3.2 State-Year Level Unemployment Rates by Gender

The individual-level data from the SIPP and the PSID are augmented by unemployment rates by gender at the year-state level,[12] calculated from the monthly basic Current Population Surveys. The universe is the non-Hispanic white civilian labor force aged 15-40. I take the annual average to reduce sampling errors. Unemployment rates by gender are assigned to each woman based on her state of residence in each year. Also, to avoid problems arising from the multicollinearity between male and female unemployment rates (see Section 4 for detail), I use the gap between male and female unemployment rates instead of the male unemployment rate.

I use unemployment rates by gender at the state level as proxies for gender-specific labor demand in the local labor market.[13] One of the main sources of differential shocks to labor demand for each gender is changes in industry- and occupation- specific labor demand. It is true that the unemployment rate picks up changes in labor supply as well as labor demand. Nevertheless, the bias on the estimated effects of the unemployment rates on marriage formation is expected to be small. Although marriage could change the labor force status of some women, its impact on the aggregate unemployment rate would be quantitatively negligible because only about 4 percent of women aged 15-40 marry each year.[14] Also, since marriage induces both transitions from employment to unemployment and from in the labor force to out of the labor force, whether marriage raises the female unemployment rate is not clear in theory. Moreover, the actual unemployment rate of married women tends to be similar to that of unmarried women of the same age categories, at least for 15-40 year old non-Hispanic white women in the CPS

[12] Maine and Vermont are grouped together, and North Dakota, South Dakota and Wyoming are grouped together, because the original variable for the state of current residence in the SIPP is defined in such a way. Alaska, Washington DC, and Hawaii are dropped.

[13] It is true that, according to Becker's (1973) theory, what really matters is the wage rate the woman could earn if employed rather than the unemployment rate. However, it is practically difficult to construct a gender-specific wage index at the state level because of substantial non-employment among married women. I could construct an index following Blau et al (2000), which is a weighted average of employment share of industry-occupation in each state by share of gender in national employment of each industry-occupation. However, such an index does not seem to have any advantage to the unemployment rate in terms of the relationship with the wage rate. Also the industry-occupation composition is as endogenous to labor supply as the unemployment rate. Moreover, given the smaller sample size of the CPS than the Census, which is used by Blau et al (2000), the unemployment rate is less noisy and intuitively easier to understand. Thus I choose gender-specific unemployment rates at the state level as the best available proxy for annual fluctuations in the gender-specific labor markets.

[14] There are about total 2,200,000 marriages per year (Vital Statistics), 90 percent of which involve women younger than 45 (Census Bureau's report based on SIPP 2001). The population of 18-39 years old women is about 50,000,000 (Census 2000).

1978-2003.

Table 2 reports summary statistics for unemployment rates by gender at the state-year level. Since identification is based on variations net of state- and year- fixed effects, I report the residuals as well as the raw rates. About half of the variation in the female unemployment rate remains after controlling for state- and year- fixed effects and the male-female gap in the unemployment rates. Variation in the male-female gap is also substantial.

3.3 Descriptive Analysis

Before going into more formal analysis, it is informative to look at the correlation between the female unemployment rates in youth and young women's subsequent marriage/fertility behavior in later years. This analysis is done at the cohort level. A cohort is defined as a group of women who were born in the same state and year. Figure 2 presents scatter plots of various cohort level outcomes over the average female unemployment rate of the state in the years when each cohort was 18-20 years old.[15] Each cohort is weighted by the sum of the sample weights of women in it.

First, panel A shows a positive correlation between the female unemployment rate at age 18-20 and the fraction who have married by age 22. That is, women who experienced worse labor market conditions in their late teens are more likely to marry by their early twenties. This is consistent with the existing evidence that worse female labor market conditions increase the incidence of marriage for young women.

In panel B, however, the female unemployment at age 18-20 is uncorrelated with the fraction of who have ever married by the mid-thirties. This suggests that the positive correlation in panel A is primarily driven by shifts in marriage timing for those who would marry by age 35 anyway. Furthermore, as shown in panel C, the female unemployment rate at age 18-20 is also uncorrelated with the probability of having a child by age 35. Women who experienced worse labor market conditions for women in youth are no more likely to have a child even though they tend to marry earlier.

Female labor market conditions in youth are uncorrelated with the fraction who will ever

[15] As a robustness check, replacing unemployment rates at age 18-20 with those at age 19-21 do not qualitatively change the results of any analyses in this paper.

marry or ever have a child in the affected cohort, but what about the number of single mothers? I define a "single mother" as a woman who had a child at least a year prior to marriage or divorced after having a child. I then calculate the fraction of women who have ever experienced this "single mother" status by age 35 for each state. Panel D of Figure 2 plots this variable over the female unemployment rate at age 18-20. Female labor market conditions in youth are not correlated with the likelihood of becoming a single mother, despite the perception that changes in marriage incidence due to labor market fluctuations affect the prevalence of single parenthood.

4 Empirical Model

The empirical analysis begins by confirming the effects of contemporaneous unemployment rates by gender on the probability of getting married. Next, to see whether marriages induced by gender-specific labor market conditions are poorer matches than those formed without such shocks, I estimate the effects of gender-specific unemployment rates at the time of marriage on the probability of divorce and on observable characteristics of spouses. Then, to see whether the increase in marriage incidence for young women results in an increase in the fraction who eventually marry in the cohort, I examine the effects of gender-specific unemployment rates that a woman experienced at age 18-20 on the likelihood of having ever married at each age; 20, 22, 24, 26, 30, 35. If the change in marriage incidence for young women is a timing effect, gender-specific unemployment rates experienced at age 18-20 will not affect the likelihood of having ever married by their thirties.

I exploit variations in gender-specific unemployment rates across states over year to control for state fixed effects and nation-wide year effects. Standard errors are estimated by clustering by states to take into account autocorrelated state-specific random shocks. Also, since the male unemployment rate is positively correlated with the female unemployment rate and their coefficients are expected to be opposite in sign, including both male and female unemployment rates as explanatory variables would boost the absolute value of both coefficients. Therefore, I use the gap between male and female unemployment rates instead of the male unemployment rate. The coefficient of the female unemployment rate is interpreted as the overall effect of local labor market conditions which the woman faces, and that of the male-female gap should be the effect

of labor market conditions for her prospective spouse relative to those for herself.

To estimate the contemporaneous effects of gender-specific unemployment rates on marriage incidence, I specify the following Cox's proportional Hazard model:

$$M_{its} = \lambda(age_{it}; birthy) \exp(\alpha_{age} u_{ts}^{w} + \beta_{age}(u_{ts}^{m} - u_{ts}^{w}) + \eta_s + \varepsilon_{its}) \quad (1)$$

where M_{its} is the probability of getting married during the calendar year t for a woman i living in state s, age_{it} is woman i's age in year t, and u_{ts}^{w} and u_{ts}^{m} are female and male unemployment rates in year t in state s. The baseline hazard λ depends on women's age and is stratified by the year of birth (*birthy*). This is equivalent to controlling for calendar-year*birth-year fixed effects. η_s is a state fixed effect, and ε_{its} is the remaining error.

Since marriage incidence varies with women's age and the value of marriage is likely to change with women's age, the effects of gender-specific unemployment rates on marriage incidence may well vary with women's age. Therefore, I allow α and β to depend on women's age by taking interactions with dummies for each single year age or four age categories (17-20, 21-23, 24-27, 28-35). Also, since more educated women tend to have stronger aims for careers, they could respond to labor market fluctuations in a different way than less educated women. Thus, I estimate (1) by educational background subsamples.

To examine whether increased marriage incidence is associated with a higher probability of future divorce, I estimate the following probit model:

$$\Pr(\text{Divorce in 5 or 10 years}) = \Phi(\alpha u_{TS}^{w} + \beta(u_{TS}^{m} - u_{TS}^{w}) + \eta_S + \xi_T + \varepsilon_{iTS}) \quad (2)$$

where T is the year of marriage, S is the state of residence during the year of marriage, u^w and u^m are female and male unemployment rates, η_S is a dummy variable for the state of marriage, and ξ_T is a dummy variable for the year of marriage.

Since the timing of marriage is endogenous, I also estimate the effects of the female unemployment rate observed during a woman's youth (18-20 years) in her state of birth. These gender-specific unemployment rates experienced at age 18-20 are expected to affect the probabil-

ity of marriage by age 20. Accordingly, dummy variables for the year of marriage and for the state of marriage are replaced with dummy variables for the year of birth and for the state of birth.

In addition, I estimate the following Cox's hazard model with controls for the contemporaneous unemployment rates:

$$D_{itTS} = \lambda(t-T;T)\exp(\alpha u^w_{TS} + \beta(u^m_{TS} - u^w_{TS}) + \gamma u^w_{ts} + \delta(u^m_{ts} - u^w_{ts}) + \eta_S + \varepsilon_{itTS}) \qquad (3)$$

where D_{itTS} is the divorce hazard, or the probability of getting divorced, and the baseline hazard depends on years since marriage $(t-T)$ and is stratified by the year of marriage, which is equivalent to controlling for year-of-marriage*calendar-year fixed effects.

Note that α and β in (2) and (3) do not imply causal effects on the likelihood of divorce for otherwise identical couples. The purpose of estimating (2) and (3) is to examine whether gender-specific labor market conditions induce couples who are likely to divorce in future to marry, i.e. the selection into marriage. Yet, it is true that gender-specific labor market conditions at the time of marriage can have a causal effect on the likelihood of divorce. In particular, worse labor market conditions for women are expected to encourage investments in marriage specific capital by lowering the opportunity cost. Hence, the increase in marriage specific investments may offset a lower match quality, causing the divorce probability to remain the same even if women do change their reservation match quality in response to labor market conditions.

Thus, as an alternative way to assess the effects on selection into marriage, I estimate the correlations between the observable characteristics of spouses and gender-specific unemployment rates at the time of marriage using linear OLS and probit models with the same set of explanatory variables as in (2). Like in the probit model for the divorce rate, I also estimate the effects of gender-specific unemployment rates at age 18-20, replacing marriage year- and state- fixed effects with birth year- and state- fixed effects.

Furthermore, if some couples who would not marry without such shocks are induced to marry, gender-specific unemployment rates in youth must affect the fraction who will ever marry. Thus, I estimate the effects of unemployment rates by gender experienced at age 18-20 on the future marital status. To confirm that gender-specific unemployment rates affect the timing of marriage,

I begin by the median regression of the age at first marriage as follows:

$$Agemar_{i\tau s} = \alpha \bar{u}^w_{\tau s} + \beta(\bar{u}^m_{\tau s} - \bar{u}^w_{\tau s}) + \eta_s + \xi_\tau + \varepsilon_{i\tau s} \tag{4}$$

where $\bar{u}^w_{\tau s}$ and $\bar{u}^m_{\tau s}$ are the average female and male unemployment rates in years when the woman was 18-20 years old in the state of birth, η_s is a dummy variable for the state of birth, ξ_τ is a dummy variable for the year of birth, and $\varepsilon_{i\tau s}$ is the remaining error. Equation (4) is estimated with women in SIPP 2001 and 2004 panels born in 1960-1970, so that I can track each woman at least up to age 30. *Agemar* of a woman who has never married is assumed to be above the median.

Next, I estimate the effects on the likelihood of having ever married by a specific age using the cohort-level dataset used in Figure 2. The dataset is restricted to women in SIPP 2001 and 2004 born in 1960-1970 to prevent picking up cohort-level trends, and is collapsed by the year and state of birth. I estimate the following linear model separately for each age using this collapsed dataset:

$$\%married = \alpha \bar{u}^w_{\tau s} + \beta(\bar{u}^m_{\tau s} - \bar{u}^w_{\tau s}) + \eta_s + \xi_\tau + \varepsilon_{i\tau s} \tag{5}$$

Each cohort is weighted with the sum of the sample weights of the women in the year-state cell.

After these analyses of marriage formation, I investigate the effects of gender-specific labor market conditions at marriage and in youth on the fertility in the long run. Specifically, I begin by estimating the effects on the number of children born by age 35 with a linear OLS model, with the same set of explanatory variables as in equation (2). Like in the model for the divorce rate and the husband's characteristics, I also estimate the effects of gender-specific unemployment rates at age 18-20, replacing marriage year- and state- fixed effects with birth year- and state-fixed effects. Next, I examine the effects of gender-specific unemployment rates in youth on the age at birth of the first child using the median regression exactly the same as (4) except for the dependent variable. Then, I estimate the effects of gender-specific unemployment rates in youth on the probability of having a child by age 25, 30, and 35 in the same way as in (5). I also estimate the effects on the probability of entering the single motherhood, which is defined as having a child

prior to marriage or divorcing after having a child.

Since marrying young in response to labor market conditions in youth may also affect the woman's earnings and labor supply, I estimate reduced form effects of gender specific unemployment rates at age 18-20 on various economic outcomes in the mid-thirties. It is true that the estimated coefficients of the unemployment rates may not be interpreted as causal unless the effects of labor market conditions in youth on women's investment in human capital through other channels can be ruled out.[16] However, it is even harder to estimate the long-term effects of gender-specific unemployment rates at marriage because the timing of marriage is endogenous and correlated with women's preference for labor supply and productivity and the presence of an infant child. Thus, as suggestive evidence, I estimate the following linear regression:

$$Deptvar_{i\tau s} = \alpha \bar{u}^{w}_{\tau s} + \beta(\bar{u}^{m}_{\tau s} - \bar{u}^{w}_{\tau s}) + \gamma educ_i + age_i + \eta_s + \xi_\tau + \varepsilon_{i\tau s} \quad (6)$$

where *Deptvar* represents economic outcomes such as log personal earnings and weeks worked last year, $\bar{u}^{w}_{\tau s}$and $\bar{u}^{m}_{\tau s}$are the average female and male unemployment rates in years when the woman was 18-20 years old in the state of birth, *educ* is her educational background, age_i is a dummy variable for age by single years, η_s is a state-of-birth fixed effect, ξ_τ is a year-of-birth fixed effect, and $\varepsilon_{i\tau s}$ is the remaining error. Since earnings and employment status are available only from the core panel, I restrict the sample to 33-37 year old women.

5 Results

5.1 Effects of Gender-Specific Unemployment Rates on Marriage Formation

Table 3 reports the estimated α and β in equation (1), the coefficients of the female unemployment rate and the male-female gap in the Cox's proportional hazard model for marriage. Panel A shows the estimated effects without allowing them to vary with age. The first column is estimated with

[16] Although such effects cannot be ruled out, their quantitative impact seems to be negligible. Kondo (2007) shows that the effects of a recession at entry to the labor market on wages and employment are negligible for non-Hispanic white women, in contrast to persistent, significantly negative effects for men. Since Card and Lemieux (2000) shows that the unemployment rate at age 18 has a slightly negative effect on the years of schooling, all regressions shown in Table 9 include controls for educational background.

the entire sample of the SIPP, and the second to fourth columns are estimated by educational background subsamples. The point estimate of the coefficient of the female unemployment rate implies that 1 percentage point rise in the female unemployment increases the number of total marriage by 4.9 percent, which is equivalent to 0.4 percentage point increase in the probability of getting married for a single women aged 17-35.[17] Likewise, the effect of 1 percentage point rise in the male-female gap decreases the number of total marriage by 3.5 percent and the probability of getting married by 0.3 percentage point. The positive effect of the female unemployment rate and the negative effect of the male-female gap is consistent with existing studies including Blau et al (2000).

The second to forth columns are estimates by educational background subsamples. The positive effect of the female unemployment rate is stronger for more educated women, and the negative effect is stronger for less educated women. This may be because the employment status of the potential husbands of less educated women is more vulnerable to aggregate labor market conditions. The last column shows the estimates from the PSID. The effects are statistically insignificant and smaller than the estimates from the SIPP probably due to the small sample size. The signs of coefficients are consistent.

To see how the effects change with women's age, Panel B presents the estimated coefficients of unemployment rates interacted with four age categories. The first column, estimated with the entire sample of SIPP, shows that the positive effect of the female unemployment rate on marriage incidence is stronger for younger women and that the effect diminishes with woman's age and becomes significantly negative for women aged 24 or older.[18] The negative effect of the male-female gap in the unemployment rate also diminishes with women's age. Figure 3 plots the effects of 1 percentage-point changes of the female unemployment rate and the male-female gap on the probability of getting married by single year ages. The effect of the female unemployment

[17] The average probability of getting married for 17-35 year old women in the SIPP sample is 8.8 percent.

[18] The results for older woman may look inconsistent with Blau *et al.* (2000)'s findings that better labor market for men and worse labor market for women increase marriage incidence for 25-34 years old women. One possible reason is that their results for older woman pick up the effects of labor market conditions which they experienced when they were young. For example, the proportion of currently married women in women who were 25-34 years old in 1980 Census could reflect any shocks that affected 20-year-old women in the early 1970s. As shown in Figure 4 and Table 6, the cumulative marriage rate of cohorts who experienced relatively worse labor marked conditions for women in their late teens remain higher until the late twenties.

rate on the marriage hazard is decreasing in age, and the effect of the female unemployment rate turns negative when the effect of the gender gap becomes zero.

The negative effect of the female unemployment rate on the marriage hazard for older women is not attributable to different effects for different educational categories. The second to the fourth columns of Table 3 show a robust pattern within each educational category. Moreover, the age group where the coefficients flip signs is later for more educated women. The last column is estimated with the PSID and looks similar to the results from the SIPP. Section 5.3 further examines potential factors correlated with women's age and may affect the impact of gender unemployment rates on marriage incidence.

One might suspect that changes in marriage incidence could affect the female unemployment rate. As mentioned in Section 3.2, such reverse effects seem to be quantitatively negligible. Moreover, appendix section B1 shows that the estimated effects of unemployment rates by gender on marriage incidence are qualitatively similar to the results of Table 3 when the state unemployment rates are instrumented with the weighted average of nation-wide, industry-occupation specific unemployment rates. Therefore, I believe that any reverse causality of marriage incidence on contemporaneous unemployment rates is negligible.

Since worse female labor market conditions increase marriage incidence for young women, the next question is whether this increased marriage incidence is associated with a higher probability of future divorce. The first and third columns of panel A of Table 4 report the estimates of equation (2), the marginal effects of the female unemployment rate and the male-female gap in unemployment rates at marriage on the probability of divorce within five years and ten years, respectively. Both coefficients are almost zero and not statistically significant.

The second and fourth columns of Table 4 show the effects of unemployment rates by gender at age 18-20. Gender-specific unemployment rates in the state and year of marriage in (2) are replaced with those at age 18-20 based on the state and year of birth, and accordingly, marriage year- and state- fixed effects are replaced with birth year- and state- fixed effects. Again, coefficients are almost zero and statistically insignificant, except for the positive effect of the male-female gap on the 10-year divorce rate. Given the negative effect of the male-female gap on marriage incidence shown in Table 3, the result does not support the hypothesis that marriages

induced by labor market fluctuations are more likely to end in divorce.

Since the effects of gender specific unemployment rates on the marriage hazard vary with women's age, I allow coefficients of gender-specific unemployment rates at marriage to vary with the wife's age at marriage.[19] Panel B shows the result; although a few coefficients are statistically significant, there seems to be no systematic relationship between gender-specific unemployment rates at marriage and the likelihood of divorce in the subsequent five years. At least, there is no evidence that an increase in marriage incidence leads to an increase in future divorces.

Further, panel C reports the estimates of equation (3), the Cox's proportional hazard model for the duration of marriage. The estimated coefficients of gender-specific unemployment rates are almost zero, confirming that gender-specific unemployment rates at marriage are not systematically correlated with the duration of marriage. This also shows that contemporaneous *aggregate* labor market conditions do not affect the probability of divorce much. This does not contradict the findings by Weiss and Wills (1997) that a negative shock to husband's earnings and a positive shock to wife's earnings increase the risk of divorce, since earning shocks at the individual level can convey information about the partner's non-economic suitability as a mate (Charles and Stephens, 2004).

As discussed in Section 4, the divorce rate may be affected by factors other than the inherent match quality. Thus, Table 5 reports the correlations between the observable characteristics of spouses and gender-specific unemployment rates at the time of marriage, as an alternative way to assess whether marriages induced by labor market shocks are poorer matches.[20] I restrict the sample to women in the SIPP core panel who married within 3 years of the survey and also use the PSID, because the SIPP provides information on spouses only for couples who are still married. Dependent variables are the difference between husband's age and the wife's age, the husband's years of schooling, and for the PSID, whether the husband is of the same religion or race. I use both unemployment rates at actual marriage and age 18-20 in the same way as in Table 4.

[19] For Tables 5 and 7, which also show effects of unemployment rates at marriage, Appendix Tables B2 and B3 show the effects by age at marriage.

[20] In general, couples with similar characteristics are less likely to divorce. Becker (1973) presents a theoretical model in which gains from marriage are larger for couples with similar traits. In particular, similarity in religion is an important factor for marital stability (Becker et al 1977, Lehrer and Chiswick 1993). In addition to religion, Weiss and Wills (1997) find that similarity in ethnicity also reduces the probability of divorce.

Panel A of Table 5 shows that women who marry under worse labor market conditions for women have spouses slightly less educated and less likely to be of the same religion and race, although the estimated coefficients are noisy and often inconsistent between the SIPP and the PSID. Yet, the size of the effect seems to be small; for example, 1 percentage point rise in the female unemployment rate at marriage is associated with 0.06 fewer years of schooling of the spouse in the SIPP sample. Moreover, as shown in panel B, unemployment rates by gender at age 18-20 have no significant effects on the ages and educational backgrounds of husbands. Since the timing of marriage is endogenous, the slightly negative correlation between the female unemployment rate at marriage and husbands' characteristics may rather suggest the negative selection of women who marry in response to worse female labor market conditions. Overall, even though labor market conditions at marriage are weakly correlated with husbands' characteristics, these correlations do not seem to be strong enough to affect the divorce probability.

So far, it has been shown that relatively worse labor market conditions for women increase marriage incidence among women in their teens and early twenties, and that these extra marriages are not associated with a higher probability of divorce in future. Then, does this increase in marriage for young women affect the fraction who will ever marry in the affected cohort? Figure 2 has already shown that the female unemployment rate at age 18-20 is not correlated with the fraction who have ever married by age 35. Figure 4 further compares the transitions in marital status of women in cohorts who are supposed to marry younger with the rest of the sample. Specifically, I split women born in 1960-1970 in the SIPP 2001 and 2004 panels[21] into two groups, one of which consists of cohorts (defined by state and year of birth) that experienced a female unemployment rate higher than the median (7.6 percent) when they were 18-20 years old. Then, I calculate the fraction who have ever married by each age for each group and plot it over age. Although women in cohorts that experience a higher female unemployment rate and a lower male-female gap at entry to the marriage market are more likely to have married by their early twenties, these differences fade away by their thirties. Thus, worse labor market conditions for women and relatively better labor market conditions for men accelerate the timing of marriage without affecting the fraction of women who will ever marry.

[21] I restrict my sample so that I can follow the same people from 18 to 30 years old.

Table 6 shows that these results are robust to controlling for state- and year- fixed effects. First, I estimate the effects of unemployment rates by gender experienced at age 18-20 on the median age at marriage with the median regression defined by equation (4), to confirm that these unemployment rates affects the timing of marriage. Women who have never married are assumed to be above the median. The first column of Table 6 shows that women who experienced worse labor market conditions in youth marry younger. Also, relatively worse labor market conditions for men delay marriage.

The rest of Table 6 reports the estimated effects on the likelihood of having ever married by a specific age with in the cohort-level linear model (5). The positive effect of the female unemployment rate at age 18-20 on the fraction of women who have ever married fades away as the cohort ages. The negative effect of the male-female gap also fades away, although the coefficients are not statistically significant even for the early twenties.

To summarize, a high female unemployment rate and a low male unemployment rate increase the incidence of marriage for women younger than early twenties but decrease it for older women. Younger women adjust the timing of marriage according to labor market conditions, but the probability of divorce in future is not affected. Labor market conditions in the teens and early twenties do not affect the fraction of women who will ever marry by the mid-thirties, either. Since the effects of contemporaneous gender-specific unemployment rates on the divorce hazard are also weak, the well-documented effects of male and female labor market conditions on the fraction of women who are currently married can be attributed to changes in the timing of marriage for women who would eventually marry anyway.

5.2 Implications for Fertility, Labor Supply and Income

The response of the marriage rate to changes in gender-specific unemployment rates is a timing effect for those who would eventually marry without such shocks. Even so, the timing of marriage itself may affect women's fertility and labor supply decisions. Also, since worse labor market conditions for women may cause some newly married women to withdraw from the labor force, labor market conditions at the time of marriage may affect investments in marriage specific human capital in the long run. Therefore, this section examines whether gender specific unemployment

rates at marriage and in youth have long-term effects on women's fertility, labor supply, and income.

First, Table 7 shows the effects of gender-specific unemployment rates at marriage and in youth on the number of children born to each woman by her mid-thirties. Since the SIPP does not provide the years of birth of all children and asks the number of children only at the Wave 2 interview, the number of children born to a woman by a specific age is available only for those who are at that age at the time of survey. Therefore, the sample used in the first two columns of Table 7 is restricted to women who are 35-37 years old at the Wave 2 interview. The first column shows negligible correlations between unemployment rates by gender at marriage and the number of children. It suggests that marrying in response to gender-specific labor market conditions do not affect the fertility in the long-run.

The estimated coefficients of gender-specific unemployment rates at marriage may not be causal effects because these coefficients may represent affected by the selection into marriage. Yet, the direction of the causal effects and the spurious effects from selection are expected to be the same. On one hand, worse labor market conditions for women are expected to induce some women to withdraw from the labor force. On the other hand, women who want to have children are more likely to be induced to marry because worse labor market conditions for women lower the opportunity cost of bearing a child. Since the estimated coefficients are not statistically distinct from zero, both the causal and selection effects are negligible.

Furthermore, the second column of Table 7 shows insignificant effects of unemployment rates at age 18-20 for all women including those who have not married by age 35. That is, even though worse labor market conditions for women accelerates the timing of marriage, the shift in marriage timing does not significantly affect the number of children that these women will have by their mid thirties. Since the sample restriction imposed on the SIPP sample is complicated, the last column shows the effects of unemployment rates at marriage estimated with the PSID as a robustness check.[22] It confirms that the effects are statistically insignificant.

Since young women marry earlier if they face a high female unemployment rate and a relatively

[22] The number of children is observed at the year when the woman becomes 35 (and 36 for 1997-2003 because the survey has become biennially since 1997). I did not estimate the effects of unemployment rates at age 18-20 because the state of birth was not available for too many women in the sample.

low male unemployment rate, these earlier marriages may lead to earlier entry into motherhood. Thus, I estimate the effects of gender-specific unemployment rates at age 18-20 on the age at birth of the first child. The first column of Table 8 shows that worse female labor market conditions in youth do not accelerate the timing of first births, despite their significant effect on marriage timing, which is shown in Table 6. Instead, the male-female gap significantly delays the timing of the first births. The second to fourth columns show the effects of unemployment rates by gender at age 18-20 on the probability of having a child by a certain age using the same specification as Table 6. Labor market conditions in youth do not affect the probability of eventually having a child either, although relatively worse labor market conditions for men seem to delay the timing.

The last two columns of Table 8 show that worse female labor market conditions do not affect the probability that a woman in the affected cohort becomes a single mother. First, even though worse female labor market conditions accelerate the timing of marriage, they do not significantly reduce the probability of having a child before marriage. The dependent variable of the last column is one if the woman either had a child before her first marriage or divorced after the birth of her first child by age 35. Again, unemployment rates at age 18-20 do not have significant effects. The result seems to be consistent with the negligible effects on the divorce probability shown in Table 4.

Even though it does not affect fertility, marrying young in response to labor market conditions in youth may affect the woman's earnings and labor supply. Thus, I estimate reduced form effects of gender specific unemployment rates at age 18-20, which affect the timing of marriage at the cohort level, on various economic outcomes in the mid-thirties. The correlation between labor market conditions in youth and labor supply can provide suggestive information about the effects of changes in marriage timing due to labor market conditions.

Table 9 shows the estimated coefficients of gender-specific unemployment rates at age 18-20 in the linear model defined by equation (6). Panel A presents the estimates for all women including those who are not married. Except for the positive effect of the female unemployment rate on weeks worked last year, labor market conditions at age 18-20 do not affect women's income and employment significantly. The last column confirms that the result of Table 6 holds for this sample, i.e. gender specific unemployment rates at age 18-20 do not affect the fraction of women

who marry by their thirties. Panel B is estimated with married women only, which confirms a similar pattern. Moreover, the last column shows that labor market conditions in youth are not correlated with the husband's income either. Overall, labor market conditions in youth do not have significant effects on personal earnings, household income or spouse's earnings, despite the significant effects on the timing of marriage. If there are any effects, worse labor market conditions for women seem to slightly increase the weeks worked.

Years since marriage is correlated with the presence of an infant child, which affects labor supply and perhaps also wages, and the timing of marriage is endogenous and correlated with women's preference for labor supply and productivity. Therefore, it is hard to estimate the long-term effects of gender-specific unemployment rates at the time of marriage on the woman's labor supply and income. Yet, the reduced form effect presented in Table 9 shows no supportive evidence that worse female labor market conditions at marriage reduce women's labor supply.

5.3 Alternative Explanations for Differential Effects across Age

Table 3 and Figure 3 have shown that the female unemployment rate has a negative effect on the probability of getting married for older woman, in contrast to a positive effect for younger women. This section examines several factors that could produce a negative effect of the female unemployment on the marriage hazard and are correlated with age.

First, the classical argument that men have a comparative advantage in market work may no longer be true for women who have settled in stable employment. Table 3 has already shown that the heterogeneous effects across women's age are not attributable to heterogeneity across educational background, which suggests that the negative effect does not come from stronger *aims* for careers. Still, it is worth investigating whether the negative effect appears among women who have not finished their transition to full-time employment.

Therefore, I restrict the sample to women who graduated from college recently. Given the high turnover rate in the entry level labor market in the United States, these women are likely to be still transitioning to stable employment. The first column of Table 10 replicates the first column of Table 3 as a benchmark. The second column shows the estimated coefficients from exactly the same specification except that the sample is limited to women who had at least some

college education and completed that education sometime between the year of observation and 3 years prior to it.[23] It does not look much different from the first column. Using the information about employment status and enrollment status in the core panel, I also estimate the same model with the sample of women who are not employed full-time or enrolled full-time in the previous year.[24] Column (3) of Table 10 shows that the effect of the female unemployment rate on marriage incidence flips signs in the mid-twenties even for women who are not employed full-time or enrolled full-time, although the negative effects are not statistically significant probably due to the smaller sample size. Therefore, more stable employment does not seem to be able to explain all of the negative effect of the female unemployment rate for older women.

Second, even unmarried, older women are more likely to have a child. If men do not want to marry women with a child during a recession because they cannot afford child-care costs, the marriage rate of women with children will fall when the unemployment rate is high. In this case, the female unemployment rate will not have a negative effect for older women without children. Thus, column (4) of Table 10 reports the same model estimated with women without children only; the presence of children is not likely to be the reason for the opposite effects for the older women.

Third, older women are more likely to have left the community where they grew up and thus may have difficulty increasing search intensity effectively, especially when other women want to marry. Column (5) shows estimates from the subsample of the SIPP who have never moved from the state of birth.[25] Although the negative effect of the female unemployment rate on the marriage hazard for older women becomes weaker, it is still significantly negative. Since the positive effect for younger women is also smaller, it is hard to conclude from this result whether the negative effect comes from losing contact with the community where the woman grew up.

Overall, the differential effects across age groups are robust across different sample restric-

[23] The year of completion is defined as the last year of enrollment taken from the Education and Training History Topical Module attached to the Wave 1 or 2. I limited the sample to women who have at least some college education because there is not much variation in age at graduation for high school graduates.

[24] Since the SIPP does not provide full employment history, I have to limit the sample to women who were unmarried and 17-35 years old at the beginning of each panel and observe their marital status only during the period of core panel survey.

[25] Although women with college education are more likely to have left their state of birth, Table 3 shows that the female unemployment rate has a negative effect on marriage incidence for older women regardless of their educational backgrounds.

tions. It is not attributable to correlation of the age of marriage with educational background, employment status, the existence of children, or whether the woman has moved from the community where she grew up.[26] Although showing the absence of effects for these factors is not direct evidence, it suggests that the effects of gender specific unemployment rates are varying with the age of the woman herself, rather than with another factor correlated with age.

6 Interpretation in a Search Theoretic Framework

The probability of marriage is the product of the probability that a woman meets a man and the probability that they agree to marry conditional on meeting. In standard search models, the probability that a woman meets a man is called the arrival rate and often depends on search effort, and the reservation quality of an acceptable match determines whether they agree to marry conditional on meeting. Therefore, the increase in marriage incidence for young women due to worse female labor market conditions must come either through an increase in search intensity for mates or a decrease in the reservation match quality that is compensated for by a temporary rise in the relative earnings of men. While lowering the reservation match quality is expected to increase the probability of divorce after the recovery of female labor market conditions, increased search effort accelerates the timing of marriage without affecting the likelihood of divorce in future. Hence, the empirical results presented in section 4.1 can be interpreted as evidence for a change in search intensity rather than a change in reservation match quality.

In a standard dynamic search model of marriage formation such as Mortensen (1988), the gain from marriage for a woman is typically defined as follows: $gain = \theta^w(V_M - V_S^m - V_S^w)$, where the woman's share of the total gain from marriage is given by a constant $\theta^w \in (0,1)$, and V_M, V_S^m and V_S^w are the value of marriage and the values of the single state for a man and for a woman. Assuming that an increase in the gain from marriage causes an increase in the actual marriage incidence, the positive effect of the female unemployment rate on marriage incidence implies that *gain* is increasing in the female unemployment rate. Likewise, the negative effect of

[26] In addition, Appendix section B.3 and Table B.4 show that even if the benefit from legal marriage could vary with age, the estimated effect of the female unemployment rate does not significantly change by splitting the sample by the existence of legal institutions that increases the benefit from being legally married.

the male-female gap implies that *gain* is decreasing in the male-female gap.

In order to build a full model which incorporates the effects of labor market conditions, however, I would have to specify the value functions which depend not only on male and female unemployment rates and the match quality but also on the stock of men and women who are looking for matches and on a matching function which generates the arrival rate from both endogenous search intensity and the supply of men and women in each period. It is however possible to see some key insights from a reduced form model in which gender-specific labor market conditions shift the demand for marriage with a given level of match quality.

For simplification, the net effects of female and male unemployment rates are summarized as "labor market conditions" U_t, which increases *gain*. The gain from a particular marriage also depends on the match quality, x, and the woman's preference for marriage, π.[27] Thus, under the assumption of transferable utility between spouses,[28] a women and a man agree to marry if and only if $gain(x, \pi, U_t) > 0$. The "demand" for marriage, $D_t(x, U_t)$, is thus defined as the number of women whose π satisfies $gain(x, \pi, U_t) > 0$ with the given (x, U_t). In other words, $D_t(x, U_t)$ is the number of women who is willing to marry with match quality x under labor market condition U_t.

For further simplification, assume $\partial gain/\partial x \geq 0$, $\partial gain/\partial \pi \geq 0$, and $\partial gain/\partial U_t \geq 0$ for any (x, π, U_t). Then, the demand curve of marriage increases in x for any given U_t. On the other hand, taking the distribution of x and the number of men and women who are single as given, the supply of matches whose qualities are greater than x decreases in x. Figure 5 shows the demand curve $D_t(x, U_t)$ and the supply curve $S_t(x)$, taking the number of women willing to marry and the number of available matches on the horizontal axis and the match quality on the vertical axis. The intersection of $D_t(x, U_t)$ and $S_t(x)$ determines the equilibrium number of marriage formed in this period and the reservation match quality, i.e. the lower bound of accepted matches.

Figure 5 also illustrates how U_t affects the number of marriage. An increase in U from U_0 to

[27] Since the model is described from the viewpoint of women, men's preference for marriage, which also affects *gain*, is included in the match quality x.

[28] Utility is assumed to be transferable between spouses. This assumption implies that a single woman is willing to transfer utility to the man whom she meets up to the point where the man is also better off from the marriage or she is no longer better off from the marriage. Hence, the benefit from marriage for a woman and that for a man can reduced into one parameter which represents the benefit from marriage for the woman net of the transfer to the man.

U_1 shifts the demand curve to the right. In Case 1, the supply curve does not shift because the number of men and women and the probability that they meet are exogenously given. Thus, the intersection moves so that the number of marriages increases from M_0 to M_1 and the reservation match quality falls from x_0^* to x_1^*. In this case, the extra marriages induced by gender specific labor market shocks are on average poorer matches and more likely to end in divorce than marriages formed without such shocks.

Yet, the number of men whom a woman meets can be increased by putting in more search effort, as long as there are some frictions in the marriage market.[29] Search effort reduces these frictions and increases the probability that a woman meets a man. From each woman's point of view, this increase in the arrival rate can be interpreted as an increase in the number of available matches or the supply of matches. Presumably, when marriage is more attractive for women, they will put in more search effort. Therefore, the probability of meeting, or the arrival rate, is likely to increase in U_t.[30] Case 2 of Figure 5 illustrates this situation: the change from U_0 to U_1 shifts the demand curve to the right, but the change of the arrival rate from λ_0 to λ_1 shifts the supply curve to the right, too. As a consequence, despite the increased number of marriage from M_0 to M_1, the reservation quality does not necessarily fall.

Although I do not specify how λ is determined, it is worth emphasizing that search effort and the reservation match quality are simultaneously determined. Therefore, the extent to which women are willing to lower their reservation match quality depends on the relative cost of increasing the arrival rate by putting in more search effort. If lowering the match quality is much more costly than increasing search efforts, it possible for women to decide not to lower reservation match quality. Case 2 of Figure 5 describes this case; search intensity increases up to the point where the marginal cost of additional effort equals to the marginal benefit from it, holding the

[29] The probability of meeting a new potential mate increases not only when women who are already searching for mates intensify the search, but also when women who had not begun searching yet choose to start searching. In addition, a typical couple spends a few years seeing each other before getting married, which Becker et al (1977) call "intensive" search to figure out whether the current partner is good enough to marry. I include effort to shorten this intensive search process in what I call "search effort" here, as well as "extensive" search effort to meet a new potential mate.

[30] Note that men could also increase their search effort because U_t raises the gains from marriage for them, too. It is also possible that women increase their search effort under slack labor market conditions because the lower wage rate reduces the opportunity cost of marital search, rather than because of the increased gains from marriage. Although these possibilities cannot be ruled out, in any case, the arrival rate increases and the supply curve shifts to the right.

reservation match quality unchanged.

The empirical results presented in the previous section imply that the match quality of newly formed marriage does not change in response to labor market conditions. Hence, Case 2 is more likely to be the case. Also, if the reservation quality does not change, an increase in marriage incidence due to a temporary increase in search effort may not necessarily raise the fraction who eventually marry in the cohort much, as long as the total number of matches with $x \geq x^*$ is limited.

Furthermore, the limited supply of men implies that each woman's search effort creates a negative externality on other women's marriage incidence.[31] This negative externality may explain the negative effect of the female unemployment rate on marriage incidence for older women. Older women may be crowded out by the increased search effort by younger women for several reasons. First, men may prefer to marry younger women because they simply appreciate youth or they believe women who have not married until the late twenties are negatively selected. Second, women who hope to marry by a certain age may have already put in much search effort, and they may not have room to adjust the timing of marriage according to labor market conditions.

If the crowding-out by young women's search effort is the main reason for the opposite effects on marriage incidence for older women, the increase in the number of young women getting married must exceed the decrease in the number of older women getting married. The overall effects shown in Table 3A are consistent with this prediction. Yet, if young women's search efforts crowd out older women, the reservation quality of husband for older women should fall when marriage incidence for younger women increases. The results presented in Appendix Tables B2 are not quite consistent with this prediction although it may be because older women are not willing to lower their reservation match quality in order to exploit the temporary increase in the gain from marriage due to labor market shocks.

An alternative explanation is that, if women are inherently different in terms of taste for marriage, and if women who choose not to marry by the mid-twenties prefer to marry when the female unemployment rate is low, the estimated coefficients are picking up heterogeneous

[31] This negative externality can be created not only by direct competitions in the "extensive" search process but also by better outside options for men which prolong the "intensive" search process necessary to reach an agreement to marry.