13.85
College Graduate (CG)	1.64	9.2	21.38	43.57	29.29
Post College Degree (PC)	0.42	2.74	8.88	23.05	48
% Women Married Down	0	17.27	31.47	33.38	52

	(2) 40-45 cohorts				
Men Education Group	Women Education Group				
	HSD	HSG	SC	CG	PC
High School Dropout (HSD)	59.87	17.82	5.98	1.91	1.45
High School Graduate (HS)	30.57	50.1	23.48	9.9	6.31
Some College (SC)	7.58	20.1	33.33	14.62	11.84
College Graduate (CG)	1.59	9.1	24.61	41.88	21.38
Post College Degree (PC)	0.38	2.88	12.59	31.69	59.03
% Women Married Down	0	17.82	29.46	26.43	40.97

	(3) 60-65 cohorts				
Men Education Group	Women Education Group				
	HSD	HSG	SC	CG	PC
High School Dropout (HSD)	59.53	11.44	4.85	1.42	0.74
High School Graduate (HS)	28.6	56.05	28.56	13.42	8.67
Some College (SC)	9.15	21.64	41	20.78	14.82
College Graduate (CG)	2.29	8.76	18.99	44.54	31.22
Post College Degree (PC)	0.43	2.11	6.6	19.84	44.55
% Women Married Down	0	11.44	33.41	35.62	55.45

Source - March CPS 1965 - 2011.

Notes - Married white women, ages 25 - 55.

Table 2: Women's Employment Rate by Wives' and Husband's Educational Attainment

Men Education Group	Women Education Group HSG	SC	CG	PC
High School Dropout (HSD)	**49**	**57.47**	**68.07**	**71.24**
High School Graduate (HS)	51.92	**62.18**	**71.58**	**80.47**
Some College (SC)	51.47	60.23	**68.39**	**79.97**
College Graduate (CG)	44.87	49.74	57.78	**71.61**
Post College Degree (PC)	41.17	44.38	47.76	66.31

Source - March CPS 1965 - 2011.
Notes - Married white women, ages 25 - 55. Proportion working at least 20 weekly hours. * - small sample size. In bold: women marrying down.

Table 3: Estimated Effects on Wife's Employment

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Female married down (d)	**0.050*** **	**0.049*** **	**0.036*** **	**0.042*** **	**0.038*** **	**0.037*** **
	(0.001)	**(0.001)**	**(0.002)**	**(0.002)**	**(0.003)**	**(0.003)**
Female married up (d)	**-0.049*** **	**-0.047*** **	**-0.029*** **	**-0.025*** **	**-0.022*** **	**-0.023*** **
	(0.001)	**(0.001)**	**(0.001)**	**(0.002)**	**(0.002)**	**(0.003)**
Female post graduate (d)	0.254***	0.249***	0.299***	0.278***	0.306***	0.293***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.006)
Female college graduate (d)	0.191***	0.182***	0.230***	0.195***	0.225***	0.204***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.006)
Female some college (d)	0.181***	0.165***	0.201***	0.152***	0.177***	0.162***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.005)
Female high school graduate (d)	0.145***	0.123***	0.145***	0.102***	0.120***	0.111***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
Age	0.003***	-0.004***	-0.003***	-0.004***	-0.003***	-0.003*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Age gap	-0.001***	-0.002***	-0.001***	-0.002***	-0.001***	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of children in the HH		-0.043***	-0.041***	-0.042***	-0.038***	-0.043*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.025)
Presence of a child 0-6		-0.221***	-0.224***	-0.221***	-0.226***	-0.233***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Male post graduate (d)				-0.038***	0.029***	0.029***
				(0.007)	(0.007)	(0.008)
Male college graduate (d)				0.010*	0.062***	0.059***
				(0.005)	(0.005)	(0.006)
Male some college (d)				0.076***	0.098***	0.096***
				(0.004)	(0.004)	(0.005)
Male high school graduate (d)				0.051***	0.061***	0.059***
				(0.003)	(0.003)	(0.004)
Dummies for the deciles of Husband's annual income	NO	NO	YES	NO	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES
MSA fixed effects	NO	NO	NO	NO	NO	YES
Mean employment (dependent variable)	0.519	0.519	0.519	0.519	0.519	0.512
Observations	972,821	972,821	972,821	972,821	972,821	681,503

Notes - Married white women, ages 25 - 55. Employment indicator is one when working at least 20 weekly hours. Marginal effects (instead of logit coefficients) are reported. *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Reference education group: HSD.

Table 4: Women Employment Rate by Women and Men Education Group

(1) Husband at the top 10% of income distribution					(2) Husband at median income (45-55% of income distribution)				
	Women Education Group					Women Education Group			
Men Education Group	HSG	SC	CG	PC	Men Education Group	HSG	SC	CG	PC
High School Dropout (HSD)	**34.99**	**40.64**	**63.19**	**60**	HSD	**54.28**	**63.64**	**68.85**	**75.38**
High School Graduate (HS)	37.11	**46.05**	**52.43**	**70.24**	HSG	59.86	**68.66**	**78.25**	**83.61**
Some College (SC)	36.55	44.88	**53.24**	**65.35**	SC	59.95	68.43	**75.26**	**83.36**
College Graduate (CG)	32.81	35.86	42.68	**59.44**	CG	60.17	62.06	71.1	**80.32**
Post College Degree (PC)	33.2	36.02	39.18	58.33	PC	48.33	54.22	56.86	73.52

Source - March CPS 1965 - 2011.

Notes - Married white women, ages 25 - 55. Proportion working at least 20 weekly hours. In bold: women marrying down.

Table 5: Estimated Effects by Education Group (Dependent Variable: Employment)

VARIABLES	(1) High School Graduate	(2) Some Graduate	(3) College Graduate	(4) Post-Graduate
Female married down (d)	-0.032***	0.009***	0.085***	0.059***
	(0.004)	(0.004)	(0.004)	(0.005)
Female married up (d)	-0.005**	-0.075***	-0.063***	
	(0.002)	(0.003)	(0.004)	
Dummies for the deciles of Husband's annual income	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES
MSA fixed effects	YES	YES	YES	YES
Mean employment (dependent variable)	0.477	0.574	0.594	0.691
Observations	324,168	147,670	112,336	52,429

Notes - Married white women, ages 25 - 55. Employment indicator is one when working at least 20 weekly hours. Marginal effects (instead of logit coefficients) are reported. All models include own age, age gap, number of children in the HH and an indicator for the presence of a child 0-6. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Assortative mating at the First Marriage - Data, Baseline and Static Model

Woman's Education	**Data**	**Baseline Dynamic Model**	**Static Model**
HS Graduate			
Up	0.264	0.261	0.236
Equal	0.586	0.585	0.523
Down	0.150	0.154	0.242
Some College			
Up	0.277	0.220	0.174
Equal	0.288	0.310	0.306
Down	0.434	0.471	0.519
College Graduate			
Up	0.168	0.162	0.115
Equal	0.465	0.463	0.324
Down	0.367	0.375	0.561
Post-college			
Up	-	-	-
Equal	0.407	0.407	0.254
Down	0.593	0.593	0.746

Table 7: Married Women's Employment by Relative Position in Education - Data, Baseline and Static Model

Woman's Education	**Data**	**Baseline Dynamic Model**	**Static Model**
HS Graduate			
Up	0.636	0.608	0.642
Equal	0.640	0.626	0.644
Down	0.660	0.662	0.669
Some College			
Up	0.609	0.609	0.653
Equal	0.672	0.658	0.693
Down	0.732	0.730	0.710
College Graduate			
Up	0.590	0.611	0.743
Equal	0.738	0.726	0.759
Down	0.795	0.791	0.773
Post-college			
Up	-	-	-
Equal	0.678	0.703	0.749
Down	0.813	0.817	0.809

Table 8: Selected Moments - Data and Baseline Model

	Data				Model			
	HS Graduate	**Some College**	**College Graduate**	**Post College**	**HS Graduate**	**Some College**	**College Graduate**	**Post College**
No. of kids by 40	1.90	1.82	1.73	1.42	1.82	1.85	1.84	1.45
Married with								
0 children	0.82	0.83	0.91	0.89	0.90	0.88	0.91	0.90
1 child	0.64	0.68	0.77	0.75	0.70	0.70	0.74	0.81
2 children	0.58	0.61	0.60	0.61	0.58	0.58	0.64	0.74
3 children	0.47	0.57	0.49	0.48	0.48	0.53	0.49	0.52
4+ children	0.46	0.36	0.35	0.47	0.43	0.40	0.39	0.50
Single with								
No Child	0.80	0.80	0.88	0.87	0.75	0.81	0.86	0.87
Child	0.64	0.77	0.90	1.00	0.67	0.81	0.89	0.94

Notes - Due to the small sample size of single women, we assumed that the fertility effect can be adequately captured by the presence of any children.

Table 9: Ability and Match Quality by Match

Panel A: Average Ability of Wives

Wife's Education	Relative Position **Up**	**Equal**	**Down**
HS Graduate	2.32	0.36	-2.06
Some College	5.36	-0.79	-1.62
College Graduate	2.60	-0.05	-2.49
Post-college	-	2.30	-1.06

Panel B: Average Ability of Husbands

Husband's Education	Relative Position **Up**	**Equal**	**Down**
HS Graduate	1.63	-2.35	-
Some College	4.66	-2.21	-3.24
College Graduate	3.49	1.04	-3.28
Post-college	-	-0.51	-2.60

Table 10: Assortative mating at the First Marriage - Baseline and No Return to Experience

Woman's Education	**Baseline Dynamic Model**	**No Return to Experience**
HS Graduate		
Up	0.261	0.259
Equal	0.585	0.537
Down	0.154	0.204
Some College		
Up	0.220	0.195
Equal	0.310	0.323
Down	0.471	0.482
College Graduate		
Up	0.162	0.126
Equal	0.463	0.366
Down	0.375	0.508
Post-college		
Up	-	-
Equal	0.407	0.240
Down	0.593	0.760

Table 11: Married Women's Employment by Relative Position in Education - Baseline and No Return to Experience

Woman's Education	**Baseline Dynamic Model**	**No Return to Experience**
HS Graduate		
Up	0.608	0.395
Equal	0.626	0.402
Down	0.662	0.430
Some College		
Up	0.609	0.416
Equal	0.658	0.457
Down	0.730	0.458
College Graduate		
Up	0.611	0.565
Equal	0.726	0.589
Down	0.791	0.652
Post-college		
Up	-	-
Equal	0.703	0.651
Down	0.817	0.682

Table 12: Assortative mating at the First Marriage - Baseline and Cohort 1945

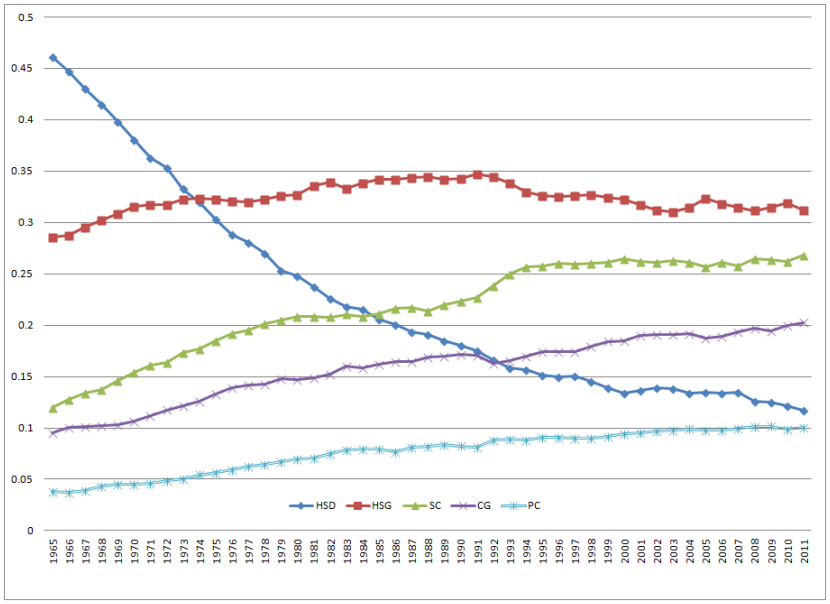
Woman's Education	**Baseline Dynamic Model**	**Cohort Return 1945**
HS Graduate		
Up	0.261	0.346
Equal	0.585	0.547
Down	0.154	0.107
Some College		
Up	0.220	0.263
Equal	0.310	0.323
Down	0.471	0.414
College Graduate		
Up	0.162	0.258
Equal	0.463	0.481
Down	0.375	0.261
Post-college		
Up	-	
Equal	0.407	0.513
Down	0.593	0.487

Table 13: Married Women's Employment by Relative Position in Education - Baseline and Cohort 1945

Woman's Education	**Baseline Dynamic Model**	**Cohort Return 1945**
HS Graduate		
Up	0.608	0.607
Equal	0.626	0.622
Down	0.662	0.664
Some College		
Up	0.609	0.612
Equal	0.658	0.654
Down	0.730	0.728
College Graduate		
Up	0.611	0.612
Equal	0.726	0.728
Down	0.791	0.787
Post-college		
Up	-	
Equal	0.703	0.701
Down	0.817	0.819

Appendix A

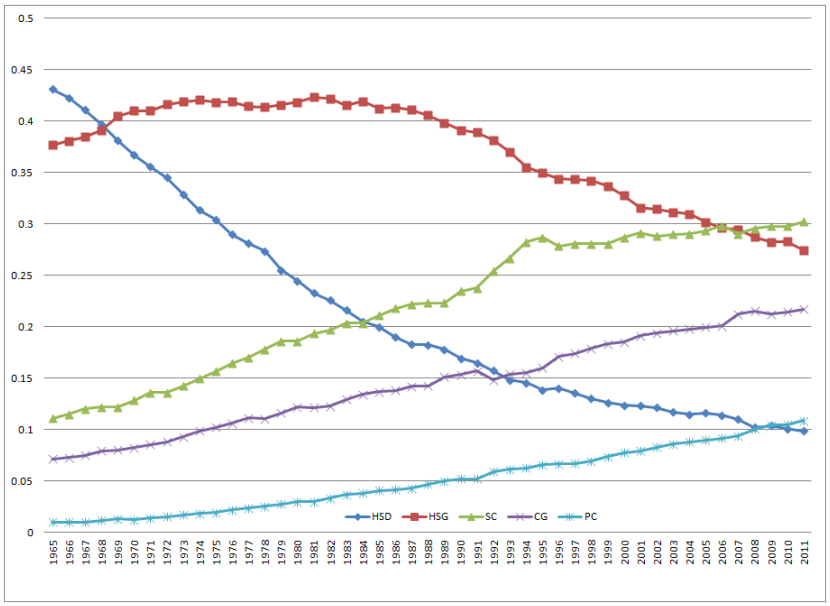
Figure A1: Men's Educational Attainment



Source - March CPS 1965 - 2011.

Notes - Ages 22 - 65.

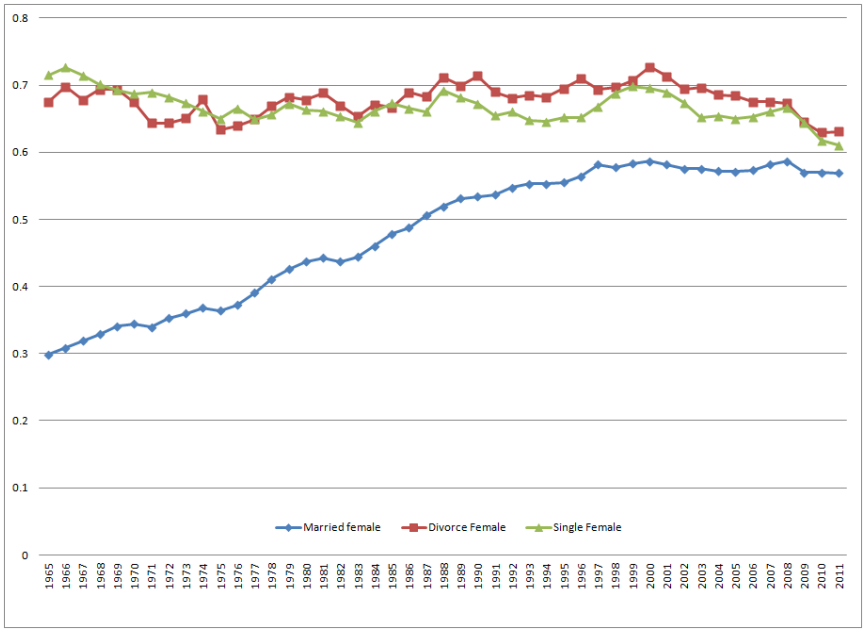
Figure A2: Women's Educational Attainment



Source - March CPS 1965 - 2011.

Notes - Ages 22 - 65.

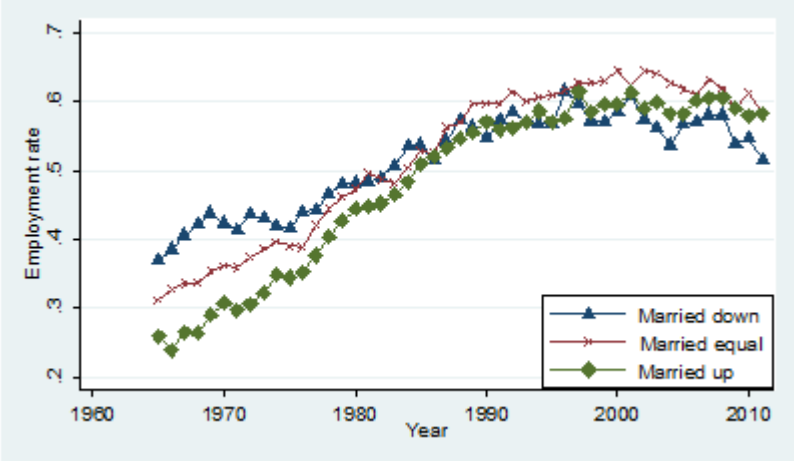
Figure A3: Female's Employment Rate by Marital Status



Source - March CPS 1965 - 2011.

Notes - White females, ages 22 - 65. Proportion working at least 20 weekly hours.

Figure A4: Married HS Graduate Female's Employment Rate by Match



Source - March CPS 1965 - 2011.

Notes - White females, ages 25 - 55. Proportion working at least 20 weekly hours.

Appendix B

Table B1: Men's Employment by Women and Men Education Group

Women Education Group	Men Education Group HSG	SC	CG	PC
High School Dropout (HSD)	**84.63**	**84.12**	**87.52**	**87.34**
High School Graduate (HS)	87.8	**88.93**	**92.51**	**92.97**
Some College (SC)	87.29	89.06	**92.78**	**93.34**
College Graduate (CG)	88.48	88.54	92.28	**93.2**
Post College Degree (PC)	85.8	85.88	89.54	92.02

Notes - * - small sample size. Proportion working at least 20 weekly hours. In bold: men marrying down.

Table B2: Women's Employment Rate by Women and Men Education Group

(1)

Husband between the 80-90% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
High School Dropout (HSD)	**38.53**	**52.33**	**66.83**	**65.52**
High School Graduate (HS)	43.88	**54.32**	**65.97**	**79.09**
Some College (SC)	46.14	55.44	**63.16**	**78.8**
College Graduate (CG)	41.64	49.61	57.3	**70.79**
Post College Degree (PC)	44.86	49.7	52.77	70.4

(2)

Husband between the 70-80% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
High School Dropout (HSD)	**44.69**	**58.33**	**66.39**	**84.78**
High School Graduate (HS)	50.73	**61.32**	**72.02**	**80.59**
Some College (SC)	51.46	61.49	**68.26**	**80.74**
College Graduate (CG)	49.54	56.56	64.06	**75.83**
Post College Degree (PC)	52	54.11	58.99	72.86

(3)

Husband between the 60-70% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
High School Dropout (HSD)	**48.87**	**57.01**	**68.42**	**66.67**
High School Graduate (HS)	54.82	**65.86**	**74.38**	**83.39**
Some College (SC)	55.89	64.76	**73.14**	**82.72**
College Graduate (CG)	52.36	58.43	68.14	**80.01**
Post College Degree (PC)	50.07	56.64	60.39	74.55

(4)

Husband between the 50-60% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
High School Dropout (HSD)	**52.74**	**61.89**	**66.77**	**72.06**
High School Graduate (HS)	58.66	**68.56**	**77.42**	**86.06**
Some College (SC)	59.69	67.09	**75.07**	**84.94**
College Graduate (CG)	58.65	61.6	71.25	**80.63**
Post College Degree (PC)	53.61	54.92	57.83	74.64

(5)

Husband between the 40-50% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
HSD	**55.83**	**62.62**	**71.25**	**75.71**
HSG	59.52	**67.67**	**77.81**	**84.65**
SC	59.84	68.43	**76.04**	**83.39**
CG	58.36	62.94	70.25	**81.18**
PC	51.94	51.85	56.51	72.49

(6)

Husband between the 30-40% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
HSD	**53.85**	**58.59**	**71.47**	**72.46**
HSG	57.26	**65.65**	**75.84**	**81**
SC	58.49	64.63	**75.39**	**83.04**
CG	56.72	58.8	66.78	**80.5**
PC	54.3	53.86	57.38	72.94

(7)

Husband between the 20-30% of income distribution

	Women Education Group			
Men Education Group	HSG	SC	CG	PC
HSD	**48.48**	**53.5**	**73.33**	**90.48**
HSG	51.61	**63.44**	**74.86**	**87.34**
SC	55.98	60.27	**73.14**	**80.45**
CG	57.31	58.2	63.41	**81.86**
PC	46.46	48.08	53.69	70.24

Notes - Married white women, ages 25 - 55. Proportion working at least 20 weekly hours. In bold: women marrying down.

Appendix C

Appendix C.1 CPS Data

Data were taken from the Annual Demographic Survey (March CPS supplement) conducted by the Bureau of Labor Statistics and the Bureau of the Census. A detailed description of the survey can be found at www.bls.census.gov/cps/ads/adsmain.htm. Our data, for the years 1965−2011, were extracted using the Unicon CPS utilities.

The sample is restricted to civilian adults, ignoring the armed forces and children. We divided the sample into five education groups: high school dropouts (HSD), high school graduates (HSG), individuals with some college (SC), college graduates (CG), and post-college degree holders (PC). To construct the education variable, until 1991 we used the years of schooling completed and added 0.5 years if the individual did not complete the highest grade attended; from 1992 onward we simply used years of schooling completed.

Weekly wages are constructed by taking the previous year's wage and salary income and dividing it by the number of weeks worked in the previous year. Hourly wages are defined as the weekly wage divided by the number of hours worked in the previous week in all jobs, while annual (annualized) wages are defined as the weekly wage multiplied by 52. Wages are multiplied by 1.75 for top-coded observations until 1995. Nominal wages are deflated using the Personal Consumption Expenditure (PCE) index from National Income and Product Account (NIPA). Since wages refer to the previous year, we use the PCE for year $X-1$ for observations in year X and, therefore, all wages are expressed in constant 2010 dollars.

Information on number of children under 6 for the period 1968 - 1975, which is missing from the survey data, is completed where possible using the distributions of this variable in 1967 and 1976 for each gender, marital status, and cohort separately. The completed information can be used to construct an aggregate trend, but not to identify the number of children for a specific individual.

To construct a couple, we kept only heads of households and spouses (i.e., households with

two families were dropped), and dropped households with more than one male or more than one female. We then merged women and men based on year and household identification, and dropped problematic couples such as those with two heads or two spouses, more than one family, or inconsistent marital status or number of children. We included in our sample married white females aged 25-55 to reflect schooling, marriage and employment patterns in each year. Individuals are considered employed if they reported working at least 20 hours weekly.

Appendix C.2 NLSY Data

Data for this section comes from the National Longitudinal Survey of Youth 1979 (NLSY79), a nationally representative sample of 12,686 men and women who were 14-22 years old at the time of the initial 1979 survey. We focus on white female members of the cross-sectional sample, a group of 2,477 young women chosen to be representative of the non-institutionalized civilian segment of the United States population in that age group. Members of this sample was re-interviewed annually from 1979-1994 and bi-annually since then, the most recent available wave being in 2008, when members of the sample were aged 43-52. In each wave, the NLSY contains information on marital status, schooling, labor force status (in past calendar year), income (in past calendar year) and other socioeconomic statuses, as well as the age, sex, education, labor force status, and income of each co-resident family member, including the spouse.

In our sample, 2,230 (90%) respondents are ever married and 247 have never married. For the purpose of the analysis, the data set was transformed into a panel data with multiple observations for each individual. A respondent is considered employed if she reported working at least 25 weeks and 20 hours per week in the past calendar year.

For the purpose of analysis, we only include couples that marry during the observation period so that we are able to follow a couple from the beginning of the marriage onwards until they get divorced or until observations are right-censored. Of the 2,230 who are married,

2,142 have entered into a first marriage during our study period. Of these, 864 ended their first marriage by divorce during 1979-2008. The duration of marriage in the sample ranges from 0 to 29 years.

We first identify women who entered into first marriages during 1979-2008. At the time of the woman's first marriage, we calculate the information on variables that will be fixed as long as we observe the respondent in that union (e.g. age, and education at first marriage, and husband's age, and education at the time of marriage). Respondents missing age and/or education information at the time of marriage for the wife or the husband were dropped (29 respondents). Then we create a series of observations, one for each completed interview, beginning with the first year of marriage. This series of observations ends either in the year of marital dissolution or in the 2008 interview for women who had not ended their first marriage during the panel. In addition to the fixed variables, each observation in the series contains information, measured in each interview year, on wife's and husband's employment status, and income. Our sample of 2,142 women, in their first marriage, contributes to a total of 23,622 observations in the panel. Divorce occurrence is defined as a dummy variable that takes the value of one if the respondent is observed divorced in the next interview year.

Table C1: Parameter Estimates

=

Utility Function		
Utility from leisure - female α_{1W}	301.544	(9.899)
Utility from children - single female α_{2W}	57.359	(0.848)
Utility from children - married female α_{3W}	17.366	(0.118)
Utility from children - married male α_{3H}	66.366	(1.752)
Intertemporal elasticity of substitution χ	0.941	(0.075)
Home Production		
Productivity shift from young children in housework $\gamma_{1,0-5}$	51.870	(0.208)
Productivity shift from older children in housework $\gamma_{1,6-18}$	38.389	(0.292)
Productivity shift from young children in market goods $\gamma_{2,0-5}$	7.260	(0.315)
Productivity shift from older children in market goods $\gamma_{2,6-18}$	7.327	(0.544)
Productivity of housework labor δ_W	850.549	(7.392)
Elasticity of substitution between housework labor and market goods ς	0.782	(0.037)
Fertility Process		
Being employed in previous period λ_1	-0.002	(0.000)
Being married λ_2	0.904	(0.028)
Age interacted with HSG attainment λ_3^{HSG}	-0.087	(0.004)
Age interacted with SC attainment λ_3^{SC}	-0.088	(0.028)
Age interacted with CG attainment λ_3^{CG}	-0.088	(0.002)
Age interacted with PC attainment λ_3^{PC}	-0.059	(0.008)
Age squared interacted with HSG attainment λ_4^{HSG}	0.000	(0.000)

Continued on next page

Table C1 – continued from previous page

Age squared interacted with SC attainment λ_4^{SC}	0.001	(0.000)
Age squared interacted with CG attainment λ_4^{CG}	0.001	(0.000)
Age squared interacted with PC attainment λ_4^{PC}	0.000	(0.000)
Husband's education λ_5	0.116	(0.172)
Number of children in the household λ_6	-0.040	(0.002)
Wage Process, Female		
Returns to experience φ_{2W}	0.053	(0.021)
Returns to squared experience φ_{3W}	-0.001	(0.000)
HSG returns φ_{4W}^{HSG}	9.482	(0.224)
SC returns φ_{4W}^{SC}	9.636	(0.133)
CG returns φ_{4W}^{CG}	10.056	(0.205)
PC returns φ_{4W}^{PC}	10.446	(0.066)
Variance of wage shock $\sigma_{\epsilon_W}^2$	0.443	(0.014)
Wage Process, Male		
Returns to experience φ_{2H}	0.063	(0.002)
Returns to squared experience φ_{3H}	-0.001	(0.000)
HSD returns φ_{4H}^{HSD}	9.455	(0.066)
HSG returns φ_{4H}^{HSG}	9.637	(0.130)
SC returns φ_{4H}^{SC}	9.805	(0.081)
CG returns φ_{4H}^{CG}	10.138	(0.407)
PC returns φ_{4H}^{PC}	10.394	(0.075)
Variance of wage shock $\sigma_{\epsilon_H}^2$	0.597	(0.024)

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Table C1 – continued from previous page

Job Offer, Female		
Working previous period ρ_{1W}	3.896	(0.088)
HSG ρ_{2W}^{HSG}	-0.805	(0.033)
SC ρ_{2W}^{SC}	-0.655	(0.015)
CG ρ_{2W}^{CG}	-0.448	(0.037)
PC ρ_{2W}^{PC}	-0.093	(0.002)
Accumulated experience ρ_{3W}	-0.028	(0.001)
Marriage Market and Match Quality		
Probability of meeting a partner p	0.319	(0.013)
Variance of starting bliss shock σ_Q^2	2.410	(0.155)
Compatibility benefit - HSG θ^{HSG}	612.250	(1.832)
Compatibility benefit - SC θ^{SC}	108.755	(0.267)
Compatibility benefit - CG θ^{CG}	791.364	(1.001)
Compatibility benefit - PC θ^{PC}	783.260	(1.322)
Probability of a positive bliss shock P_Q^+	0.223	(0.016)
Probability of a negative bliss shock P_Q^-	0.245	(0.056)

Notes - Standard errors in parentheses. Men always work so some male parameters are not estimated.

Appendix D Alternative Explanations

Appendix D.1 Schooling and Non-market Productivity

? suggests that in more educated couples, the women might choose to work less, in order to stay home with their children. He argues that schooling yields nonmarket as well as market benefits, or more specifically, greater schooling indicates greater nonmarket productivity. This higher nonmarket productivity is suggested by the advantages conferred on the children of better-educated parents. **?** estimates a model in which the dependent variables is work hours and not employment, and he is not analysing the effect of the female's relative position in education within the household but only adds the spouse's education level to the work hours regression of the individual. His estimation suggests that in a more educated couple, the husband will work more while the wife will work less, investing more of her leisure in the couple's (young) children. He also notes that the effect of the spouse's schooling on the individual labor supply is stronger for couples with young children. Given that, one should consider interactive effects between wife's relative education and presence of a young child, in addition to the main effects that are controlled for already, see Table **??**). If relative wife's education is associated with her non-market productivity in the early child rearing years, interaction effects could explain the observed variation associated with wife's relative education and her labor supply behavior.

We estimate the basic model of female employment again, adding an interaction term between the two indicator dummies for the relative position in education and the presence of a young child[40]. Comparing column (1) with column (2) in Table **??**, we see that the main effects for marrying down or up fell slightly but are still sizeable (marginal effects are of 3.2 and 1.5 percentage points, respectively). The effects are more pronounced for those with a young child, in particular for those where the female married up. The estimates for the interaction terms indicate that a married up woman might choose to work less in order to

[40] Alternatively, we estimated the basic model separately for couple with and without children 0-6. Results were similar.

invest more time in her children, the marginal effects among the married up females are of 3 percentage points. Yet, the effect of young children is not substantial among married down women (marginal effects are of 1 percentage point). To conclude this section, we can argue that although children (particularly young ones) play a role in the employment decision of married down versus married up women, the non-market productivity hypothesis can't explain the differences in employment rates, suggesting there is room for other explanations[41].

Appendix D.2 The Unemployment Risk Hypothesis

Another possible explanation derives from the correlation between the spouse's unemployment risk and his education level. We already know that women married to a less educated man will choose to work more regardless of his income. Yet, it might be the case that the women decide upon her employment according to the long term income of the husband and not according to his income in the previous period. In this case, if less education indicates higher instability in the labor market, a woman married to a less educated man might choose to work more as an insurance against the possibility her husband will lose his job. This is known as "The Added Worker Effect (AWE)". So as to check this hypothesis, we created Unemployment Indexes that capture the probability of a specific individual to be unemployed in a specific year according to the individual's characteristics (occupation, education, age, industry)[42]. We tested the hypothesis using five different indexes for unemployment. The estimated marginal effects of our two main variables of interest when including each of these indexes as controls separately (Table **??**, columns (2) through (6)) do not differ significantly from the base model results (column (1)). The marginal effects of the unemployment indexes are trivial and insignificant. We conclude that the unemployment risk effect has no marked

[41] **?** find a positive impact of marital homogamy on child outcomes. Enhanced levels of parental agreement about the organization of family life and symmetry in the allocation of time to child care emerge as the intervening mechanisms behind this association. Yet, in our model's result the asymmetry between the behaviour of married up and married down women is very strong, the comparison between homogamous and heterogamous couples can't provide an explanation for the phenomenon.

[42] The unemployment index is the proportion of unemployed individuals in a specific group, e.g., the percentage of unemployed individuals in an occupation x in year y will be the probability to become unemployed to an individual with occupation x in year y.

impact in the static framework. This is in line with results in the AWE literature. Empirical studies have generally been unable to uncover significant magnitude of AWE (**???**). **?** showed that in a life cycle context the AWE should be relatively small as wives of husbands facing greater risk of unemployment will usually work more hours, not necessarily at the point when husbands are unemployed. The later holds as long as the income loss from a short spell of unemployment is small relative to husband's lifetime earnings.

Appendix D.3 The Divorce Risk Hypothesis

Previous research has shown that couples are more likely to divorce when they do not share the same education background, particularly when it is the wife who has more education. These negative effects appear to have remained unchanged over time and, by some estimates, may have even increased (**??**). Given the steady rise in the number of marriages in which wives have more education than their husbands (see **??**), one would expect divorce rates to have increased as a result. Instead, after increasing through the late 1970s, they have gradually declined (**?**). Nevertheless, we want to examine whether the negative coefficient of the education gap actually captures a higher probability of divorce. In other words, we want to examine the "precautionary working" hypothesis. Namely, that married down women are working more in order to increase their experience and therefore their potential earning in a case of marriage dissolution (**?**)[43].

Data[44]

To test this hypothesis, we can't use the CPS since we can't detect the ex-spouse education, once the individual is divorced. In order to capture the pre-divorce characteristics of the couple we need a panel data set. Data for this section comes from the National Longitudinal Survey of Youth 1979 (NLSY79), a nationally representative sample of 12,686 men and

[43] **?** argue that the increase in the probability of divorce can explain a large proportion of the observed changes in female LFP from the 1935 to the 1955 cohort.

[44] For more details about the data and variable coding, see **??**

women who were 14-22 years old at the time of the initial 1979 survey. We focus on white female members of the cross-sectional sample, a group of 2,477 young women chosen to be representative of the non-institutionalized civilian segment of the United States population in that age group. Members of this sample were reinterviewed annually from 1979-1994 and bi-annually since then, the most recent available wave being in 2008, when members of the sample were aged 43-52. In each wave, the NLSY contains information on marital status, schooling, labor force status (in past calendar year), income (in past calendar year) and other socioeconomic statuses, as well as the age, sex, education, labor force status, and income of each co-resident family member, including the spouse. A respondent is considered employed if she reported working at least 25 weeks and 20 hours per week in the past calendar year. Of the 2,230 married women, 864 (39%) ended their first marriage by divorce during 1979-2008. The duration of marriage in the sample ranges from 0 to 29 years.

Educational Matching

Table **??** illustrates the frequencies and percentages of the marriage matching distribution by educational attainment categories at the time of marriage. It can be seen that educational homogamy is most common - 49% (sum of diagonal). For about 25% of the couples we observe a higher educated wife. Spouses with strongly divergent education categories are uncommon: only 9 couples consist of a wife three education categories higher than her husband's - CG wife/ HSD husband, and PC wife/ HSD or HSG husband; 13 couples consist of a husband three education categories higher than his wife's - CG husband/ HSD wife, and PC husband/ HSG wife.

Wife's Employment and Educational Disparity Between the Spouses

We now wish to examine whether the employment phenomenon found in CPS hold for the NLSY. Similar to the CPS, we consider white married[45] women age 25-55. By age 25, 90% are

[45] We exclude 11 couples that marry before the first interview so we will have the education gap at the day of marriage.

no longer enrolled in any college/university. We estimate the preferred model specification in Table **??** using the NLSY sample. We regress wife's employment status on the two dummy variables for whether the female married down, married up, a set of control variables, and standard errors are clustered at the individual level. The results are shown in Table **??**, column (1) and our earlier results are re-established. Women that marry down have a higher probability of being employed, even after controlling for husband's income, and results are highly significant. The estimated logit coefficients indicate that marrying down vs marrying up has an average marginal effect of 6 percentage points[46]. The magnitude of the later implies an increase of about 10 percent in wives' employment rate[47]. The estimated coefficients of the other independent variables are properly signed and significant: probability of being employed increases with education, and age; the likelihood for employment is reduced with husband's annual earnings, the presence of young children, and number of children.

Wife's Relative Position in Education and Divorce Risk

In Table **??**, for each of the feasible marital match cells, the rate at which these first marriages dissolve during the study period is computed. Respondents with higher educational attainment tend to have more stable marriages. This is true for both husbands and wives, and stronger for couple where both members have relatively high education (notice the pattern along bold diagonal). However, the influence of the educational disparity is small if any. The divorce rate for couples where the wife is more educated than her husband is 38%, comparing to 39% for couple where the husband is more educated than the wife and 42% for homogamous couples.

For our analysis, we estimate the probability of divorce in period t given explanatory

[46]Applying the same sample restrictions, the logit model for married females' employment yielded a remarkably similar marginal effect for married down vs married up is roughly 7 percentage points for the CPS 1960-1965 birth cohorts data (these are the NLSY79 birth cohorts).

[47]A similarly specified regression for male respondents in the panel produces small, and statistically insignificant results for the effect of educational disparities between the spouses on the husband's employment status.

variables in $t-1$ using a complementary log-log (cloglog) regression model[48]. We assume a non-parametric baseline and create duration-specific dummy variables, one for each spell year at risk. The analysis focuses on the effects of wife's relative position in education on the risk of divorce. We define, similar to the above, two dummy variables that indicate whether the husband is more educated than the wife or vice versa (couples with same level of education are the control group). We further include a set of variables to control for various other factors that may influence the risk of divorce: indicators for wife's and husband's education; wife's age; both spouses' income decile indicators; age gap at marriage (husband's - wife's); the number of children and the presence of young children.

Table **??** shows the results. The standard errors reported in the table allow for arbitrary correlation between the disturbance terms within a couple (cluster). Regarding the impact of educational disparities between the spouses on the risk of divorce we see that controlling for everything else it has a negligible and insignificant effect. The effects of the other controls are consistent with the literature identifying the possible causes for marital instability (**?**). Higher age at first marriage is stability enhancing (**?**). Women who get married later tend to have spent more time searching for the best matches and/or have gathered more information about their future spouses. This group of women should experience less post-marriage shocks and therefore have lower chance of getting divorced. Age gap within the couple has a positive but insignificant effect. Presence of children reduces the probability of divorce since they indicate an increase in marital-specific capital and such capital would be worth less in any other marriage or when being divorced. As expected, own and spouse's education level has a negative effect on divorce risk. Higher education level is a predictor of the partner's high levels of market as well as non-market skills. Thus, higher-educated couples gain more from marriage compared to the lower-educated couples and their risk of divorce is lower.

Judging by the result from the NLSY, it seems that the wife's relative education carries no extra risk of divorce. Therefore, the divorce risk hypothesis does not hold up.

[48]Results do not differ qualitatively if we use a logit model.

Appendix D.4 Selection

Let us now examine whether pre-marriage characteristics (ability, expectations or attitudes) of the couple can explain the different behaviour. The following section will try to address whether there is selection into marriage: assume two types of women, women with utility from consumption only and women with utility both from consumption and work[49]. Following this assumption, women with higher utility from work might choose to marry a less educated husband making her the main breadwinner at the household. On the other hand, we can assume two types of men in the population, one preferring to marry higher educated women and one preferring less educated women. It is impossible, of course, to check those assumptions directly since the type of the individual is unobserved, therefore we will use observed pre-marriage characteristics of the couple that might be correlated with the unobserved type of the individual. Comparing the characteristics of the married up women with those of the married down women will help us decide whether a selection into marriage exists. In this discussion, we will use both the CPS sample and the NLSY sample that were used in the previous chapters (and are described in detail in Appendix C).

Females' Pre-marriage Characteristics

In order to study female selection into marriage, we looked at pre-marriage variables that might be correlated with the unobserved work preferences of the women. We start with the age of marriage, assuming that a woman who married later, might have more experience and therefore higher wage and higher probability to be employed. Overall, although educated women married later, there was no significant difference in the married up to married down women age at marriage (see Table **??**). The average age of married for HS dropouts was below 20 compared to an average of above 31 for post-graduates, but at each education group, married down women married a year younger compared to married up women. In addition, we observe that women marrying down married younger husbands (a year and a

[49]The difference between the two types can be in preferences toward work, children, leisure and so on.

half younger compared to the married up group).

We then check for whether the reason the married down women work more is because of their higher unobserved ability. We examine the average score on the AFQT, as a measure to the person's underlying ability. As shown in Table **??**, it turned out that the married down women have lower average scores than the married up women. In each education group, the women with higher scores married more educated husband compared to women with lower scores, this result is not surprising. Nevertheless, it fails to explain why those with the lower scores will choose higher employment rates.

Next, we examine whether there is a difference in the preference for children between the two "types" of women, namely, whether a woman who plans a big family, might choose a more educated husband who will enable her to work less. The NLSY79 survey contained in several rounds a direct fertility expectation question[50]. Respondents were asked about how many children they actually expected, which is considered a good predictor of future fertility outcomes. As shown in Table **??**, conditional on the female's education category there are no significant differences in mean expected number of children across the three match types (married up, equal, and down). These data are drawn from the survey year closest to the year the respondent was 21[51]. We follow by looking at differences in actual number of kids at the age of 40, Table **??**, when most women had completed their family planning. We couldn't find any significant variation in the average number of children in the household. We also implemented this analysis using the CPS sample, reaching the same conclusion.

One might be concerned that this is a classic case of selection on women's attitudes towards females' roles in the household. The NLSY elicits the individual's opinion towards a female's roles in home-making and in the labor market. In 1979, 1982, 1987 and 2004, respondents are asked whether they strongly disagree (1), disagree (2), agree (3) or strongly agree (4) with different statements. Among those, we believe that the most straightforward

[50]The survey question: "Altogether, how many (more) children do you expect to have?". For those women who already had children, the (total) expected number of children is given by expected number of children plus the number of children already born.

[51]The respondent may be as young as 19 or as old as 23 years of age.

statement, defining a woman's role, is "A woman's place is in the home, not in the office or shop". Table **??** displays the mean response by the female's relative position in education and education level, using responses from the survey year closest to the year the respondent was 21 (as above). The table reveals no substantial variation in opinion across females married up, equal or down, given their respective education level. The responses also reflect that lower education level is associated with "more traditional" views, i.e., women should specialise in home production and men in market production[52].

Finally, a probit model (table **??**), for each female education group, is applied to an indicator for being married down to estimate the relevance of the various female attributes. In addition to AFQT, number of expected children, attitude towards female's roles, we added a measure of physical attractiveness (proxied by BMI[53]). The results are consistent with the above statistics: AFQT is negatively and significantly correlated with marrying down; attitudes and expectations on the number of children are not relevant. Some evidence is found among some college and college graduate females that married down females are more likely to be overweight or obese. However, introducing BMI to the employment equation indicates no significant correlation between the two measures.

Males' Pre-marriage Characteristics

We question whether the more educated husbands have different characteristics, allowing their wives to work less. We are interested in whether the male marriage premium differs for those that marry up, i.e., a more educated female, compared to those that marry equally or down. Although we already ruled out the husband's income playing a large role, if any, in the wife's employment decision, we estimate a log wage regression for the husband controlling for the type of women he married. Virtually all studies find that married men tend to earn significantly more than single men, with estimates of the marriage premium

[52]Responses to the other similar statements reveal the same patterns in attitudes.

[53]Height and weight measures were used to calculate body mass index (BMI), which was then categorized as underweight (< 18.5), normal weight ($>= 18.5$ and < 25), overweight ($>= 25$ and < 30), and obese ($>= 30$). These data are drawn from the survey year closest to the year the respondent was 21.

usually exceeding 10 percent, depending on the time period, sample examined, and model specification (**??**). Using CPS, in our specification, we consider only married males and the parameter estimate of interest is for a dummy variable indicating "married up". Marriage is coded into three separate categories (married up, down and equal) and the comparison is between those married equal and married down[54]. As shown in Table **??**, the result indicates that husbands married to a more educated female earn 5% more per hour, the reference group being the homogamous marriages. This is consistent with mean AFQT scores, displayed in Table **??**, for male respondents in the NLSY sample. Notice the higher mean score among men marrying up (females marrying down) conditional on educational attainment, while the average score increases monotonically with education level. This suggests that the male marriage premium mirrors the marriage selection pattern. An educated woman might choose to marry a less educated husband if his ability is higher with respect to his counterparts in the same education group. While this finding can help us rationalize the match between the couple, it can't explain why those women are working more.

[54]Control variables include education, full time full year indicator, and potential experience (age-education-6) quartic. The presence of children is controlled with two dummy variables: a child younger than 6 in the family and the number of children in the family. Other controls include dummy variables for survey year and MSA fixed effects.

Table D1: Estimated Effects Including Interactions

VARIABLES	(1)	(2)
Female married down (d)	**0.037*** **	**0.032*** **
	(0.003)	**(0.003)**
Female married up (d)	**-0.023*** **	**-0.015*** **
	(0.003)	**(0.003)**
F married down X presence of child 0-6		**0.012*** **
		(0.004)
F marriedup X presence of child 0-6		**-0.032*** **
		(0.004)
Female post graduate (d)	0.293***	0.297***
	(0.006)	(0.006)
Female college graduate (d)	0.204***	0.209***
	(0.006)	(0.006)
Female some college (d)	0.162***	0.167***
	(0.005)	(0.005)
Female high school graduate (d)	0.111***	0.114***
	(0.004)	(0.004)
Age	-0.003*	-0.003*
	(0.002)	(0.002)
Age gap	-0.001	-0.001*
	(0.000)	(0.000)
Number of children in the HH	-0.043*	-0.043*
	(0.025)	(0.025)
Presence of a child 0-6	-0.233***	-0.228***
	(0.002)	(0.002)
Male post graduate (d)	0.029***	0.023***
	(0.008)	(0.008)
Male college graduate (d)	0.059***	0.053***
	(0.006)	(0.007)
Male some college (d)	0.096***	0.090***
	(0.005)	(0.005)
Male high school graduate (d)	0.059***	0.055***
	(0.004)	(0.004)
Dummies for the deciles of Husband's annual income	YES	YES
Time dummies	YES	YES
MSA fixed effects	YES	YES
Observations	681,503	681,503

Notes - Married white women, ages 25 - 55. Employment indicator is one when working at least 20 weekly hours. Marginal effects (instead of logit coefficients) are reported. *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Reference education group: HSD. Column (1) is identical to column (6) in table **??** (the preferred specification) and is reproduced here to facilitate comparison.

Table D2: Estimated Effects Including Unemployment Indexes

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Female married down (d)	**0.037*** **	**0.040*** **	**0.040*** **	**0.041*** **	**0.040*** **	**0.040*** **
	(0.003)	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**
Female married up (d)	**-0.023*** **	**-0.025*** **	**-0.024*** **	**-0.024*** **	**-0.024*** **	**-0.024*** **
	(0.003)	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**
Occupation unempl index		-0.003				
		(0.002)				
Industry-Occupation unempl index			-0.001			
			(0.000)			
Industry unempl index				-0.003		
				(0.002)		
Occupation-Age-Education unempl index					-0.000	
					(0.000)	
Age-Education unempl index						-0.001
						(0.001)
Dummies for the deciles of Husband's annual income	YES	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES
MSA fixed effects	YES	YES	YES	YES	YES	YES
Observations	681,503	681,503	681,503	681,503	681,503	681,503

Notes - Married white women, ages 25 - 55. Employment indicator is one when working at least 20 weekly hours. Marginal effects (instead of logit coefficients) are reported. All models include indicators for own and spouse education, own age, age gap, number of children in the HH and an indicator for the presence of a child 0-6. *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Reference education group: HSD. Column (1) is identical to column (6) in table **??** (the preferred specification) and is reproduced here to facilitate comparison.

Table D3: NLSY - Logit Regression on Employment for Married Age 25-55

VARIABLES	(1) Married Females
Female married down (d)	**0.357**** **(0.180)**
Female married up (d)	**-0.081** **(0.175)**
Female post graduate (d)	1.010* (0.528)
Female college graduate (d)	1.084*** (0.382)
Female some college (d)	0.860*** (0.298)
Female high school graduate (d)	0.707*** (0.192)
Age	-0.011 (0.018)
Age gap	-0.006 (0.010)
Number of children in the HH	-0.400*** (0.035)
Presence of a child 0-6	-0.874*** (0.062)
Male post graduate (d)	0.043 (0.499)
Male college graduate (d)	0.079 (0.391)
Male some college (d)	-0.004 (0.304)
Male high school graduate (d)	0.004 (0.194)
Dummies for the deciles of spouse's annual income	YES
Time dummies	YES
Observations	18,460

Notes - Standard errors are corrected for clustering within individual - 1,823. *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Reference groups: High school dropouts; Females married homogamously.

Table D4: NLSY - Distribution of Marital Matching by Education

Wife's	Husband's Education					
Education	HSD	HSG	SC	CG	PC	Total
High School Dropout (HSD)	130	131	20	4	0	285
	6.07	6.12	0.93	0.19	0.00	13.31
High School Graduate (HS)	150	571	160	53	9	943
	7.00	26.66	7.47	2.47	0.42	44.02
Some College (SC)	25	173	135	97	24	454
	1.17	8.08	6.30	4.53	1.12	21.20
College Graduate (CG)	4	63	72	178	62	379
	0.19	2.94	3.36	8.31	2.89	17.69
Post College Degree (PC)	1	5	15	27	33	81
	0.05	0.23	0.70	1.26	1.54	3.78
Total	310	943	402	359	128	2142
	14.47	44.02	18.77	16.76	5.98	100.00

Notes - First row reports the number of observations. Second row shows the cell percentage

Table D5: NLSY - Proportion of Marriages that Dissolve by Educational Matching

Wife's	Husband's Education					
Education	HSD	HSG	SC	CG	PC	Total
High School Dropout (HSD)	**0.68**	0.54	0.65	0.75	.	0.61
	130	131	20	4	0	285
High School Graduate (HS)	0.57	**0.44**	0.43	0.30	0.22	0.45
	150	571	160	53	9	943
Some College (SC)	0.40	0.38	**0.43**	0.30	0.17	0.37
	25	173	135	97	24	454
College Graduate (CG)	0.25	0.25	0.22	**0.22**	0.16	0.22
	4	63	72	178	62	379
College Graduate (CG)	1.00	0.00	0.40	0.15	**0.09**	0.17
	1	5	15	27	33	81
Total	0.60	0.43	0.40	0.26	0.15	0.40
	310	943	402	359	128	2142

Notes - In each cell, first row shows the probability of marriage termination for first marriages. Second row reports the number of observations.

Table D6: NLSY - Cloglog Estimates on Probability of Divorce, First Marriages Only

VARIABLES	(1)	(2)	(3)
Female married down (d)	**0.183***	**-0.056**	
	(0.093)	**(0.179)**	
Female married up (d)	**-0.158***	**0.004**	
	(0.091)	**(0.180)**	
Female post graduate (d)	-0.937***	-0.321	-0.408
	(0.309)	(0.589)	(0.325)
Female college graduate (d)	-1.086***	-0.637	-0.702***
	(0.160)	(0.411)	(0.168)
Female some college (d)	-0.598***	-0.269	-0.321**
	(0.134)	(0.303)	(0.133)
Female high school graduate (d)	-0.368***	-0.160	-0.184*
	(0.104)	(0.180)	(0.103)
Age at marriage	-0.037***	-0.040***	-0.040***
	(0.011)	(0.011)	(0.011)
Age gap	0.010	0.009	0.009
	(0.008)	(0.008)	(0.008)
Number of children in the HH	-0.153***	-0.133***	-0.133***
	(0.049)	(0.049)	(0.049)
Presence of a child 0-6	-0.063	-0.009	-0.010
	(0.093)	(0.093)	(0.093)
Male PC (d)		-0.840	-0.759***
		(0.544)	(0.271)
Male CG (d)		-0.510	-0.443***
		(0.406)	(0.157)
Male SC (d)		-0.190	-0.142
		(0.299)	(0.124)
Male HSG (d)		-0.326*	-0.296***
		(0.176)	(0.098)
Dummies for the deciles of spouse's annual income	NO	YES	YES
Dummies for the deciles of wife's annual income	NO	YES	YES
Marriage duration dummies	YES	YES	YES
Observations	23,622	23,622	23,622
Clusters	2,142	2,142	2,142

Notes - Standard errors are corrected for clustering within couples; *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Reference groups: High school dropouts; Females married homogamously.

Table D7: NLSY - Mean Age at Marriage

Wife's Education	Relative Position in Education: Married down	Married equal	Married up	Total
HS dropout	NA	19.13	20.18	19.70
HS graduate	22.19	22.41	23.80	22.70
Some college	24.20	23.87	26.07	24.60
College graduate	26.76	26.10	28.23	26.69
Post-graduate	31.04	31.85	NA	31.37
Total	24.92	23.12	23.78	23.74

Notes -

Table D8: NLSY - Mean Wives' AFQT Score

Wife's Education	Relative Position in Education: Married down	Married equal	Married up	Total
HS dropout	NA	28,487	30,396	29,517
HS graduate	40,505	46,850	49,642	46,514
Some college	61,935	64,233	67,135	63,986
College graduate	76,438	78,569	82,348	78,408
Post-graduate	82,022	82,863	NA	82,369

Notes -

Table D9: NLSY - Mean Expected Number of Children

Wife's Education	Relative Position in Education: Married down	Married equal	Married up	Total
HS dropout	NA	1.20	1.27	1.24
HS graduate	1.95	2.02	2.11	2.03
Some college	2.04	2.27	2.49	2.23
College graduate	2.34	2.65	2.50	2.51
Post-graduate	2.27	2.24	NA	2.26
Total	2.12	2.07	2.00	2.06

Notes -

Table D10: NLSY - Mean Actual Number of Children

Wife's Education	Relative Position in Education: Married down	Married equal	Married up	Total
HS dropout	NA	1.04	1.20	1.14
HS graduate	1.47	1.65	1.86	1.68
Some college	1.74	2.00	1.92	1.86
College graduate	1.94	2.13	2.05	2.05
Post-graduate	1.33	1.61	NA	1.45
Total	1.71	1.79	1.76	1.76

Notes - In 2004, when the youngest women in the sample completed their 40th birthday, most women were with completed fertility. The oldest female in that survey year was 47 years of age.

Table D11: NLSY - Gender Role Attitudes Mean Score at Age 21

Wife's Education	Relative Position in Education: Married down	Married equal	Married up	Total
HS dropout	NA	1.86	1.85	1.85
HS graduate	1.84	1.79	1.66	1.77
Some college	1.59	1.77	1.53	1.62
College graduate	1.45	1.46	1.44	1.45
Post-graduate	1.29	1.28	NA	1.29

Notes -

Table D12: Probit Estimates by Education Group (Dependent Variable: Marrying Down)

VARIABLES	(1) High School Graduate	(2) Some College	(3) College Graduate	(4) Post-Graduate
AFQT (in thousands)	-0.006**	-0.006**	-0.007*	0.005
	(0.002)	(0.003)	(0.004)	(0.010)
Gender role Attitudes	0.094	-0.109	-0.007	0.175
	(0.070)	(0.086)	(0.117)	(0.314)
Children expectations	-0.012	-0.099**	-0.078	0.004
	(0.042)	(0.049)	(0.051)	(0.117)
Underweight	-0.028	-0.187	-0.498*	0.438
	(0.180)	(0.197)	(0.276)	(0.452)
Overweight	0.197	0.416**	0.725**	
	(0.151)	(0.204)	(0.290)	
Obese	0.364	0.507	1.021**	
	(0.230)	(0.495)	(0.511)	
Observations	873	423	354	72

Notes - Married white women, first marriages. *** p<0.01, ** p<0.05, * p<0.1.

Table D13: NLSY - Mean Husbands' AFQT Score

Husband's Education	Relative Position in Education			
	Married down	Married equal	Married up	Total
HS dropout	NA	17,988	23,782	21,286
HS graduate	40,184	43,915	49,500	44,740
Some college	60,114	63,532	66,001	62,552
College graduate	74,462	79,375	85,830	77,874
Post-graduate	82,604	92,123	NA	85,079

Notes - Married respondents men in the sample. Men who marry down (up) are men that marry women of lower (higher) education level than themselves. A male marrying down means that the female marry up, and vice versa.

Table D14: CPS - Log Hourly Wage for Married Men

VARIABLES	(1)
Male married up (d)	**0.047*** (0.002)**
Male married down (d)	**-0.057*** (0.002)**
Male post graduate (d)	0.896*** (0.005)
Male college graduate (d)	0.772*** (0.004)
Male some college (d)	0.509*** (0.004)
Male high school graduate (d)	0.303*** (0.004)
Time dummies	YES
MSA fixed effects	YES
Observations	551,505

Notes - *** p<0.01, ** p<0.05, * p<0.1. (d) for dummy variable. Sample consists of husbands married to white females aged 25-55. Reference groups: High school dropouts; Males married homogamously. Model includes: education category indicators, full time full year indicator, and potential experience (age-education-6) quartic. The presence of children is controlled with two dummy variables: a child younger than 6 in the family and the number of children in the family.