Marriage Markets and Married Women's Labor Force Participation*

Shoshana Grossbard
Department of Economics
San Diego State University

and

Catalina Amuedo-Dorantes
Department of Economics
San Diego State University

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Abstract

Based on a model that views men and women as participants in competitive markets for women's home production time, we predict that the scarcer women are relative to men, the less married women are likely to participate in the labor force. The magnitude of this effect is expected to depend on married women's educational attainment. We use time series for four U.S. regions to test our prediction. As hypothesized, we find that an increase in the growth rate of the sex ratio results in a decline in the labor force participation growth rate of married women. However, the sex ratio effect is attenuated the greater the growth rate in college-educated wives.

I. Introduction

While married women have traditionally played an important economic role within the confines of their homes, marriage bars and other socio-economic factors led U.S. women to experience low labor force participation (LFP) rates until World War II. Women's LFP rates in the U.S. experienced a marked increase between 1965 and 1980, the improvement being most remarkable for married women. For instance, during these fifteen years, the LFP rate of women ages 25 to 29 rose from 39 percent to 67 percent, an increase of 28 percentage points. In contrast, in the next fifteen years—from 1980 to 1995—the LFP rate for this age group grew by only 8 percentage points to 75 percent of women in the labor force, and it has not grown much ever since.

Economic explanations of labor supply have principally focused on wage and income effects. In this paper, we show that these trends can be explained not only by variables traditionally included in models of female labor supply, but also by changing equilibrium conditions in markets for married women's home production time due to fluctuations in birth rates and ensuing variations in the ratio of men to women likely to marry each other. This is what demographers refer to as the sex ratio of 'marriageables', which helps explain the trend in female labor force participation rates in four U.S. regions for the period 1965-2000.

Our explanation hinges on the assumptions that a majority of men and women adhere to traditional roles of wife/homemaker and husband/provider and that markets establish equilibrium values for women's work in marital household production. Since adherence to traditional gender roles varies with educational attainment, we estimate models that allow for interaction between sex ratio and education. We expect variations in sex ratio to explain more of the fluctuations in married women's LFP when the percent of college-educated women is lower.

Our analysis expands on analyses of changes in women's LFP over time by Pencavel (1998) and Grossbard-Shechtman and Granger (1998). Pencavel (1998) found that, in the U.S., generational differences in women's LFP rates account for considerable variation in LFP rates over time, whereas variables typically included in economic models of labor supply account for relatively little of such LFP variation. Grossbard-Shechtman and Granger (1998) offered an explanation as to why cohorts matter. They used time series data for the period 1965 to 1990 and showed that 'being born in a growing cohort' explained a large part of the variation in all women's LFP in the U.S., regardless of marital status.

We add to the study by Grossbard-Shechtman and Granger (1998) in several ways. First, we examine the effect of sex ratios in addition to accounting for any cohort effects. Second, we use a regional time series analysis, whereas their analysis relied on time series for the U.S. Third, our time series covers a substantially longer time period. Fourth, we focus our attention on married women on whose labor supply sex ratios are expected to have more impact. Finally, we examine how sex ratio effects on married women's LFP rates are affected by women's educational attainment.

II. Theoretical Perspective

In the past, economists have given the following reasons why women's LFP would fluctuate over time and across regions.

1. Income and Wages

According to Mincer (1962), higher wages had been a major reason why women were attracted to join the labor force prior to 1960. Mincer solved a puzzle that had confounded labor economists at the time: time series results showed that women's LFP and wages were growing in the same direction, in apparent contradiction to findings of a negative association between wages and women's LFP based on cross-sectional data. Mincer resolved this puzzle by separating the effects of male and female wages. What explained women's entry into the labor force in time series were increases in women's wages, whereas increases in male wages accounted for the negative association between wages and women's LFP in cross-sections studies. Mincer interpreted the effect of married women's own wages on their LFP rates as a substitution effect and the effect of husbands' wages primarily as an income effect.

While this wage/income explanation has held for earlier periods, its effectiveness in explaining recent trends in LFP seems limited. A number of studies have indicated that, in recent years, women's wages and their LFP have not been moving in the same direction. Rosen (1992) pointed out that the LFP rates of women increased greatly during the 1970's, when women's wages were stagnant or declining. It is possible that a low positive association between female wages and female labor supply reflects the fact that women entering the labor market for the first time had low levels of human capital.

Leibowitz and Klerman (1995) based on cross-sections from various years of the Current Population Survey found that, relative to women's wages, men's wages and unemployment explained more changes in married mothers' employment between 1971 and 1990. A possible explanation for the stronger effect exhibited by male wages on women's LFP relative to female wages is that female wages are endogenous in a study of female LFP. For any given demand for female labor, changes in the supply of that labor will cause fluctuations in wages.

2. *Education*

Previous studies have found that the rise in women's LFP was associated with increased levels of education.[1] This is consistent with the view that education improves the individual's preparation for the job market, raising her permanent wages and the opportunity cost of leisure and home production, all of which favors an increased participation in the labor market. Additionally, education affects the supply and demand for women's work in household production through the marriage market, as we discuss below.

3. *Culture*

Partially as a result of the decreasing explanatory power of wage/income variables,[2] scholars –especially those trained in sociology– have turned to cultural explanations focused on variables such as attitudes towards work and family. To account for possible changes in attitude affecting married women's LFP rates, we include a set of year dummies in the analysis, even though we recognize that these dummies may also capture other factors, such as the state of the economy (boom or bust).

4. *Fertility*

The growth in women's LFP rates over time has also been attributed in part to decreases in fertility.[3] Causality here can go either way. Not only is it possible that lower fertility explained increases in women's labor supply, but higher LFP rates may have also caused lower fertility. Furthermore, labor supply and fertility may also be related spuriously due to the effect of other variables on both labor supply and fertility (e.g. Deville (1977) and Lehrer and Nerlove (1986)). Acknowledging the importance of women's childbearing on their LFP choices, and despite the difficulties of appropriately isolating its true impact, we control for women's fertility

[1] See, for example, Huet (1977), Shapiro and Shaw (1983), Smith and Ward (1984), Mincer (1985), Goldin (1990), and Leibowitz and Klerman (1995).
[2] In this regard, Pencavel (1998) posits that variation in male and female wages accounts for less than half of the observed changes in women's LFP rates over time.
[3] See, for example, Mincer (1962), Deville (1977), Ekert (1983), Smith and Ward (1984), Mincer (1985), Goldin (1990), Rosen (1992), and Leibowitz and Klerman (1995).

as captured by the percent of women with children less than six years of age living in the household. To the extent that women who report having a child under the age of six living in the household made their childbearing decisions prior to the interview date during which they report their current work status, this variable is predetermined to their current labor supply choices if not exogenous.

5. *Sex Ratios*

To explain why sex ratios matter, we first review some economic analyses of marriage markets. Following Grossbard (1976), we view marriage as a small non-profit firm that governs the exchange of work in household production in return for monetary and non-monetary compensation.[4] Following Grossbard-Shechtman (1984), we assume that workers in marital household production maximize their utility and decide on their allocation of time to leisure, home production time, and labor force participation.[5,6] As in conventional models of labor demand and supply (D & S) , there is a supply and a demand for work in marital household production. We assume that the market for work in household production is competitive and that the market equilibrium dictates compensation levels for workers in household production similar to wages in the labor market.[7] These compensations can take a material form –such as the

[4] Both men and women could be working in household production, but since we are focusing on explaining women's LFP, we are focusing on women as workers in marital household production, and on men as offering them compensating benefits of monetary or non-monetary nature.
[5] In contrast, most other theories of marriage implicitly assume that all of a person's time belongs to their marriage. This holds for Becker (1973, 1981), Chiappori (1988), Lundberg and Pollak (1993).
[6] Grossbard-Shechtman (1984) assumes that individuals only have private utility and there are no public goods. Grossbard (2005) expands this model to a situation where individuals maximize their utility from household public goods.
[7] Note that market models are related to search models. In fact, search models can be viewed as a subcategory of market models dealing with the dynamic process of how a person gets a job offer and possibly accepts it.

benefit of health care, lodging, and other living expenses– or they may consist of psychic benefits. Our focus in this study is on married women as workers in marital household production. We assume that a majority of married women who do not participate in the labor force work in marital production benefiting their husbands. These couples may follow traditional gender lines and husbands may compensate their wives for their household production by contributing to a greater extent in paying any household bills.

It follows from a D & S analysis of markets for women's work in marital household production that the higher men's demand relative to the supply, the higher the equilibrium compensation women can expect for their work in marital household production. One reason why demand may be high relative to supply is that there may be more men demanding women's work in household production than there are women supplying these services. Therefore, *ceteris paribus*, the higher the sex ratio (defined as the number of male participants divided by the number of female participants) in a market for dating and marriage composed of individual men and women with traditional preferences for gender roles, the higher the market compensation that women can expect to receive for work in marital household production. In contrast, women participating in marriage markets with low sex ratios experience a lower demand for work in marital household production and, thus, are expected to earn a lower compensation for that work.

We capture the essence of this familiar competitive D & S model with the following equation:

(1) $y = y(Z)$,

where y is the market-established compensation married women can expect to receive for their work in household production and Z is a vector of factors affecting that compensation via shifts in demand or supply. One of these factors is the sex ratio in the marriage market to which a woman belongs.

We are particularly interested in that part of the compensation for women's work in marital household production that takes the form of access to the husband's income. Following Grossbard-Shechtman and Neuman (1988), equation (1) can be restated as:

(2) $y = k(Z) * I,$

where I is husband's income, and k is the proportion of that income that the married woman has access to, reflecting the husband's willingness to pay the bills. Factors shifting demand and supply in the market for women's work in marital household production, such as the sex ratio or income, can affect k.[8] The decision to participate in the labor force is then modeled as a function of the wage w in regular labor markets relative to the compensation y for marital household production. It follows from the first order conditions of a standard occupational choice model that:

(3) $1>0 \quad if \;\; (w + Mu_l / Mu_x) > (y + Mu_m / Mu_x),$

where l stands for work in the labor force and, therefore, $1>0$ means positive LFP; m is work in marital household production; x are market goods and services; and Mu stands for marginal utility. This condition states that a woman will work in the labor market if the total compensation from the labor market (pecuniary and psychic) exceeds the total compensation (material and non-material) from marital household production. Hence, *ceteris paribus*, the higher the compensation for women's work in household production (y), the less a woman is

[8] It is assumed that the material benefits and the psychic benefits included in y don't behave in opposite directions, and that even if they do (the possible result of compensating differentials, see Grossbard-Shechtman 1984), it remains the case that the factors in Z that lead to a higher total compensation will also lead to a higher material benefit paid by the husband: $k(Z) * I$.

likely to enter the labor force.[9] This holds regardless of whether the sex ratio varies due to regional or time fluctuations.

Sex ratios vary over time because of fluctuations in cohort size. Cohort size variations can cause fluctuations in sex ratio because, on average, the men dating or marrying a particular group of women tend to be older than they are. For instance, if a particular cohort is larger than a preceding cohort, the sex ratio calculated for that particular group of women will be less than one.[10] Such is the case of cohorts of women born at the beginning of a baby boom and likely to marry men born prior to that baby boom and, thus, belonging to smaller cohorts. Vice-versa, if a particular cohort of women is smaller than a preceding cohort, the sex ratio will be larger than one. For example, cohorts of women born at the beginning of a baby bust will typically marry men born prior to that baby bust who belong to larger cohorts.

It follows that baby-boom women (i.e. women born during the baby boom) would be more likely to participate in the labor force than baby-busters (Heer and Grossbard-Shechtman 1981, Grossbard-Shechtman and Granger 1998). In the U.S., there was rapid growth in the LFP of married women ages 25 to 29 in the years 1965-1980. These are precisely the years during which baby-boomers were reaching these ages. In contrast, married women entering ages 25 to 29 in the period 1980-95 were born during the baby-bust. As such, we expect that, relatively to their baby-boom counterparts, they would obtain a higher y if they are willing to work in marital production. This implies smaller increases in LFP for baby-bust women born in 1964 and reaching the age of 25 in 1989 relative to baby-boom women born in 1946 and reaching the age

[9] Higher sex ratios are expected to be associated not only with higher compensations for women's work in household production but also with higher marriage rates and lower cohabitation rates (see Heer and Grossbard-Shechtman 1981, Guttentag and Secord 1983, and Angrist 2002).

[10] Note that the more rigid age preferences, the more fluctuations in cohort size will cause marriage market imbalances.

of 25 in 1971.

Sex ratios can also vary across geographic areas. In the past, cross-city comparisons have also provided evidence of a negative association between sex ratios and married women's labor supply. It was found that married women were more likely to supply labor in cities where sex ratios are higher than average (Grossbard-Shechtman and Neideffer 1997, Chiappori, Fortin and Lacroix 2002). Furthermore, good labor demand conditions for women simultaneously attract female migrants (thus lowering sex ratios) and lead women to participate more in the labor force, providing an alternative explanation for a negative association between regional sex ratios and women's LFP.

An alternative explanation for an inverse relationship between LFP of women and fluctuations in cohort size can be found in Easterlin's (1980) theory. According to Easterlin, growing cohorts, such as baby-boomers, face worse income opportunities than the ones encountered by their parents when they were growing up. Baby-boom women thus may meet baby-boom men with low relative incomes. This would also push married women into the labor force. Furthermore, according to Easterlin, baby-boom couples are also expected to have fewer children. This could lead to the prediction that married baby-boom women have higher LFP rates.   However, if sex ratio effects on married women's LFP persist after appropriately accounting for income and fertility, a D & S analysis of marriage would provide a better explanation for the observed female labor supply trends.

6. Intervening Effect of Education

So far the analysis herein has assumed that traditional women are willing to work in marital household production and traditional men are interested in marrying women who work in marital household production. Adherence to traditional gender roles is expected to be an important determinant of whether fluctuations in sex ratio affect married women's LFP or not. The less people follow such traditional roles, possibly because the division of labor in the household is more egalitarian, the less it is likely that men pay women for working in household production. Additionally, the more egalitarian the gender roles, the more work in marital household production is replaced by contracts to outsiders –such as restaurants and child care workers, eliminating the need for any marital compensation for household production.

Education is a good predictor of traditionalism in a couple's division of labor. Egalitarian gender roles are more commonly found among the college educated (see Hersch 2003). Educated women would thus be less likely to be monetarily compensated for work in marital production and thus less likely to avoid entering the labor force. This explanation for educated women's higher rates of labor force participation can be added to two more commonly given explanations: educated women's higher wage (w) and marginal utility derived from working (Mu_l).[11] Therefore, the greater the percent of college-educated wives, the smaller the reduction in married women's LFP following an increase in the sex ratio.

In the next section, we examine the LFP effects of sex ratios over time (cohort size effects) and across regions while accounting for the aforementioned factors possibly influencing female LFP decisions.

III. Data and Empirical Methodology

Data

With the exception of the data on sex ratios, the data used in this study were extracted from Current Population Surveys (CPS, March files) and aggregated by five-year age groups in four regions (Northeast, Midwest, South and West) for every five years between 1965 and the

[11] More educated individuals may be able to find higher quality jobs, enabling them to enjoy their jobs more than their less educated counterparts.

year 2000. Data for married women (LFP, fertility, and percent with college education) were obtained for age groups 20 to 24, 25 to 29, 30 to 34, 35 to 39, and 40 to 44. We do not consider women older than 44 given our interest in women who may get compensated for their women's work in household production, with women with young children at home having a higher likelihood of receiving intra-marriage transfers of income. Data on men's wages were extracted for men who are two years older, i.e. 22 to 26, etc. up to age 46. We then calculated frequencies for each of the year/age/region groups.

Reliable CPS data were first collected in 1967, and our 1965 data are extrapolated from the data for 1967 and 1970. Inconsistencies in how variables were defined at different points in time were resolved using the UNICON version of the CPS data. Nonetheless, we still encountered difficulties in constructing a fertility variable. For some years, we have information on the presence of children under age three in the household, while for other years there is only information on the presence of children under age six. Hence, we chose to use the percent of married women who have a child under age six in a particular time/age/region group as our fertility variable. We recreated the frequencies of married women with children under age six living in the household for the years 1970 and 1975 for which this information is missing. In particular, for the year 1975, we extrapolated the frequency of married women with children under age six living in the household from the frequencies that we obtained for the years 1976 to 1980, assuming that the yearly growth (decline) rate was constant over the period 1975 to 1980. To create the value of this variable for 1970, we used information on the percent growth of married women with children under the age of three living in the household between 1970 and 1975, along with the frequency of married women with children under the age of six computed for 1975. Therefore, we had to assume that the growth (decline) rate over the period 1970 to

1975 was the same for the frequency of married women with children under age three and with children less than six years of age (see Data Appendix for greater detail).

Sex ratios were calculated from Census data for five-year age groups by dividing the number of men two years older by the number of women in a particular cohort, i.e. we computed

$$\text{(4)} \quad \textit{Sex Ratio} = (M_{t-2} + M_{t-1} + M_t + M_{t+1} + M_{t+2}) \,/\, (F_t + F_{t+1} + F_{t+2} + F_{t+3} + F_{t+4}),$$

where M is the number of men and F the number of women.[12] We used a fixed male/female age difference at marriage of two years, the average age difference at first marriage in the U.S.[13] It was assumed that the marriage market conditions influencing LFP at any given age are captured by the sex ratios that people face when they are in their twenties, when they are most likely to enter a first marriage. Depending on the age/year group, sex ratios were derived using data from the Census for women 20-24 or 25-29 and for men 22-26 or 27-31. These age groups are chosen under the assumption that marriage conditions when people are in their twenties are likely to continue to influence their marital compensation later on in life. What moves these sex ratios is the difference between the number of the women born in years ($t+3$) and ($t+4$) and the number of men born in years ($t–1$) and ($t–2$).[14]

Values for the sex ratio for women born between 1926 and 1980 and men born between 1924 and 1978 in the four regions of the U.S. as well as for the entire country are shown in Table 1. Each five-year cohort was given a name related to historical events that occurred around their year of birth. Focusing on the U.S. as a whole (bold numbers), it can be seen that this sex ratio fluctuated dramatically from a minimum of 0.87 for the women born right after World War II in

[12] The difference in age at marriage was surprisingly stable during the whole period under study.
[13] Varying age differences were assumed in the calculation of sex ratios by Goldman et al. (1984).
[14] The numbers of men and women born in years t, ($t+1$), and ($t+2$) are roughly equal and appear in both the numerator and the denominator of these sex ratios.

the years 1946-50 (men born 1944-48), to a maximum of 1.07 for the women born in 1971-75 (men born 1969-1973) around the passage of Roe versus Wade, a landmark ruling that led the number of abortions to increase in the United States.[15] The sex ratio for women born in 1966-70 (men born 1964-68), the Moon generation, was also high at 1.06.

Table 1 also reports changes in LFP rates for married women of different ages. These are changes over the last five years. Table 1 indicates a negative correlation between sex ratio and married women's LFP. It can be seen that almost at every age the Post-World War II generation women, the women with the lowest sex ratio, experienced faster growth in LFP than other five-year cohorts of women. For example, it is shown in Table 1 that married women age 30-34 experienced an increase of 13.5 percentage points in LFP when the women of the Post-World War II generation (born 1946-50) replaced the women of WWII (born 1941-1945) in 1980. The latter's LFP at that age in 1975 stood at 45.8 percent. Within five years, as this age group filled with the birth cohort of 1946-1950, the LFP rate for this group jumped to 59.3 percent in the labor force, an increase of 13.5 percentage points. This generation had the lowest sex ratio of any five-year generation born in the twentieth century: .87 (WW II women also had a low sex ratio, but it was not as low). Furthermore, it can be seen that married women born in periods of baby bust have experienced either no growth in LFP, or a slight decrease relative to the previous generation (in the case of Moon generation women age 30 to 34 in 2000). Table 1 also shows that regional variations in sex ratio are negatively correlated with changes in married women's LFP, as we predicted.

Our model of LFP is estimated using six years of data from the period 1975 to 2000 (at five-year intervals), resulting in 120 aggregate observations (6 points in time, 4 regions, and 5

[15] Links between abortion law changes and changes in fertility in the 1970s have been discussed, e.g. by Donohue and Levitt (1999) and Angrist and Evans (1999).

age groups). Table 2 presents means, standard deviations, and definitions for the variables used in our analysis.

Empirical Methodology

As it is common in the labor literature,[16] we specify a basic model of the LFP rate in the logarithms of our continuous dependent variables, as follows:[17]

$$(5) \qquad LFP_{tir} = c_0 + c_1 \log w_{tir}^{m} + c_2 \log F_{tir} + c_3 \log E_{tir} + c_4 \log SR_{tir} + c_5 A_i + c_6 R_r + c_7 Y_t + e_{tir}$$

where *LFP* represents married women's LFP rates, w^m are average real wages of married men, *F* stands for women's fertility as captured by the percent of women with children under six years of age living in the household, *E* represents the percent of married women with a college education, *SR* is the sex ratio, *A* stands for age group dummies, *R* represents the region dummies, and *Y* is a vector of year dummies. Each variable is defined for time *t,* age group *i*, and region *r*.

Women's fertility and educational attainment may be endogenous to their LFP. However, while endogenous, both of these variables can be considered to be predetermined to the extent that women who report having a child under the age of six living in the household made their childbearing decisions prior to the interview during which they report about their current work status. Similarly, the educational attainment question refers to whether or not the wife has a college diploma, which involves a decision regarding her educational attainment made well before the interview.

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[16] See Hamermesh (1995) for examples using this type of specification as well as Grossbard-Shechtman and Granger (1998).
[17] The estimation of our model in levels yields very small coefficient estimates with no significant alterations of the final results.

Equation 5 is differentiated with respect to time in order to reduce the effect of some of the unmeasured factors that influence residual correlations. Thus, we first estimate the following model:

$$\text{(6)} \qquad \frac{\partial LFP_{tir}}{\partial t} = DLFP_{tir} = \tau_0 + \tau_1 \frac{\dot{w}^m_{tir}}{w^m{}_{tir}} + \tau_2 \frac{\dot{F}_{tir}}{F_{tir}} + \tau_3 \frac{\dot{E}_{tir}}{E_{tir}} + \tau_4 \frac{\dot{SR}_{tir}}{SR_{tir}} + \tau_5 A_i + \tau_6 R_r + \tau_7 Y_t + u_{tir}$$

where $\dot{w}_f / w_f$ indicates a rate of growth. We approximate the dependent variable in equation (6) by the change in women's rate of LFP over a five-year period (denoted by DLFP). Hence, as is commonly done in time series analysis, we estimate changes in LFP as a function of rates of growth in our continuous explanatory variables. In addition, we test for any serial correlation in the error terms using the Durbin-Watson statistic.

The theoretical model predicts that the coefficients on the sex ratio, male wages, and married women's fertility in equation (6) will be negative. In contrast, the estimated coefficient on the growth rate of the percent of college-educated married women is expected to have a positive sign. In order to assess whether sex ratios have a differential effect on married women's LFP rates depending on their educational attainment, we interact *SR* and *E.* We expect that the coefficient of the interaction term will be negative. Hence, our second model specification is given by:

$$\text{(7)} \qquad DLFP_{tir} = \tau_0 + \tau_1 \frac{\dot{w}^m_{tir}}{w^m{}_{tir}} + \tau_2 \frac{\dot{F}_{tir}}{F_{tir}} + \tau_3 \frac{\dot{E}_{tir}}{E_{tir}} + \tau_4 \frac{\dot{SR}_{tir}}{SR_{tir}} + \tau_5 \left(\frac{\dot{E}_{tir}}{E_{tir}}\right)\left(\frac{\dot{SR}_{tir}}{SR_{tir}}\right) + \tau_6 A_i + \tau_7 R_r + \tau_8 Y_t + u_{tir}$$

Finally, we re-estimate equation (7) adding a square term for the rate of growth in the sex ratio to test for non-linearities in sex ratio effects. This square term is also interacted with education, resulting in our third model specification:

(8) $$DLFP_{tir} = \tau_0 + \tau_1 \frac{\dot{w}^m_{tir}}{w^m_{tir}} + \tau_2 \frac{\dot{F}_{tir}}{F_{tir}} + \tau_3 \frac{\dot{E}_{tir}}{E_{tir}} + \tau_4 \frac{\dot{SR}_{tir}}{SR_{tir}} + \tau_5 \left(\frac{\dot{SR}_{tir}}{SR_{tir}}\right)^2 + \tau_6 \left(\frac{\dot{E}_{tir}}{E_{tir}}\right)\left(\frac{\dot{SR}_{tir}}{SR_{tir}}\right) + \tau_7 \left(\frac{\dot{E}_{tir}}{E_{tir}}\right)\left(\frac{\dot{SR}_{tir}}{SR_{tir}}\right)^2$$
$$+ \tau_8 A_i + \tau_9 R_r + \tau_{10} Y_t + u_{tir}$$

IV. Sex Ratio Effects on Married Women's Labor Force Participation

The results from estimating equations (6) to (8) are reported as models 1, 2 and 3 in Table 3. In all models, the Durbin Watson statistic is close to 2, failing to reject the null hypothesis of non-serially correlated errors. In accordance with the earlier literature on labor supply, we find a negative association between the changes in married women's LFP and the rate of growth in married men's average real wages. Also in line with previous findings in the literature, we observe a direct relationship between changes in married women's LFP and the growth rate in the percent of college-educated married women.

We are principally interested in examining the association between sex ratios and married women's LFP. All models show that the sex ratio has a negative effect on married women's LFP. However, models 2 and 3 show that its statistical significance is dependent on married women's educational attainment. As predicted, we find a positive sign for the interaction between the rate of growth in the sex ratio and the rate of growth in the percent of college-educated married women. Since model 3 indicates that the effect of sex ratio does not take the form of a quadratic expression, we rely on model 2 to calculate the sex ratio effect under different assumptions regarding the rate of growth in the percent of college-educated married women.[18]

[18] This is done as follows: *SR* effect = {coefficient on *SR* + [coefficient on (*E***SR*)]*mean value of *E*}. In this case a 1 percent increase in the growth rate of the sex ratio would lead to the following change in married women's LFP rate: [-0.1153+[0.0051*20.25)] = -0.012

As shown by Table 2, the average rate of growth in the percent of college-educated married women over a five-year period was 20 percent for all 120 age/region/year categories. The standard deviation was 26.65 percent. Using this information, we calculate the sex ratio effect at 10 percent below the mean and at 10 percent above the mean value for the rate of growth in the percent of college-educated married women. Were the rate of growth in the percent of college-educated married women at 10 percent below the mean, meaning that the percent of college-educated married women grew at 10.25 percent over five years rather than at 20.25 percent, an increase in the rate of growth of the sex ratio by 1 percent would be associated with a drop of 6.4 percentage points in married women's LFP over a five year period. Were the rate of growth in the percent of college-educated wives at 10 percent above the mean,[19] a 1 percent increase in the growth rate of the sex ratio would lead to an increase, instead of a decrease, of 4 percentage points in the LFP over a five year period.

Furthermore, we find an inverse link between the change in married women's LFP rates and the fraction of women in the 20-24 age group. This could simply be a result of the increasing percent of women in this age group still in school relative to the increasing growth rate in the percent of older women (reference category) in the labor force. We also observe a negative coefficient for the Western region of the U.S. relative to the Midwest, which could be the reflection of various factors. Among them, the possibility exists that this region's fewer changes in the percent of married women in the labor force is, in part, explained by its already higher LFP of married women at the beginning of the time period being examined. Finally, there seems to be a declining trend in the change of married women's LFP from 1990 onwards relative to our base year: 1975.

[19] Note that the percent of college-educated married women grew at 30.25 percent over five years.

V. Discussion and Conclusions

After controlling for changes in men's wages, married women's fertility, educational attainment, age, and year and region fixed-effects, we find evidence of a statistically significant negative association between sex ratios and the LFP of married women of limited educational attainment. This result is based on a dataset that exploits regional and time fluctuations. Our time series results thus help explain why young generations of married women characterized by high sex ratios have experienced stagnation and perhaps decreases in LFP (see Table 1), while older generations of married women characterized by low sex ratios have experienced rapid increases in LFP.

In recent years, sex ratios have been rising as baby-bust generations have entered markets for dating and marriage. If we have not witnessed drops in the LFP of married women paralleling the increases in LFP witnessed for baby-boom women in earlier decades, it could be because sex ratios increased along with women's educational attainment, with these two variables having opposite effects on women's LFP rates.

Alternative interpretations of our time series results can be derived from Easterlin's theory: he predicted a positive association between cohort size and the participation of married women in the LF. Since changes in cohort size are inversely related to sex ratio variation over time, Easterlin's theory also led to the prediction of an inverse relation between sex ratios and married women's LF. However, Easterlin's explanation for the link between the sex ratio and the labor supply of women can be separated from the argument made here by controlling for both income and fertility, as we do in our analysis. Furthermore, our findings reveal the existence of a sex ratio effect when women have relatively low education, a result that does not follow from Easterlin's theory.

To the extent that our findings are partially the result of regional variation, an alternative explanation for the negative association between sex ratios and married women's LFP is that regions offering better job opportunities to women attract more women and, therefore, have lower sex ratios. However, it is not clear why this effect would weaken with a higher percent of college-educated women. On the contrary, one expects more migration by highly educated women than by women with low education and, consequently, according to this alternative migration hypothesis, the negative association between sex ratio should be stronger in the case of more educated women.

Overall, it seems reasonable to conclude that causality runs in the direction that we posited and that we see some evidence of sex ratio effects on married women's LFP. The finding that an increase in the growth rate of the sex ratio results in a decline in the growth rate of wives' LFP makes sense in terms of our model: assuming traditional gender roles and competitive markets for women's work in marital household production, marriage market conditions that favor women (i.e., higher sex ratios) lead men to be more likely to pay the bills in marriage, inducing more women to drop out of the labor force. Furthermore, this model applies better the lower the percent of college-educated women, since men and women with low education are less likely to adopt egalitarian gender roles.

Future work should examine whether sex ratios affect other dimensions of labor supply, such as the labor supply of men, and the attachment of men and women to the labor force. Additionally, it would be of interest to draw international comparisons. In sum, it is hoped that this study will increase researchers' interest in D & S analysis of markets for marital household production, which have proven potentially useful for explaining a wide range of household behavior.

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Table 1
Generations of Women, Sex Ratios, and Changes in Married Women's Labor Force Participation for Four Regions in the United States

Year of Birth	Generation Name	U.S. Region	Sex Ratio[1]	Δ LFP[2] ages 20-24	ΔLFP ages 25-29	ΔLFP ages 30-34	ΔLFP ages 35-39	ΔLFP ages 40-44
1926-1930	Pre-Depression	**U.S.**	**0.98**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**4.96**
		NE	0.95	n.a.	n.a.	n.a.	n.a.	2.68
		Midwest	1.06	n.a.	n.a.	n.a.	n.a.	10.05
		South	0.96	n.a.	n.a.	n.a.	n.a.	3.07
		West	0.99	n.a.	n.a.	n.a.	n.a.	3.31
1931-1935	Depression	**U.S.**	**1.00**	**n.a.**	**n.a.**	**n.a.**	**6.69**	**5.65**
		NE	0.96	n.a.	n.a.	n.a.	4.80	3.87
		Midwest	1.06	n.a.	n.a.	n.a.	8.87	5.63
		South	1.01	n.a.	n.a.	n.a.	7.56	6.94
		West	1.01	n.a.	n.a.	n.a.	3.87	5.05
1936-1940	New Deal	**U.S.**	**0.95**	**n.a.**	**n.a.**	**6.84**	**5.09**	**9.23**
		NE	0.95	n.a.	n.a.	6.02	2.18	12.61
		Midwest	1.02	n.a.	n.a.	5.85	6.03	9.75
		South	0.92	n.a.	n.a.	8.89	3.12	6.25
		West	0.91	n.a.	n.a.	6.22	9.75	10.35
1941-1945	World War II	**U.S.**	**0.91**	**n.a.**	**5.97**	**5.44**	**10.83**	**4.12**
		NE	0.90	n.a.	7.23	5.25	12.88	1.77
		Midwest	0.93	n.a.	6.69	6.28	12.33	3.96
		South	0.88	n.a.	1.74	3.34	9.34	4.52
		West	0.92	n.a.	9.86	7.17	9.47	5.68
1946-1950	Post WW II	**U.S.**	**0.87**	**11.28**	**11.84**	**13.51**	**6.61**	**7.05**
		NE	0.89	10.07	11.05	15.26	8.61	11.11
		Midwest	0.93	8.43	14.19	17.32	6.53	5.71
		South	0.84	12.21	10.98	10.32	6.39	7.48
		West	0.85	14.98	9.71	11.61	5.36	3.92
1951-1955	Korean War	**U.S.**	**0.95**	**10.47**	**8.25**	**6.06**	**5.28**	**2.85**
		NE	0.94	12.22	13.59	8.18	6.52	-0.11
		Midwest	0.99	14.28	8.80	5.55	4.82	6.84
		South	0.93	9.22	6.70	6.45	3.86	0.13
		West	0.94	5.12	6.18	4.28	6.30	5.81
1956-1960	Sputnik	**U.S.**	**0.97**	**2.12**	**7.40**	**3.82**	**1.40**	**1.23**
		NE	0.97	2.68	5.44	2.46	0.86	2.98
		Midwest	1.04	2.08	6.00	4.23	2.83	0.27
		South	0.93	1.19	7.26	5.59	2.47	3.29
		West	0.96	5.19	9.84	2.81	-0.78	-2.22

Table 1 – Continued

Year of Birth	Generation Name	U.S. Region	Sex Ratio	ΔLFP ages 20-24	ΔLFP ages 25-29	ΔLFP ages 30-34	ΔLFP ages 35-39	ΔLFP ages 40-44
1961-1965	Kennedy	**U.S.**	**1.03**	**4.60**	**3.49**	**3.62**	**-1.84**	**n.a.**
		NE	1.01	6.65	2.54	4.54	-0.77	n.a.
		Midwest	1.09	10.02	6.18	5.03	-2.67	n.a.
		South	1.01	1.79	6.90	2.98	-0.58	n.a.
		West	1.01	1.55	-2.31	2.19	-2.97	n.a.
1966-1970	Moon	**U.S.**	**1.06**	**-0.23**	**-0.14**	**-2.14**	**n.a.**	**n.a.**
		NE	1.05	-3.66	2.59	-0.80	n.a.	n.a.
		Midwest	1.16	-1.66	4.28	-2.00	n.a.	n.a.
		South	1.03	1.65	-5.06	-1.22	n.a.	n.a.
		West	1.02	1.49	-0.38	-4.45	n.a.	n.a.
1971-1975	Roe	**U.S.**	**1.07**	**-0.23**	**0.76**	**n.a.**	**n.a.**	**n.a.**
		NE	1.05	-0.06	1.62	n.a.	n.a.	n.a.
		Midwest	1.11	1.43	-0.11	n.a.	n.a.	n.a.
		South	1.06	1.63	4.06	n.a.	n.a.	n.a.
		West	1.06	-2.27	-1.24	n.a.	n.a.	n.a.
1976-1980	First Echo	**U.S.**	**1.01**	**0.15**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
		NE	1.01	-0.61	n.a.	n.a.	n.a.	n.a.
		Midwest	1.08	-1.95	n.a.	n.a.	n.a.	n.a.
		South	0.97	-1.50	n.a.	n.a.	n.a.	n.a.
		West	0.98	-1.47	n.a.	n.a.	n.a.	n.a.

Notes: [1]Ratio of men age 22 to 26 to women age 20 to 24 or men age 27 to 31 to women age 25 to 29 calculated based on Census data from 1940 to 2000. The age group depends on the Census year. Sex ratios for last two generations were calculated based on the 1990 Census using younger age groups.
[2]Calculated from CPS years 1965-2000.

Table 2
Definition and Means (S.D. in Parentheses) for Five-year Age Groups and Five-year Changes, 1970-2000

Variables	Definitions	All Cohorts
DLFP	Change in rate of married women's labor force participation (LFP) over 5-year period	4.58 (4.63)
Male Wage	Rate of growth in real wages of married men	0.03 (7.76)
Children6	Rate of growth in the percent of married women with children under 6	-0.21 (14.05)
College	Rate of growth in the percent of married women with a college degree by age	20.25 (26.65)
Sex Ratio[1]	Rate of growth in the ratio of number of men two years older over number of women	0.02 (0.06)

Sources: March CPS 1965-2000. [1]U.S. Bureau of the Census. See the notes at the bottom of Table 1.

Table 3
Regression of Changes in Married Women's Labor Force Participation in the U.S. during 1965-2000

Variables	**Model 1**	**Model 2**	**Model 3**
Sex Ratio	-1.74	-11.53*	-15.95**
	(4.83)	(6.30)	(6.63)
Sex Ratio Squared	-	-	108.6
			(93.3)
Male Wage	-0.2381***	-0.2387***	-0.2399***
	(0.0618)	(0.0604)	(0.0612)
Children6	-0.0070	-0.0066	-0.0062
	(0.0242)	(0.0237)	(0.0241)
College	0.0331***	0.0331***	0.0329**
	(0.0121)	(0.0108)	(0.0135)
College*Sex Ratio		0.5107**	0.6038***
	-	(0.22)	(0.22)
College*Sex Ratio Squared	-	-	-0.0646
			(3.2777)
Age 20-24	-3.5337***	-3.5699***	-3.5182***
	(0.9537)	(0.9687)	(0.9513)
Age 25-29	-0.4067	-0.3361	-0.2232
	(0.9559)	(0.9788)	(0.9785)
Age 30-34	-0.4480	-0.5093	-0.4780
	(0.8383)	(0.8460)	(0.8581)
Age 35-39	-0.7234	-0.7772	-0.8311
	(0.8051)	(0.8259)	(0.8382)
NE	-0.2265	-0.1418	0.0217
	(0.8058)	(0.7792)	(0.7996)
South	-0.8400	-0.8665	-1.0376
	(0.7221)	(0.7079)	(0.7251)
West	-2.0800***	-1.8332***	-1.9972***
	(0.7006)	(0.6720)	(0.6735)
Year 1980	0.6562	1.1855	1.2472
	(1.1157)	(1.0860)	(1.1010)
Year 1985	1.0815	1.2852	1.3695
	(1.2951)	(1.2648)	(1.2830)
Year 1990	-2.8658**	-2.6600**	-2.5095**
	(1.2057)	(1.1841)	(1.1955)
Year 1995	-4.8269***	-4.6604***	-4.4746***
	(1.1845)	(1.1629)	(1.1798)
Year 2000	-5.0347***	-4.7824***	-4.5543***
	(1.3641)	(1.3347)	(1.3306)
Number of observations	120	120	120
F-statistic	14.46	14.67	13.45
Prob > F	0.0000	0.0000	0.0000
R-squared	0.6546	0.6687	0.6737
Durbin-Watson d-statistic	1.9750	2.0037	1.9746

Notes: standard deviations in parentheses; * significant at p > .10; ** significant at p > .05; *** significant at p >.01. All regressions include a constant term. Age 40-44, Midwest, and Year 1975 are used as reference categories.

Data Appendix

Reliable CPS data were first collected in 1967, and our 1965 data are extrapolated from the data for 1967 and 1970. To recreate the frequencies of married women with children under age six living in the household for the year 1975, we extrapolated the frequency of married women with children under age six living in the household from the frequencies we obtained for the years 1976 to 1980, assuming the yearly growth (decline) rate was constant over the period 1975 to 1980.

To create the value of this variable for 1970, we used information on the percent growth of married women with children under the age of three living in the household between 1970 and 1975, along with the frequency of married women with children under the age of six computed for 1975. Here, we assumed that the growth (decline) rate over the period 1970 to 1975 was the same for the frequency of married women with children under age three and with children under six years of age as follows:

$$(Freq\_children6)_{1970}=(Freq\_children6)_{1975}*[1-(Percent\ change\ of\ Freq\_children3)_{1975}/100]$$

where *Freq_children6* stands for the frequency of married women with children under six years of age in the household and *Freq_children3* represents the frequency of married women with children under three years of age in the household.