Abortion Costs and Single Parenthood: A Life-Cycle Model of Fertility and Partnership Behavior*

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Abstract

I solve and estimate a life-cycle model of fertility and partnership behavior to examine the relationship between abortion restrictions and single parenthood. In addition to the direct effects of restrictions on abortion decisions and sexual behavior, the model nests two channels relating abortion policy to partnership that have been discussed in the literature. First, upon becoming pregnant, a woman may realize information about the father's commitment to a relationship. A change in abortion policy impacts the number of women who become pregnant and realize such information. Second, abortion policy impacts competition in the market for partners. In a model of dynamic partnership transitions and fertility decisions, these mechanisms may have immediate effects on behavior and outcomes as well as effects that manifest over time. The estimated model is used to simulate the impacts of removing three types of abortion restrictions. I find that the removal of Medicaid funding restrictions or parental consent laws decreases unwed motherhood by causing some pregnant women to switch from giving birth to aborting, while having small impacts on the availability of partners. In contrast, the removal of mandatory counseling and delay laws increases unwed motherhood by having a relatively larger impact on partnership alternatives.

Keywords: Abortion, Fertility, Marriage, Cohabitation, Classification Error
JEL Classification: J12, J13

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1 Introduction

A simple economic model of abortion decisions predicts that a decrease in the cost of abortion will decrease total births and births to single mothers. However, the biological relationship between fertility and partnership suggests that any attempt to measure the impact of abortion policy on single parenthood requires a model of participation in the market for partners, sexual behavior, pregnancy, and abortion decisions. In their efforts to explain teen and out-of-wedlock motherhood, respectively, Kane and Staiger (1996) and Akerlof, Yellen, and Katz (1996) discuss mechanisms through which abortion costs could be related to partnership decisions and outcomes.[1] They hypothesize that these mechanisms could have countervailing effects on the relationship between abortion costs and births or births to single mothers. I construct and estimate a life-cycle model of a woman's fertility and partnership decisions that explicitly accounts for and identifies these mechanisms in addition to the direct effects of abortion policy on fertility decisions. I extend the aforementioned models by including endogenous, dynamic partnership transitions over the life-cycle. The dynamic model highlights an additional channel through which abortion policy and single parenthood may be linked: if those women whose fertility is impacted by a policy are more or less likely than the average woman to match with a partner in the future, then the policy could have dynamic selection effects on single parenthood.

Existing evidence on the effects of abortion policy comes from variation in the timing of policies across states. Results from the literature on the 1973 legalization of abortion in the U.S. suggest that legalization increased pregnancy rates and decreased birth rates (Levine et al., 1999; Gruber et al., 1999; Ananat et al., 2007; Ananat et al., 2009). These findings are consistent with a simple model that includes two mechanisms. First, a decrease in abortion costs increases the quantity of abortions demanded among pregnant women. I refer to this mechanism as the price effect. If pregnancy is exogenous with respect to abortion costs, then the prediction of a decrease in births follows. However, a decrease in abortion costs also decreases the cost of pregnancy for women who would choose abortion should a pregnancy occur. If individuals are forward looking when making sexual and contraception decisions, and avoiding pregnancy is costly, then these women will accept a higher probability of becoming pregnant. I refer to this second mechanism as the insurance effect. Because the insurance effect implies an increase in pregnancy only for women who would choose abortion, the prediction of a decrease in births remains.

In contrast to the prediction of the simple model, studies that have estimated the causal effect of state-level abortion policies on births have found that decreases in abortion costs

[1] Abortion costs are broadly defined to include pecuniary, legal, health, time, and utility costs.

increase the birth rate in some cases (Kane and Staiger, 1996; Levine, Trainor, and Zimmerman, 1996; Levine and Staiger, 2004). To explain these findings, Kane and Staiger (1996) propose a model in which some uncertainty about a partner's commitment is resolved between conception and the abortion decision. A choice between abortion and birth may be uncertain, ex-ante, if the relative cost of each depends on the partner's level of commitment.[2] Among women facing this uncertainty, a decrease in the cost of abortion decreases the *expected* cost of pregnancy, which leads to a higher pregnancy rate. For some of these pregnancies, a revelation of positive information about the partner results in birth being the optimal choice. I refer to this mechanism as the information effect.[3] Any increase in births due to the information effect will be among mothers who receive positive information from a partner and are more likely to be in a partnership at the time of the birth.

Motivated by the dramatic increase in the percentage of single family homes in the U.S. following the legalization of abortion, Akerlof, Yellen, and Katz (1996) argue that it is important to consider how reproductive technologies relate to competition in the market for partners. They develop a model with two types of women: those who would consider aborting a pregnancy and those who would not. Due to the insurance effect, those women who would consider abortion will supply a greater amount of sexual activity outside of committed relationships when the cost of abortion falls. This supply shift affects the options available to men in the market for partners. In a model with only a price effect and insurance effect, those women who are unwilling to have an abortion will not change their sexual behavior in response to a change in the cost of abortion. However, as the availability of sex outside of a committed relationship increases for men, these women may also increase sexual activity in order to remain competitive for partners. When an unintended pregnancy occurs for these women they will not abort the pregnancy regardless of the father's commitment.[4] I refer to this mechanism as the competitive effect.

While the possibility of an information effect and competitive effect has been discussed in the literature, their significance and magnitude have not been tested empirically to the best of my knowledge. The primary contribution of this paper is the estimation of a model that

[2] Finer et al. (2005) survey 1,209 abortion patients and find that 48 percent of women cite relationship problems or a desire to avoid single parenthood as the reason for the abortion, suggesting that partnership uncertainty is an important factor in the abortion decision.

[3] Please see the comparative statics section of the online appendix for a graphical depiction of the information effect. The graphical model illustrates which women could experience an increase in the probability of a birth due to the information effect.

[4] The formal model in Akerlof, Yellen, and Katz (1996) is a model of a woman's decision to ask a partner for a promise of marriage should a pregnancy occur. As legalization increases the availability of sex outside of marriage, men become less likely to remain in a relationship when asked for such a promise. Hence, those women who are unwilling to abort a pregnancy are less likely to ask. The mechanism can be interpreted as an effect of abortion policy on the social norms for sexual behavior outside of partnerships.

nests the price effect, insurance effect, information effect, and competitive effect. Separately identifying these mechanisms is of theoretical interest, but is also of practical importance as the significance of each mechanism could vary by policy type and demographic group. Further, the welfare implications of abortion policy for women depend on which mechanisms are relevant; only the competitive effect suggests that a decrease in the cost of abortion could result in welfare losses for some women.[5] I also extend the current discussion by considering the possibility of dynamic selection effects stemming from each of the mechanisms. Because partnership survival rates are heterogeneous, dynamic selection effects could have significant impacts on life-cycle single parenthood. For example, the information effect predicts that a decrease in the cost of abortion will increase contemporaneous births *within partnerships*. However, if these partnerships, which form following an unintended pregnancy, are more or less likely to survive over time than an average partnership, then there will be effects on single parenthood in the future.[6]

The model describes the optimization problem of a woman who makes decisions at each age from 15 to 45 years old with respect to partnership, sexual activity, contraception, schooling, and employment. She receives flow utility based on the alternative she chooses and consumption of a composite good. The cohabitation and marriage markets are modeled in a search context. An offer of marriage or cohabitation is received with some probability that depends on characteristics of the woman, her sexual behavior, and the abortion policies faced by her competitors in the market for partners. When making her decision, the woman calculates expected lifetime utility taking into account the probability of pregnancy and the probability of having partner offers in the future. If a pregnancy occurs, she realizes information about her probability of receiving partner offers in the next period. She decides whether or not to abort a pregnancy based on her preference for abortion and the expected future utilities associated with abortion and birth. Preferences for abortion are shifted by a woman's characteristics, including her religiosity, the abortion policies in her state of residence, and a permanent unobserved preference for abortion.

I solve the dynamic model via backwards recursion and estimate the structural parameters of the model, including preference parameters, the distribution of partner offers, and the distribution of information revealed following pregnancy, via maximum likelihood. The estimation sample is from the National Longitudinal Survey of Youth 1997 cohort (NLSY97), and consists of over 2,600 women interviewed each year for fifteen consecutive years. Variation in state-level abortion restrictions both across and within states over these fifteen years,

[5]The welfare implications for children are less straightforward.

[6]Similarly, those women who become single mothers due to the competitive effect and those women who avoid a birth due to the price effect may be more or less likely than the average woman to match with a partner in the future.

as well as variation in marriage and cohabitation market characteristics across and within counties, aid in identifying the parameters of the model. One reason that it is difficult to separately identify the mechanisms of interest is the high level of underreporting of abortion in individual-level surveys, and separate identification of the mechanisms requires individual-level panel data. A comparison of the abortion rate in the NLSY97 with estimates of the abortion rate from the Guttmacher Institute, which surveys the known universe of abortion *providers*, suggests that women in the NLSY97 severely underreport abortions. Hence, I address underreporting by combining the NLSY97 survey data with aggregate data on abortion, miscarriage, and birth rates to calculate misreporting probabilities for each possible joint outcome of pregnancy and abortion. These estimated misreporting probabilities are used to adjust the likelihood function for misreporting and vary by age, race, and year.

Based on preliminary estimation results, the model predicts that: (1) the removal of public funding restrictions *decreases* the percent of women who are unwed mothers, with the effect initially increasing with age before tapering off; (2) the removal of mandatory counseling and delay laws *increases* unwed motherhood slightly despite having a price effect of similar magnitude to public funding restrictions; and (3) the removal of parental consent laws *decreases* unwed motherhood at young ages.[7] The difference in the predicted direction of the effect for mandatory delay laws relative to the other restrictions is driven by these laws having larger impacts on competition in the market for partners. Public funding restrictions do not appear to have an impact on partnership alternatives in a manner that is consistent with the competitive effect, while parental consent laws do have sizable competitive effects for cohabiting women. However, because a small number of minors cohabit, the effect at a population level is small and does not overwhelm the price effect. Across the three restrictions, the information effect is more relevant for cohabiting women than single women. The information effect is responsible for a small number of births, but these births are more likely to be among women who are partnered in the next period and who are less likely to be single into the future.

The paper proceeds as follows. Section 2 discusses related literature. Section 3 presents the parameterized decision model. Section 4 discusses data and presents motivation for the mechanisms of interest. Section 5 discusses identification and estimation. Section 6 presents estimation results and policy simulations. Section 7 concludes.

[7] States that have public funding restrictions do not allow Medicaid insurance to pay for abortion services. Mandatory counseling and delay laws require women to receive counseling prior to obtaining an abortion and to wait a specified amount of time after the initial appointment. If a woman must travel a far distance to a clinic, then delay laws could be particularly costly. Finally, parental consent laws require minors to have consent from a parent or legal guardian prior to obtaining an abortion. It is noted that in all states with parental consent restrictions, minors have the option to petition the court if their parent or guardian is not willing to give consent.

2 Related Literature

2.1 Empirical Evidence on the Effects of Abortion Policy

The empirical literature on abortion policy has provided evidence on the effects of both legalization and state-level policies on births and sexual and contraceptive behavior. A fairly large group of papers provides evidence that the insurance effect is relevant (Kane and Staiger, 1996; Levine et al., 1996; Levine, 2003; Levine and Staiger, 2004; Ananat et al., 2009; Klick et al., 2003, 2008, and 2012; Jacobs and Stanfors, 2015). As noted, evidence on the total effects of abortion costs on births is mixed and differs for the literature on legalization and the literature on state-level policies.[8] I add to these studies by decomposing total effects on births and pregnancy into the mechanisms modeled and considering the significance of each mechanism across three types of state policies.[9] A related literature has also developed that highlights the effect of selection on the average characteristics of the cohort born immediately following legalization. For example, Gruber et al. (1999) find that the "marginal child" who was not born due to the legalization of abortion would have been more likely to live in a single parent home and to live in poverty. I examine the effects of less restrictive policies than a legal ban of abortion on single parenthood over the life-cycle.

The empirical literature relating abortion policy to partnership formation is small. Angrist and Evans (1999) find that the early legalization of abortion in some states resulted in lower marriage rates among teenage men and women relative to those states that legalized abortion following the *Roe v. Wade* decision. Choo and Siow (2006) estimate a static marriage matching model and show that the legalization of abortion was an important reason for the falling value of marriage between 1970 and 1980. Finally, Beauchamp (2016) examines the effect of state-level abortion restrictions on separation of the mother and father, marriage rates, and cohabitation rates among pregnant women using miscarriage as an instrument for endogenous selection into giving birth. He argues that his results show that higher abortion costs increase cohabitation for young and poor women who give birth and that this finding supports a variant of Akerlof, Yellen, and Katz's (1996) theory.

[8]Levine and Staiger (2004) argue that for relatively small changes in the cost of abortion the price effect will be less important, wheras the insurance effect may still be relevant. They examine the effects of abortion policies across countries that vary in the severity of restrictions and show that countries experiencing large decreases in the cost of abortion experience a decrease in births, but those with small changes experience no change in births and an increase in pregnancies and abortions.

[9]Even a null total effect of policy on the contemporaneous birthrate will be a combination of the mechanisms described here, which means that policy could have different implications for life-cycle fertility, life-cycle single parenthood, or across demographic groups.

2.2 Models of Abortion, Fertility, and Partnership

A theoretical literature has developed that discusses the welfare implications of the availability of abortion and birth control for women. In direct contrast to the predictions of Akerlof, Yellen, and Katz (1996), Chiappori and Oreffice (2008) develop a static, frictionless matching model of the marriage market that implies that legalization of abortion increases welfare for all women. A primary difference is that Chiappori and Orrefice do not model preferences for sex and assume that unintended *pregnancy* is exogenous with respect to a change in the availability of abortion. They write that, "Our approach views fertility mostly as the intended consequence of a well-informed decision, whereas [Akerlof et al.'s] emphasizes children as involuntary by-products of sex." I model individuals as deciding an amount of sexual activity and contraceptive use while taking into consideration the impact of these decisions on the probability of becoming pregnant, which allows for both "intended" and "unintended" pregnancy. In the United States, approximately 50 percent of all pregnancies, and 70 percent of pregnancies for women under the age of 30, are unplanned (Sawhill and Venator, 2015).

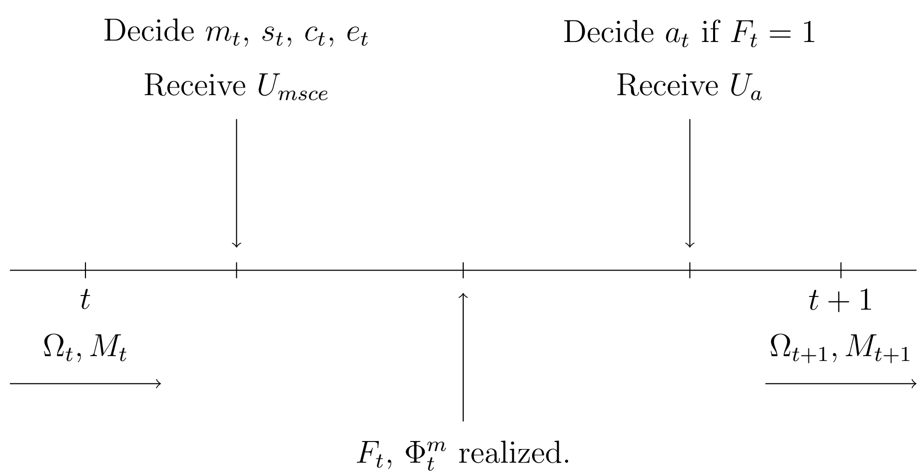
This paper is also related to a group of papers that estimate structural models of fertility and partnership decisions (Eckstein and Wolpin, 1989; Van der Klaauw, 1996; Francesconi, 2002; Brien, Lillard, and Stern, 2006; Keane and Wolpin, 2010). Most of these papers treat pregnancy as the decision variable rather than sexual behavior and ignore abortion. These models implicitly assume that pregnancy is timed perfectly and do not address unintended pregnancy.[10] Furthermore, many papers that model fertility restrict the sample to married women and those that model partnership leave fertility as an exogenous process. Arcidiacono, Beauchamp, and McElroy (2016) use a two-sided directed search model to uncover male and female preferences over partner characteristics and relationship terms among teenagers. They find that men value sexual relationships more than women and that some women would prefer not to have sex but do so in order to increase the probability of matching with a partner. These results support the possibility of a competitive effect. Amador (2014) is the first paper to estimate a structural model that includes the abortion decision and he uses Guttmacher Institute data to correct for underreporting of abortion. However, he does not model the relationship between marriage or cohabitation markets and abortion, or that a woman may have more information at the time that she makes the abortion decision than at the time of conception. Rather, partnerships and sexual activity are modeled as stochastic processes and the paper focuses on the life-cycle effects of abortion restrictions on schooling and wages.

[10] Exceptions include Hotz and Miller (1993) and Carro and Mira (2006) who model couples' contraceptive behavior.

3 Model

This section describes the optimization problem of a woman who makes sequential decisions to maximize her expected lifetime utility. The model is a discrete-choice, discrete-time model. Each year between the ages of 15 and 45 represents a time period. The timing of decisions and outcomes within a period is summarized in Figure 1, with detailed explanation provided in the following subsections. Entering a period the individual observes a vector of variables that describe her history of choices and outcomes, which is denoted Ω_t and I will refer to as her state vector. She also observes her set of partnership offers for that period, M_t. Given the state vector and partner offers, the woman evaluates discrete alternatives for four behaviors: whether or not to accept partnership offers (m_t); level of sexual activity (s_t); frequency of contraceptive use (c_t); and employment/schooling (e_t). Next, the pregnancy state, F_t, is realized. If pregnant, a woman observes a draw of the random variable Φ_t^m, which shifts the probability distribution of partner offers in the next period. The distribution from which Φ_t^m is drawn depends on current partnership status, $m_t = m$. Based on her information set, the individual decides whether or not to abort the pregnancy (a_t). A pregnancy that is not aborted results in a live birth.[11]

Figure 1: Timing



3.1 Per-Period Alternatives

Partnership alternatives include marriage, cohabiting with a partner who is not a spouse, and being single. Combinations of these alternatives are available stochastically and are referred to as partner offers. Partner offers should be interpreted as the opportunity to marry or cohabit. Modeling both an offer and the woman's decision of whether or not to accept an

[11] Spontaneous abortion, or miscarriage, is not modeled.

offer allows for either partner to end a relationship.[12] Marriage and cohabitation are treated as mutually exclusive. Further, a woman cannot receive both an offer of marriage and an offer of cohabitation, which means that marriage and cohabitation are never both included in the choice set. This assumption is necessary for identification, discussed in subsection 5.2.3. Alternatives for partnership, $m_t = m$, include:[13]

$$m = \begin{cases} 2 & \text{married} \\ 1 & \text{cohabiting} \\ 0 & \text{single} \end{cases}$$

There are three possible offer sets: $m \in \{0, 2\}$, $m \in \{0, 1\}$, and $m \in \{0\}$. The offer set for period t is denoted M_t:

$$M_t = \begin{cases} M^2 & \text{if } m \in \{0, 2\} \\ M^1 & \text{if } m \in \{0, 1\} \\ M^0 & \text{if } m \in \{0\} \end{cases}$$

For example, M^2 is the set that includes marriage and being single as alternatives.

While evaluating partnership alternatives, an individual simultaneously evaluates alternatives for sexual activity, contraceptive use, and employment/schooling. Her alternatives for sexual activity, $s_t = s$, and contraceptive use, $c_t = c$, are discretized such that:

$$s \in \{0, 1, ..., S\}$$
$$c \in \{0, 1, ..., C\}$$

Contraceptive use alternatives represent the categorized percentage of sexual encounters for which the individual uses contraception. If abstinent ($s_t = 0$), then a contraception decision is not made. In estimation, S and C equal three; sexual activity is discretized into none, low, and high levels, while contraceptive use is discretized into never use, sometimes use, and always use.[14] Every alternative for sexual activity is available in each period regardless of partnership status; however, the flow utility (disutility) associated with each alternative

[12] As discussed below, jointly modeling partner offers and a partnership decision is also necessary for separating the effects of abortion policy on competition in the market for partners from effects on the value of partnerships.

[13] "Single", as used here, refers to individuals who are neither legally married nor living with a romantic partner. Single individuals include those who are dating but not living with a partner.

[14] Arcidiacono, Khwaja, and Ouyang (2012), who estimate a discrete choice model with sex and contraceptive choice to examine the effect of access to contraception on teenage pregnancy, discretize sex into three categories and contraception into four categories. Amador (2014), who models contraceptive choice, discretizes the alternatives into three categories.

depends on a woman's state vector and the jointly chosen partnership (m_t) and contraception (c_t) alternative.

An individual's mutually exclusive alternatives for employment and schooling, $e_t = e$, are:

$$e = \begin{cases} 2 & \text{work} \\ 1 & \text{attend school} \\ 0 & \text{do not work or attend school} \end{cases}$$

The indicator d_t^{msce} takes a value of one when $m_t = m$, $s_t = s$, $c_t = c$, and $e_t = e$ and 0 otherwise.

A woman's sexual and contraceptive behaviors affect the probability of becoming pregnant in period t. If she becomes pregnant, she chooses whether or not to abort the pregnancy, denoted by a_t. If $a_t = 1$, the pregnancy ends without a live birth. If $a_t = 0$, the pregnancy ends with a live birth, which is modeled as being completed entering the next period.

3.2 State Vector and State Transitions

When evaluating her alternatives at the beginning of a period, a woman takes into account the information contained in her state vector as her state affects the current period utility associated with each alternative and is used to form expectations over future possible states. The observed (by the agent and econometrician) state variables are denoted as follows.

$$\begin{aligned}
D_{0,t} &\equiv \text{consecutive years single following a partnership entering period t} \\
D_{1,t} &\equiv \text{consecutive years cohabiting entering period t} \\
D_{2,t} &\equiv \text{consecutive years married entering period t} \\
m_{t-1} &\equiv \text{partnership in the prior period} \\
N_t &\equiv \text{number of children entering period t} \\
B_{t-1} &\equiv \text{birth in the prior period} \\
LB_t &\equiv \text{years since last birth entering period t} \\
K_{1,t} &\equiv \text{years of schooling entering period t} \\
K_{2,t} &\equiv \text{years of work experience entering period t} \\
R_t &\equiv \text{religiosity} \\
H_t &\equiv \text{indicator of Medicaid eligibility given pregnancy in period t} \\
\mathbf{G_t} &\equiv \text{state of residence abortion restrictions and other state/county characteristics} \\
\mathbf{Z_t} &\equiv \text{individual characteristics: age } (A_t)\text{, age squared, and race } (r_t)
\end{aligned}$$

I use the vectors $\mathbf{D}_t = [D_{0,t} D_{1,t} D_{2,t}]$ and $\mathbf{K}_t = [K_{1,t} K_{2,t}]$ for notational purposes. The vector of state variables, Ω_t, also includes current period preference shocks and an individual's time-invariant unobserved type, both described below, which are observed by the economic agent but not by the econometrician.

The state variables that are determined endogenously by the model are partnership history, $\mathbf{D}_t$ and m_{t-1}, fertility history, N_t, B_{t-1}, and LB_t, and human capital stocks, $\mathbf{K}_t$. The endogenous state variables update from one age to the next based on the individual's decisions and the occurrence of pregnancy. For example, consecutive years married takes a value of one in the period following the formation of a marriage, increases by one when a married individual has the opportunity to remain married and chooses to do so, and resets to zero if a marriage ends. Number of children increases by one entering the period following a pregnancy if the woman chooses not to abort the pregnancy. Years of education and work experience increase by one when the individual chooses to attend school or work, respectively.

The remaining state variables are assumed to be exogenously determined, including the individual's religiosity and the Medicaid eligibility threshold in her state of residence. The vector $\mathbf{G_t}$ includes information on the state and county that an individual resides in. The vector $\mathbf{G_t^R}$ includes indicators of abortion restrictions in the woman's state of residence; PF_t indicates whether her state restricts Medicaid from paying for abortion, PR_t indicates whether her state requires a minor to have parental consent prior to obtaining an abortion, and CL_t indicates whether her state requires a mandatory delay and counseling prior to obtaining an abortion.[15] The vector $\mathbf{G_t^S}$ includes the sex ratio in the woman's county of residence, denoted $G^S_{1,t}$, as well as a measure of the religiosity in her county of residence, denoted $G^S_{2,t}$.[16]

Assumptions must be made regarding how an individual in the model forms expectations of future state and county of residence characteristics, including state abortion restrictions, the supply of partners, and Medicaid eligibility limits. Individuals are assumed to have adaptive expectations for these exogenous state variables. For example, an agent who is making a decision at time t forms her expectations of future utility under the belief that the abortion restrictions in time $t+1$ will be equivalent to those in time t. The assumption that changes in abortion policy are a surprise is consistent with the assumption made by the papers discussed in section 2 that have estimated the causal effects of abortion policy.

[15] As of November 1, 2015, 33 states do not allow Medicaid funding for an abortion, 38 states require parental consent or notification, and 35 states require a mandatory delay and counseling prior to obtaining an abortion.

[16] The measures used for supply of men and county religiosity are discussed in section 4.

3.3 Pregnancy and Partner Offers

The probability of becoming pregnant depends on an individual's sexual behavior and contraceptive use, as well as individual characteristics. The probability of becoming pregnant is zero if an individual abstains from sex. If an individual has sex, the latent variable that determines pregnancy is modeled as

$$F_t^* = \gamma_0 + \gamma_1 Z_t + \sum_{c=1}^{C}\sum_{s=1}^{S} \mathbb{1}[s_t = s, c_t = c](\gamma_2^{sc} + \gamma_3^{sc} A_t) + \mu^1 + \epsilon_t^F \tag{1}$$

The parameters γ_2^{sc} capture the effect of each combination of sex and contraception, and γ_3^{sc} captures how these effects vary with age. The term μ^1 is a permanent unobserved (to the econometrician) factor that affects the probability of becoming pregnant (e.g., level of fertility after controlling for age).[17] B_t is an indicator of birth; hence $B_t = 1$ if a woman becomes pregnant and chooses not to abort ($a_t = 0$).

Recall that M_t represents the set of partnership alternatives, where $M_t = M^0$ if the alternative set only includes being single, $M_t = M^1$ if the set includes cohabitation and being single, and $M_t = M^2$ if the set includes marriage and being single. It is assumed that the underlying process by which offers are made is represented by a multinomial logistic structure. Let $M_t^k = \mathbb{1}[M_t = M^k]$, where $k \in \{0, 1, 2\}$. The latent variable for M_{t+1}^k, for $k \in \{1, 2\}$, is modeled as follows:

$$\begin{aligned} M_{t+1}^{k*} = {} & \eta_0^k + \eta_1^k \mathbf{D}_t + \eta_2^k \mathbf{Z}_t + N_t(\eta_3^k + \sum_{m=0}^{1} \eta_4^{km} \mathbb{1}[m_t = m]) + R_t(\eta_5^k + \eta_6^k G_{2,t}^S) + \eta_7^k \mathbf{G}_t^R + \eta_8^k \mathbf{G}_t^S \\ & + \eta_9^k B_t + \eta_{10}^k a_t + F_t \phi_t^k + \sum_{s=0}^{S}\sum_{m=0}^{1} \mathbb{1}[s_t = s, m_t = m](\eta_{11}^{ksm} + \eta_{12}^{ksm} \mathbf{G}_t^R) + \mu_k^2 + \epsilon_{k,t}^M \end{aligned} \tag{2}$$

The first line of equation (2) allows the partner offer distribution to be shifted by partnership history, age and race, number of children, the interaction of children with current partnership, own religiosity and its interaction with county level religiosity, state-level abortion restrictions, sex ratios by age and race, and county religiosity. The interaction of own religiosity with county religiosity allows for the possibility that a woman may be more (or less) likely to have the opportunity to marry or cohabit if she lives in a place where men are of a similar level of religiosity to her. Likewise, including sex ratios by race allows for women to be more likely to have the opportunity to marry or cohabit if there are a relatively high number of men of the same race as her in her county of residence.

[17] Permanent unobserved factors are denoted μ^i and are modeled using a finite mixture distribution following Heckman and Singer (1984). See discussion in subsection 5.1.2

Both the information effect and competitive effect enter the model in the second line of equation (2). The information effect is captured by $\Phi_t^m = (\phi_t^1, \phi_t^2)$, which is a random vector that has an unknown outcome at the time that m_t, s_t, c_t, and e_t are chosen, but is known at the time that a_t is chosen. Hence, when the individual is evaluating her alternatives at the beginning of the period she must take an expectation over the possible values of Φ_t^m. The effect of ϕ_t^k enters as a level effect whenever a pregnancy occurs (i.e., $F_t = 1$). Φ_t^m is assumed to take one of four discrete values. The outcome for Φ_t^m jointly determines a value for ϕ_t^2, which enters the latent variable for marital offers, and a value for ϕ_t^1, which enters the latent variable for cohabitation offers. For notation, $\Phi^{m,j}$ denotes one of the four possible outcomes of Φ_t^m, and $\rho_{m,j} = P(\Phi_t^m = \Phi^{m,j})$.[18] Information is revealed following pregnancy if either $m_t = 0$, represented by Φ_t^0, or $m_t = 1$, represented by Φ_t^1. The model assumes that married individuals do not receive additional information about the probability of receiving partner offers after becoming pregnant. This assumption is made primarily because of a limited number of abortions by married women in the estimation sample, as well as a limited number of married individuals who separate immediately following a pregnancy, which results in very little variation that can be used to identify a separate distribution of information for married individuals.[19]

The competitive effect enters in a reduced form way.[20] Recall that the competitive effect considers the possibility that abortion costs affect the sexual behavior of a woman's competitors in the market for partners. Hence, even if a woman has a strong preference against abortion, she may have an incentive to increase sexual behavior following a decrease in abortion costs in order to compete for partners. Here, an individual's level of sexual activity affects the probability of receiving partnership offers in the next period and this effect varies with the abortion restrictions faced by other women in her state of residence, contained in $\mathbf{G_t^R}$. So, for example, one element of η_{11} captures the effect of being single and abstinent on the probability of receiving an offer, while an element of η_{12} captures how this effect varies with the abortion costs faced. With this specification, changes in the cost of abortion could impact the partner offer distribution in two ways that could create incentives for women to engage in more *or less* sexual activity: (1) the slope of offer probabilities with respect to sexual activity could be impacted, and (2) the average level of offer probabilities

[18]The distributions of Φ_t^0 and Φ_t^1 are estimated semi-parametrically under the assumption that they are discrete distributions. For each distribution, four combinations of ϕ_t^1 and ϕ_t^2 (i.e., eight total factors) and the probability of each combination are estimated.

[19]Identification of partner offer parameters is discussed in subsection 5.2.3, including how the distribution of Φ_t^m is separated from the idiosyncratic preference for abortion and the non-random effect of a birth and abortion on partner offers, η_6^k and η_7^k.

[20]Fully modeling the competitive effect would require a model that included both male and female agents and an equilibrium model of the market for sex and partnership and their interaction with each other.

could be impacted. With respect to (1), if a decrease in abortion costs increases the slope of offer probabilities with respect to sexual activity, and partner offers are valuable, this would be consistent with the possibility of a competitive effect. With respect to (2), a decrease (increase) in the level of offers could incentivize some individuals to increase sex and some individuals to decrease sex.[21]

Marriage and cohabitation markets differ across state of residence in ways that may be correlated with abortion policy. The level effect of abortion policy on offers, captured by η_7, will absorb these differences so that they should not bias the parameters representing the competitive effect unless the differences are further correlated with the interaction of abortion policy and sexual behavior after conditioning on the policies.[22] Correlation between partner markets and geographic location is also controlled for by allowing observable characteristics of where the individual lives to enter the offer probability. For example, sex ratios and the level of religiosity in an individual's *county* of residence affect offer probabilities through η_6 and η_8. As a majority of individuals in the sample do not move across states during the sample period, the permanent unobserved factors, $\mu^2 = [\mu_1^2, \mu_2^2]$, may further control for persistent *unobserved* differences in the marriage markets across states.[23]

3.4 Preferences

An individual receives utility at two points during a period. First, she receives utility associated with alternatives m_t, s_t, c_t, and e_t. Then, later in the period, if she becomes pregnant she receives utility based on the abortion decision made and her consumption of a composite good. A random preference shock for each combination of m_t, s_t, c_t, and e_t, denoted ϵ_t^{msce}, is known at the beginning of the period, while a shock for each abortion alternative, ϵ_t^a, is only realized after a pregnancy.

The following utility functions represent the individual's preferences within a period, where U_{msce} is flow utility associated with the alternatives $m_t = m$, $s_t = s$, $c_t = c$, and

[21]For example, if the level of offers decreases when abortion costs decrease then some individuals may be incentivized to increase sexual activity to increase offer probabilities from a now lower level. But at the same time, some individuals who would have had a high level of sexual activity may now no longer be willing to accept the same probability of pregnancy given a lower probability of receiving offers.

[22]In the simulations presented in 6.3 the level effects of abortion policy in the partner offer functions are fixed across all policy regimes so that only the interactions of sexual activity with policy create differences in the partner offer distributions across the regimes.

[23]67 percent of the sample remain in the same state for all years observed. Of the remaining 33 percent, 39 percent change states once and 37 percent change twice. Those who switch states appear to often move to neighboring states or states in the same region of the country, which may have similar unobserved differences in marriage markets.

$e_t = e$, and U_a is flow utility associated with the alternative $a_t = a$:

$$U_{msce} = \mathbf{X}_t^N \alpha_0 + \sum_{m=1}^{2} \mathbb{1}[m_t{=}m]\mathbf{X}_t^m \alpha_1 + \sum_{s=1}^{S} \mathbb{1}[s_t{=}s]\mathbf{X}_t^s \alpha_2 + \sum_{e=1}^{2} \mathbb{1}[e_t{=}e]\mathbf{X}_t^e \alpha_3 + \epsilon_t^{msce} \tag{3}$$

$$U_a = \frac{C_t^{1-\theta}}{1-\theta} + a_t(\alpha_4 + \alpha_5 R_t + \alpha_6 \mathbf{Z}_t + \alpha_7 PR_t + \alpha_8 CL_t + \mu^6) + B_t(\alpha_9 LB_t + \alpha_{10} LB_t^2) + \epsilon_t^a \tag{4}$$

The vector $\mathbf{X}_t^N$ contains number of children, number of children squared, and allows for preferences for children to vary with race. The other $\mathbf{X}$ vectors contain variables that shift the utility of marriage, sex, and employment. Specifically,

$$\mathbf{X}_t^m = [1,\ N_t,\ (1 - \mathbb{1}[m_{t-1} = m]),\ r_t,\ \mu_m^3]$$
$$\mathbf{X}_t^s = [1,\ \mathbb{1}[m_t = 0],\ \mathbb{1}[m_t = 1],\ \mathbb{1}[m_t = 0]R_t,\ \sum_{c=1}^{C} \mathbb{1}[c_t = c],\ \mu_s^4]$$
$$\mathbf{X}_t^e = [1,\ N_t,\ B_{t-1},\ \mathbb{1}[m_t = 0],\ \mathbb{1}[m_t = 1],\ \mu_e^5]$$

The parameters μ_m^3, μ_s^4, and μ_e^5 capture permanent unobserved heterogeneity in preferences for each of the m, s, and e alternatives.[24] The parameters in the vector α_1 capture the utility (disutility) of romantic partnerships and the complementarity of partnership with the number of children in the household.[25] To capture the initial fixed costs of cohabiting or becoming married an indicator of the current partnership is interacted with an indicator of not being in the same type of partnership in the prior period, following Keane and Wolpin (2010). The parameters in α_2 capture the marginal utility of sexual behavior and allow for the possibility that marginal utility of sex depends on partnership status and religiosity. The fifth element of $\mathbf{X_t^s}$ captures the utility (disutility) of contraceptive use.[26] The parameters in α_3 capture the utility (disutility) of work and school, and the complementarity of working and being in school with children and partnership.

In equation (4), C_t is a composite consumption good, PR_t is an indicator of a binding

[24] It is noted that the elements of the α vectors that multiply these permanent unobserved factors are 1. Alternatively, the permanent unobserved factors could be fixed across alternatives with different factor loadings for each alternative.

[25] With respect to partners, women in the model have preferences for the presence of a partner, the type of partner (married or cohabiting), and the amount of income that a partner earns (discussed below). Preferences for having a partner and partner type vary by characteristics of the woman and the jointly chosen sexual activity, contraceptive use, and employment/schooling alternatives.

[26] Recall that contraceptive use is a percentage of sexual encounters for which the individual uses contraception. Hence, the cost of contraception varies with level of sexual activity.

parental consent restriction, and CL_t is an indicator of a binding mandatory counseling and delay law. Recall that the competitive effect depends on heterogeneity in preferences and costs of obtaining abortion. The parameters in U_a capture how abortion and pregnancy impact period utility directly. The marginal utility of abortion is shifted by an individual's religiosity, age, the requirement of parental consent if less than 18 years old, and the requirement that an individual receive state mandated counseling and wait a state mandated amount of time before undergoing an abortion. The permanent unobserved factor μ^6 allows for unobserved heterogeneity in abortion preferences. If the individual becomes pregnant and chooses to give birth (i.e., $B_t = 1$), her utility from having a child depends on the amount of years that have passed since she last gave birth, LB_t and LB_t^2, which allows for preferences over child spacing.[27]

It is noted that without observations on the monetary and time costs of specific actions, such as marrying or attending school, monetary, time, and psychic (utility) costs are not separately identified. For this reason, some of the parameters that are included in the utility function capture two or three of these types of costs. For example, the coefficient on attending school includes effort and time costs.

3.5 Budget Constraint and Wages

Each period, the individual's consumption is constrained by her per-period budget constraint. The model ignores saving and borrowing. If the individual is employed, the constraint is

$$\begin{aligned} C_t =& w_t \mathbb{1}[m_t{=}0] + (w_t + y_t^2)\lambda_t^2 \mathbb{1}[m_t{=}2] + (w_t + y_t^1)\lambda_t^1 \mathbb{1}[m_t{=}1] + \lambda_t^Y Y_t \\ &- a_t[\gamma_0 + \gamma_1 H_t + \gamma_2 H_t PF_t] - \gamma_3 \mathbb{1}[e_t{=}1]\mathbb{1}[K_{1t}{\geq}12] - \gamma_4 N_t \end{aligned} \tag{5}$$

In the constraint, w_t is the woman's wage offer, y_t^2 is a married partner's wage, and y_t^1 is a cohabiting partner's wage. If the individual is not employed, then she does not receive w_t. λ_t^m for $m \in \{1, 2\}$ represents the share of household income that an individual consumes when married and cohabiting, respectively. Y_t is unearned family income and λ_t^Y is the share of unearned family income that the individual consumes. Unearned income includes child support, parental support, and government support. Recall that H_t is an indicator that the individual is eligible for Medicaid if she becomes pregnant. The monetary costs of abortion are captured by the estimated parameters γ_0, γ_1, and γ_2.[28] The parameter γ_0 represents the average monetary cost of abortion for those who are *not* eligible for Medicaid if pregnant;

[27]Preferences for spacing also arise in the model because giving birth affects wages in the next period, which is shown in the next subsection, and also affects the utility cost of attending school and working.

[28]As noted in the discussion of identification in subsection 5.2.1, if the price of abortion is not observed then the parameter γ_0 is not separately identified from the preference for abortion and must be fixed at a given value.

$\gamma_0 + \gamma_1$ represents the average cost for those who are eligible for Medicaid and live in a state without a restriction on Medicaid funding; $\gamma_0 + \gamma_1 + \gamma_2$ represents the average cost for those who are eligible for Medicaid, but live in a state that restricts Medicaid funding for abortion.[29] Finally, the parameter γ_3 captures tuition costs of higher education.

The distribution of wage offers, w_t, is modeled as follows:

$$\ln w_t = \delta_0^w + \delta_1^w \mathbf{K}_t + \delta_2^w K_{2,t}^2 + \delta_3^w \mathbf{K}_t r_t + \mu^7 + \nu_t^w \tag{6}$$

$$\nu_t^w \sim N(0, \sigma_w^2)$$

A partner's human capital is drawn from a distribution that is shifted by the woman's human capital, race, and age. Partner earnings are modeled as follows, where $m \in \{1, 2\}$:

$$\ln y_t^m = \delta_0^m + \delta_1^m \mathbf{K}_t + \delta_2^m K_{2,t}^2 + \delta_3^m \mathbf{K}_t r_t + \mu^8 + \nu_t^m \tag{7}$$

$$\nu_t^m \sim N(0, \sigma_m^2)$$

A common unobserved factor, μ^8, is included that affects both earnings from a cohabiting or a marital partner. There is an exogenous probability that a romantic partner does not work; hence, the earnings equations for marital and cohabiting partners are modeled using a Tobit framework. The share of household earnings that the woman consumes is restricted to be in the unit interval and takes the following form, for $m \in \{1, 2\}$:

$$\lambda_t^m = \frac{exp(\lambda_0^m + \lambda_1^m G_t^R + \lambda_2^m G_t^S)}{1 + exp(\lambda_0^m + \lambda_1^m G_t^R + \lambda_2^m G_t^S)} \tag{8}$$

The parameters on G_t^R and G_t^S allow for bargaining power within the relationship to depend on abortion policies and other characteristics of the market for partners. The competitive effect of abortion costs may also manifest as an effect on the bargaining power of women who are in partnerships.

Unearned income, Y_t, is modeled as an exogenous stochastic process that depends on an individual's decisions and state vector as follows:

$$\ln Y_t = \delta_0^Y + \sum_{i=1}^{2} \delta_i^Y \mathbb{1}[m_t = i] + \delta_3^Y \mathbb{1}[m_t = 0, N_t > 0] + \delta_4^Y \mathbf{Z}_t + \delta_5^Y N_t + \sum_{i=1}^{2} \delta_{i+5}^Y \mathbb{1}[e_t = i] + \nu_t^Y \tag{9}$$

[29]It is noted that Medicaid eligibility is not an indicator of Medicaid take-up in the case of pregnancy. However, Medicaid.gov reports that over 40 percent of births in the United States are financed by Medicaid. This suggests a high take-up rate as the percent of the population eligible for Medicaid during pregnancy based on the nationally representative sample in the NLSY is below 50 percent. Further, many abortion clinics inform their patients about the possibility of Medicaid funding.

$\nu_t^Y \sim N(0, \sigma_Y^2)$

The sharing equation λ_t^Y is in the form of equation (8), but consists of one parameter.[30]

3.6 The Optimization Problem

The individual's objective is to maximize her expected discounted lifetime utility. The model has a finite time horizon, with the last period, T, set at age 45.[31] In each period $t \leq T$, there are two points at which an individual could face a decision. First, consider an individual at the beginning of a period, making a decision over alternatives of m_t, s_t, c_t, and e_t. Let $V_{msce}(\cdot_t)$ represent the expected remaining lifetime utility associated with alternative $m_t = m$, $s_t = s$, $c_t = c$, and $e_t = e$ at time period t. That is, $V_{msce}(\cdot_t)$ is the expected sum of flow utilities from time period t to T for the current period alternatives $m_t = m$, $s_t = s$, $c_t = c$, and $e_t = e$, the individual's state vector, Ω_t, and permanent unobserved type μ. I refer to $V_{msce}(\cdot_t)$ as the alternative specific value function. $V_{msce}(\cdot_t)$ can be written recursively as the sum of contemporaneous utility and the expected future utility associated with that alternative:

$$\begin{aligned}
V_{msce}(\Omega_t, \epsilon_t^{msce}) &= \overline{U}_{msce} + \epsilon_t^{msce} \\
&+P(F_t = 0 \mid \Omega_t, d_t^{msce} = 1)\left(\frac{C_t^{1-\theta}}{1-\theta} + \beta \sum_{k=0}^{2} P(M_{t+1} = M^k | \Omega_t, d_t, \mu) V(\Omega_{t+1} | M_{t+1} = M^k)\right) \\
&+P(F_t = 1 \mid \Omega_t, d_t^{msce} = 1) \sum_{j=1}^{4} \rho_{m,j} W(\Omega_t | d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j}) \qquad (10)
\end{aligned}$$

The first line of equation (10) is the contemporaneous flow utility associated with the alternatives $m_t = m$, $s_t = s$, $c_t = c$, and $e_t = e$. The second line is expected future utility given that a pregnancy does not occur. β is the discount factor. $V(\Omega_{t+1}|M_{t+1} = M^k)$ is the expected maximal period $t+1$ value function among all possible alternatives given the updated state vector and set of partner alternatives, M_{t+1}.[32] The expectation is over future preference shocks and future earnings shocks. The third line is the expected future utility given that a pregnancy does occur. $W(\Omega_t|\cdot)$ is the expected maximum of the value function for abortion, W_1, and the value function for birth, W_0, which are described in detail in the

[30] As with partner earnings, a Tobit framework is used to model other income due to a mass of observations at zero.

[31] To close the model, at age 45 the individual is assumed to receive a remaining lifetime utility that is a flexible function of state variables at period T. Parameters of this function are estimated along with the other structural parameters.

[32] It is noted that the update from Ω_t to Ω_{t+1} is determined by the chosen alternatives and pregnancy outcome that occur during the period; this conditioning has been suppressed in the notation used throughout the paper.

following paragraph. The expectation is over the preference shock for abortion, ϵ_a. It is noted that $W(\Omega_t|\cdot)$ depends on the information about partner offers, Φ_t^m, that is revealed following pregnancy and so an individual must integrate over this distribution. Recall that $\rho_{m,j}$ is the probability that $\Phi_t^m = \Phi^{m,j}$.

Now, consider the problem facing an individual who realizes a pregnancy and must evaluate alternatives for abortion, a_t. Conditional on the alternatives selected at the beginning of the period as well as unobserved type μ and information Φ_t^m, the alternative specific value function for $a_t = a$ can be written as follows:

$$W_a(\Omega_t, \epsilon_t^a | d_t^{msce}{=}1, \Phi_t^m){=}\overline{U}_a + \epsilon_t^a + \beta \sum_{k=0}^{2} P(M_{t+1}{=}M^k | \Omega_t, d_t, \Phi_t^m) V(\Omega_{t+1} | M_{t+1}{=}M^k) \tag{11}$$

$\overline{U}_a + \epsilon_t^a$ is the contemporaneous flow utility associated with the decision $a_t = a$. Recall from equation (4) that $\frac{C_t^{1-\theta}}{1-\theta}$ enters $\overline{U}_a$. The remainder of equation (11) is expected future utility. To calculate expected future utility the individual integrates the expected maximal value at $t+1$, $V(\Omega_{t+1}|M_{t+1}{=}M^k)$, over the distribution of partner offer sets taking into account the draw of Φ_t^m that she observed upon becoming pregnant.

The expected maximal value functions, $V(\Omega_{t+1}|\cdot)$ and $W(\Omega_t|\cdot)$, can be written more explicitly as:

$$V(\Omega_{t+1}|M_{t+1} = M^k) = E[\max_{\substack{msce \\ m \in M^k}} V_{msce}(\Omega_{t+1}, \epsilon_{t+1}^{msce})] \tag{12}$$

$$W(\Omega_t | d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j}) = E[\max_a W_a(\Omega_t, \epsilon_t^a | d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j})] \tag{13}$$

The optimization problem can be solved using backward induction. Starting with the last period in which choices are made, period T, the individual can calculate the deterministic value function, $\overline{W}_a(\Omega_T|\cdot)$ for each combination of s_t, c_t, m_t, e_t, Φ_t^m and for each possible state, Ω_T. Using $\overline{W}_a(\Omega_T|\cdot)$, she is able to calculate $W(\Omega_T|\cdot)$, which can in turn be used to calculate the deterministic alternative specific value functions for combinations of s, c, m, and e, $\overline{V}_{msce}(\Omega_T|\cdot)$. Taking an expectation over preference shocks and pregnancy allows her to calculate $V(\Omega_T|M_T = M^k)$ for each possible Ω_T. The collection of $V(\Omega_T|M_T = M^k)$ allows her to calculate the continuation payoff for any combination of s, c, m, and e in period $T-1$ given any state Ω_{T-1}. Hence, she can make the same calculations for period $T-1$ and continue working backwards to the first period.

4 Data

The structural parameters of the model are estimated using data from the geocoded file of the National Longitudinal Survey of Youth's 1997 cohort (NLSY97). The NLSY97 is a nationally representative sample of approximately 9,000 individuals (including 4,385 women) who were between the ages of 12 and 18 at the beginning of 1997. These individuals have been interviewed on an annual basis since 1997. The most recent interview that is used in analysis was conducted in 2011, when the respondents were between the ages of 27 and 33. At each interview, respondents who are 15 years or older are asked in detail about current and past partnerships, pregnancy history and outcomes, sexual and contraceptive behavior, employment, own earnings and other sources of income. The final estimation sample includes 2,632 women and 38,002 woman-year observations. Over the sample period, these women report 3,820 pregnancies, excluding miscarriages, and 467 abortions. The data section of the online appendix discusses the estimation sample, provides a discussion of how the information in the NLSY97 is mapped to the variables used to estimate the structural model, and presents some relevant sample statistics.

To construct a history of abortion laws across states of residence, I use the "State Report Cards" produced by the National Abortion Rights Action League (NARAL) and cross check these with "State Policy in Brief" reports produced by the Guttmacher Institute.

I use two additional data sources to obtain information on a woman's county of residence. For a measure of supply of men, I use the United States Census Bureau's State and County Characteristics data. These data allow me to calculate for each year and county of residence estimates of the proportion of the unincarcerated population that is men within 4 age ranges: 15 to 19 years old, 20 to 24 years, 25 to 29 years old, and 30 to 34 years old. I also calculate the proportion of men in each age range separately for whites, blacks, and Hispanics due to the degree of homophily observed in the market for partners. Both of these sex ratios are included in $\mathbf{G_t^S}$. I use the United States Census Bureau's County Business Patterns series to construct a measure of the religiosity of the population that lives in an individual's county of residence. The County Business Patterns data include economic information on religious organizations in each county in the United States.[33] As a measure of the intensity of religiosity within a county, I calculate the inflation-adjusted, per-capita amount of dollars of payroll paid by religious organizations within that county.[34]

[33] A religious organization is defined as either (1) establishments primarily engaged in operating religious organizations, such as churches, religious temples, and monasteries, or (2) establishments primarily engaged in administering an organized religion or promoting religious activities.

[34] The County Business Patterns data provides the total payroll for religious organizations within each county. I divide this payroll by the population of the county and use the Consumer Price Index to adjust for inflation.

4.1 Underreporting of Abortion

Ventura et al. (2012) provide statistics on pregnancy rates, birth rates, miscarriage rates, and abortion rates for 1990 through 2008. Importantly, these rates are broken into categories by year, age group, and race. Birth rates are determined using birth certificates for all births in the United States. Miscarriage rates are constructed using data collected by the National Survey of Family Growth on fertility histories. The abortion data are a combination of CDC Abortion Surveillance data and the Guttmacher Institute's data from surveys of abortion providers, with the rate reported by the CDC adjusted to those reported by the Guttmacher Institute. Table 1 compares the abortion rate in my estimation sample with national rates by year, age, and race. As discussed in subsection 5.1.4, observing consistent estimates of population rates of pregnancy, birth, miscarriage, and abortion allows me to calculate misreporting probabilities and adjust the likelihood function for underreporting of abortion during estimation.

4.2 Motivation for the Mechanisms of Interest

This subsection presents motivation from the data for each of the mechanisms. The purpose of the following exercises is to provide evidence that there is sufficient variation in the data to identify each of the channels being modeled. Some of the information presented in this subsection is based on correlations in the data and may not be evidence of causal relationships. The sample used for this analysis includes all observations in the NLSY97 that are not a part of the oversample of black and Hispanic individuals and for which all relevant information is reported.

4.2.1 The Insurance Effect

As noted in section 2, multiple studies have used variation in state-level abortion policy to identify the aggregate effects of these policies on pregnancy or sexual behavior and many of the results support the existence of an insurance effect. I use a similar strategy to estimate the effects of three abortion restrictions— parental consent laws (PR_{ist}), Medicaid funding restrictions (PF_{ist}), and mandatory counseling and delay laws (CL_{ist})— on risky sexual behavior. Both the insurance effect and the competitive effect predict that abortion policy will influence sexual behavior. Hence, if both are relevant, a reduced form estimate of the relationship between policy and sexual behavior will combine the two effects. However, because the existence of an insurance effect is a necessary condition for the existence of a competitive effect and the two effects are predicted to impact sexual activity in the same direction, a test of the null hypothesis that policy has no effect on sexual behavior serves as a test for the non-existence of an insurance effect.

Difference-in-differences models of the following form are estimated:

$$y_{ist} = \alpha_0 + \alpha_1 \mathbb{1}[A_{ist} < 18] + \alpha_2 \mathbb{1}[H_{ist} = 1] + \alpha_3 \mathbf{G}^R_{ist} + \alpha_4 \mathbf{X}_{ist} + \lambda_s + \gamma_t + \epsilon_{ist} \tag{14}$$

where y_{ist} is number of times an individual reports having unprotected sex, λ_s is a state fixed effect and γ_t is a time fixed effect.[35] Given the panel nature of the data, random effects regressions are estimated to correct the standard errors for within-individual correlation in ϵ_{ist}. $\mathbf{G^R_{ist}}$ is a vector of the three policy variables, PR_{ist}, PF_{ist}, and CL_{ist}, which are indicators of *binding* restrictions. Indicators of being under 18 years, $\mathbb{1}[A_{ist} < 18]$, and being Medicaid eligible, $\mathbb{1}[H_{ist} = 1]$, are included as regressors so that the control group for minors only consists of other minors and the control group for those eligible for Medicaid only consists of others who are eligible. $\mathbf{X}_{ist}$ includes other control variables that are time-varying and that may be correlated with both the abortion policy in an individual's state of residence and the outcomes of interest.[36] Because policy variation is at the state-level, the primary concern for identification is the presence of differential trends in time-varying unobservables across states that are correlated with both the timing of changes in abortion policy and sexual behavior within a state.

Table 2 presents the results from this analysis. The first two columns, labeled "Unprotected Sex 1," report results from random effects regressions, while the second two columns, labeled "Unprotected Sex 2," report results from random effects Tobit models that take into account the mass of individuals who are sexually active but never have *unprotected* sex. Public funding restrictions and mandatory counseling laws are associated with significantly lower quantities of unprotected sex across the specifications. The effects of parental consent laws on quantity of unprotected sexual activity are not significant.[37]

4.2.2 The Price Effect

The price effect suggests that higher abortion costs will decrease a woman's probability of choosing abortion given a pregnancy. The left side of Table 3 reports results from a linear

[35] The model can be written in the standard form of a difference-in-differences model as the policy variables— PR_{ist}, PF_{ist}, and CL_{ist}— can be rewritten as an interaction of an indicator of being in the affected group and an indicator of the time periods when the policy is in effect. The state fixed effects, λ_s, control for time-invariant differences across treatment and control groups, while time fixed effects, γ_t control for time-varying unobservables that are common across groups.

[36] Specifically, $\mathbf{X}_{ist}$ includes a measure of the individual's religiosity, the county sex ratio and county religiosity measures discussed above, and a state-specific linear time trend.

[37] The results in Table 2 are from the sample of sexually active individuals who report having sex fewer than 365 times in a year. Regressions including women who are not sexually active produce qualitatively similar results, with the same signs and significance but smaller magnitudes. Results are sensitive to whether or not the sample includes outliers who report having sex more than 365 times. I have estimated a variety of models that account for outliers in different ways, the results of which are available upon request.

probability model of the abortion decision estimated on the sample of pregnant women who are single or cohabiting.[38] The model controls for religiosity, R_t, and for a third degree polynomial of unprotected sex, which allows me to compare women who chose similar probabilities of becoming pregnant.[39] In addition to the variables listed in the table, the model controls for a flexible function of state variables and income:

$$a_t = \beta_0 + \sum_{j=1}^{3} \beta_j (UPSI_t)^j + \beta_4 \mathbb{1}[m_t = 1] + \sum_{e=0}^{1} \beta_5^e \mathbb{1}[e_t{=}e] + \beta_6 \mathbf{D}_t + \beta_7 \mathbf{D}_t^2 + \beta_8 m_{t-1} + \beta_9 N_t + \beta_{10} B_{t-1} + \beta_{11} \mathbf{K}_t + \beta_{12} R_t + \beta_{13} A_t + \beta_{14} (A_t)^2 + \beta_{15} r_t + \beta_{16} \mathbf{G}_t^R + \beta_{17} \mathbf{G}_t^S + \beta_{18} w_t + \beta_{19} y_t^m + \mu + \nu_t^a \tag{15}$$

The results in Table 3 indicate that facing public funding restrictions, counseling and delay laws, and parental consent laws are all negatively correlated with the probability that a pregnant woman reports having an abortion. The results also show that, all else being equal, both higher religiosity, R_t, and higher levels of unprotected sex are associated with a lower probability of reporting abortion.

4.2.3 The Information Effect

Suppose that there are two groups of *observably identical* women who both become pregnant but make different abortion decisions. Further suppose that the group who chose abortion are more likely to be single following the pregnancy, while those who chose birth are more likely to be in a partnership. This covariation could either be due to variation in unobservables that were known by the women prior to pregnancy, or due to unobservables that were only realized by the women after becoming pregnant. For the information effect to have the effect on births described above, it must be the case that there is information that is only realized after a pregnancy occurs. Examples of potential confounders include unobserved information about partner opportunities that were known prior to pregnancy or unobserved preferences for abortion that are correlated with unobserved preferences for partnership.[40] By observing women before, during, and after pregnancy I am able to separate those unobservables that are known prior to becoming pregnant from those that are realized during pregnancy. In

[38] Because abortion policies also impact the distribution of women who become pregnant (i.e. who is selected into the sample), jointly modeling sexual and contraceptive behavior with the abortion decision is necessary for estimating a pure price effect. Further, the linear probability model ignores underreporting of abortion. The restriction to single or cohabiting women is made because this model is also used to develop evidence for the information effect, but estimations on the full sample provide similar results with the same sign and higher levels of significance.

[39] Models controlling for discretized levels of sexual activity show similar results.

[40] In the structural model, permanent unobserved preferences for abortion and partnership are included in equations (3) and (4) and are estimated as discussed in subsection 5.1.2. Hence, this potential confounder is explicitly accounted for when estimating the structural model.

particular, anything that impacts the abortion decision that women know and consider prior to pregnancy, even if unobserved to the econometrician, will affect the probability of pregnancy that these women choose. Hence, in addition to conditioning on the state vector, it is important to condition on sexual and contraceptive behavior.[41]

To examine this variation in a reduced form setting, I first estimate a random effects linear probability model of abortion, detailed in equation (15) above. The model is estimated on the sample of pregnant women who are either single or cohabiting. The time-varying component of the residual, $\hat{\nu}_t^a$, is calculated for each of these women. Because abortion is a binary variable, those women with a positive residual are almost exclusively those who had an abortion, and those with a negative residual are those who did not have an abortion.[42] Large positive residuals are those individuals who the model predicts to give birth, but instead are observed choosing abortion. Large negative residuals are those who the model predicts to choose abortion, but instead give birth.

The residuals from the linear probability model of abortion are included as a covariate in a multinomial logit model for partnership outcomes that includes all of the variables included in equation (2).[43] The right side of Table 3 shows the results from the multinomial logit on partnership. The base category is single, so the coefficients are interpreted as the effect of the residual on the probability of cohabitation (or marriage) relative to being single. In the first multinomial logit ("Multionomial Logit 1"), the negative coefficients on the residual for both marriage and cohabitation suggest that larger residuals make individuals less likely to be cohabiting or married relative to being single. This result suggests that women who the model predicts to give birth but instead choose to abort are more likely to be single in the next period, and/or those women who the model predicts to abort but instead give birth are more likely to be cohabiting or married in the next period. Given the discussion above, the result suggests that some women realize upon becoming pregnant that they are *unlikely* to be in a partnership, which makes abortion relatively more attractive, while some women realize that they are *more* likely to be in a partnership, which makes birth relatively more attractive.

As an extension, "Multinomial Logit 2" interacts the residual from the linear probability

[41] It is possible that time-varying shocks other than "partner signals," such as a health shock, could be realized after pregnancy that impact both the abortion decision and the partnership outcome following pregnancy. These shocks will not be separated from what I refer to as a partnership signal, but could result in the same impacts on births and single parenthood when abortion policy changes.

[42] The residual for those who had an abortion is one minus the predicted probability of abortion, and for those who gave birth it is zero minus the predicted probability of abortion.

[43] In addition to conditioning on unprotected sex in the linear probability model for abortion, it is essential to condition on an indicator of birth and an indicator of abortion in the partnership model to separate the effects of information from the effects of abortion or birth.

model of abortion with an indicator of cohabitation to examine whether the effects differ for cohabiting women and single women. The level effect of the residual represents the impact for single women, and the sum of the level and interaction terms represents the impact for cohabiting women. The results show that both single and cohabiting women may learn information about the future probability of cohabitation upon becoming pregnant, with the effect being larger for cohabiting women. However, these estimates are not significant. For future marriage probabilities, the significant interaction term and insignificant level term suggest that some cohabiting women learn that they are more likely to be married upon becoming pregnant, but there is not evidence that this is true for single women.

4.2.4 The Competitive Effect

If the competitive effect is relevant, then the relationship between sexual activity and partner offers should be such that women in states with low abortion costs have a greater incentive to increase sexual activity than those in states with high costs. If the derivative of offer probabilities with respect to sexual activity are decreasing in abortion costs this would be suggestive that such a relationship exists. I present correlational evidence that this may be true by estimating a multinomial logit on partnership outcomes and comparing the average predicted probabilities of marriage and cohabitation across levels of sexual activity and by whether or not each type of restriction is present.

The multinomial logit model is of the form presented in equation (2), with additional controls for state and year fixed effects and with sexual activity discretized into five levels.[44] Using the parameters from the multinomial logit, I calculate predictive margins for the probability of next period marriage and cohabitation across levels of sexual activity both with and without each type of abortion restriction.[45] Tables 4a, 4b, and 4c show the results for public funding restrictions, mandatory counseling laws, and parental consent laws, respectively. In addition to the predictive margins at each level of sex with and and without the restriction, the tables show the percent change in the predictive margins of moving from each level of sexual activity to any higher level of sexual activity. If the percent changes in predicted offer probabilities from increasing sex are greater when conditioning on there being no restriction (the bottom-panels of the table), this could be suggestive of a competitive effect. Considering Table 4a, public funding restrictions appear in most cases to be associated with an

[44]The results from the multinomial logit are not presented here to preserve space, but are available upon request. The five levels of sexual activity are: (1) abstinence, (2) at least once, but less than once every four weeks, (3) at least once every four weeks, but less than every two weeks, (4) at least every two weeks, but less than every week, and (5) every week or more. These categories account for 31, 12, 8, 14, and 35 percent of observations, respectively.

[45]The predictive margins are the average of predicted probabilities across all individuals in the sample fixing sexual activity and a given abortion restriction at chosen values.

increase in the slope of partnership probabilities, which is inconsistent with a competitive effect. However, Tables 4b and 4c show similar patterns for mandatory counseling laws and parental consent laws that are consistent with the possibility of a competitive effect. Both tables indicate that moving from abstinence to any higher level of sex is associated with a greater increase in cohabitation probabilities when abortion costs are lower and that moving to the highest level of sexual activity from any lower level is associated with a greater increase in marriage probabilities when abortion costs are lower.

5 Estimation and Identification

5.1 Estimation

The structural parameters of the dynamic model are estimated using a nested algorithm. In an inner algorithm, backwards recursion is used to solve the model at a given set of parameters. The outer algorithm uses the model solution to calculate the likelihood function (see below) and updates the parameters using the Berndt-Hall-Hall-Hausman (BHHH) algorithm. There are 236 parameters to be estimated, excluding permanent unobserved factors: 38 preference parameters, 14 parameters in the latent variable for pregnancy, 45 parameters in both the marriage offer function and the cohabitation offer function, 54 parameters describing women's earnings, partner earnings, household income sharing, and the budget constraint, 22 parameters that define the distribution of partnership signals following pregnancy, 8 parameters from the model closing equation, and the relative risk aversion parameter.

5.1.1 Value Function Approximation

Solving the model requires calculating the expected maximal value functions, given by equations (12) and (13), for each time period t and for each element of the state space that an individual can possibly reach by t. In period T, there are over 50 million elements in the state space. Hence, I use the interpolation method introduced by Keane and Wolpin (1994). With this method, starting with period T, I randomly draw 1,000 elements of the state space for that period. The expected maximal value functions are calculated for each of these 1,000 states and are regressed on second order polynomials of the state variables. Using the estimated coefficients from the linear regression I am able to predict the expected future maximal value associated with any element of the state space for period $T-1$. I repeat the interpolation regression for period $T-1$ and continue to work backwards through time.

As detailed in subsection 3.5, the woman's wage offers, her partner's earnings, and unearned income are drawn from a log-normal distribution. Wage offers and other income variables for a period are assumed to be known by the individual when she makes her decision at the beginning of the period. However, to calculate expected future value functions it is necessary to take an expectation over future shocks in these equations. This expectation involves a quadruple integral over four independent, normal distributions. The integral is simulated using a Halton sequence to obtain 50 draws for each of the wage, partner income, and unearned income error distributions in each time period for each individual.

In addition to calculating the value function for each time period, an assumption must be made regarding the continuation value following period T. As is common in the literature, I use a linear function of the individual's state variables to approximate the terminal value. The parameters in this closing function are estimated jointly with the other parameters in the model.

5.1.2 Permanent Unobserved Heterogeneity

Unobserved heterogeneity is incorporated in the model using a finite mixture distribution (Heckman and Singer, 1984; Mroz, 1999). This method assumes that the population of women takes on Z unobserved types and type $z \in \{1, ..., Z\}$ is drawn from an unobserved discrete distribution. In estimation, each vector of discrete factors $\mu_z = \{\mu_z^1, ..., \mu_z^8\}$ is estimated for each type z, excluding one type for which the discrete factors are normalized to 0. The probabilities of an individual being each type, π_z, are also estimated.

5.1.3 The Likelihood Function

In each time period, an individual's contribution to the likelihood function includes her choice probabilities, the probability of her observed pregnancy outcome, the probability of her observed wage if working, the probability of her husband's (partner's) observed wage if married (cohabiting), and the probability of observing her level of unearned income.

Time-varying preference shocks ϵ_t^{msce} and ϵ_t^a are assumed to be distributed Type 1 Extreme Value. It is noted that the inclusion of permanent unobserved heterogeneity in the utility function allows for non-i.i.d. unobservables across alternatives and time.[46] Hence, the restrictive assumption of independence of irrelevant alternatives (IIA) is unnecessary here. Under the assumption that ϵ_t^{msce} and ϵ_t^a are Type I Extreme Value, equations (12) and (13) take the following closed form (leaving implicit the integration over own and partner wage

[46] Within an individual, unobserved preferences will be correlated over time due to the permanent unobserved preferences. Also, within an individual, there will be correlation in unobserved preferences across alternatives; for example, any alternative of $msce$ that includes $m = 2$ will provide unobserved utility of $\mu_{2,z}^3$. Further, the distribution of permanent unobserved heterogeneity could, for example, reveal that those types that are estimated to have a high unobserved preference for sexual activity are more likely to have a high unobserved preference for cohabitation.

shocks):

$$V(\Omega_{t+1}|M_{t+1} = M^k) = \gamma + \log\left(\sum_{m \in M^k} \sum_{sce} exp(\overline{V}_{msce}(\Omega_{t+1}))\right) \tag{16}$$

$$W(\Omega_t|d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j}) = \gamma + \log\left(\sum_a exp\left(\overline{W}_a(\Omega_t|d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j})\right)\right) \tag{17}$$

where γ is Euler's constant. The assumption of Type 1 Extreme Value and additively separable preference shocks also yields the following conditional choice probabilities:

$$P(d_t^{msce} = 1|\Omega_t, M_t = M^k) = \frac{exp(\overline{V}_{msce}(\Omega_t))}{\sum\limits_{s'c'e'} \sum\limits_{m' \in M^k} exp(\overline{V}_{m's'c'e'}(\Omega_t))} \tag{18}$$

$$P(a_t = 1|\Omega_t, \Phi_t^m = \Phi^{m,j}, F_t = 1) = \frac{exp(\overline{W}_1(\Omega_t|d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j})}{\sum\limits_{a=0}^{1} exp(\overline{W}_a(\Omega_t|d_t^{msce} = 1, \Phi_t^m = \Phi^{m,j}))} \tag{19}$$

These conditional probabilities can not be computed directly. Since signal mass points, Φ_t^m, are unobserved, the conditional probability of choosing abortion must be integrated over the distribution of Φ_t^m. For those individuals who are observed to be single, the partner offer set is unknown, which requires the probability of choosing any combination of $m_t = 0$, $s_t = s$, $c_t = c$, and $e_t = e$ to be integrated over the distribution of partner offer sets. Also, because it is assumed that an individual observes a wage offer each period, as well as the wages of potential partners from whom she holds partner offers, the choice probabilities must be integrated over unobserved wages for those who are not working and over unobserved husband (partner) wages when the partner offer set includes marriage (cohabitation), but the individual does not accept the offer. The integration over unobserved wages and partner wages is simulated using a Halton sequence to obtain 50 draws from the respective distribution per time period.

The following choice probabilities are used to construct the likelihood contribution of an individual, leaving implicit the integration over unobserved wages and partner wages:

$$P(d_t^{0sce} = 1|\Omega_t) = \sum_{k=0}^{2} P(M_t = M^k) P(d_t^{0sce} = 1|\Omega_t, M_t = M^k) \tag{20}$$

$$P(d_t^{1sce} = 1 \ \cap \ M_t = M^1 \ |\Omega_t) = P(d_t^{1sce} = 1|\Omega_t, M_t = M^1) P(M_t = M^1) \tag{21}$$

$$P(d_t^{2sce} = 1 \ \cap \ M_t = M^2 \ |\Omega_t) = P(d_t^{2sce} = 1|\Omega_t, M_t = M^2) P(M_t = M^2) \tag{22}$$

$$P(a_t = 1|\Omega_t, F_t = 1) = \sum_{j=1}^{4} \rho_j P(a_t = 1|\Omega_t, \Phi_t^m = \Phi^{m,j}, F_t = 1) \tag{23}$$

The first probability enters the likelihood for those individuals who are observed to be single, the second for those observed to be cohabiting, and the third for those observed to be married. For those who were not pregnant in the prior period, the unconditional offer set probability, $P(M_t = M^k)$, can be calculated directly. For those individuals who were pregnant in the prior period, and either single or cohabiting, the offer set probability, $P(M_t = M^k)$, is calculated as $\sum_{j=1}^{4} \rho_{m,j} P(M_t = M^k|\Phi_t^m = \Phi^{m,j})$ because these individuals observed a draw from the distribution of Φ_t^m during pregnancy.

Hence, for individual i, in time period t, the likelihood contribution at a set of parameters Θ is:[47]

$$\begin{aligned} L_{i,t}(\Theta|\mu) = \Bigg(\prod_{s=0}^{2} \prod_{c=0}^{2} \prod_{e=0}^{2} & P(d_t^{0sce} = 1)^{d_t^{0sce}} P(d_t^{1sce} = 1 \ \cap \ M_t = M^1 \ )^{d_t^{1sce}} \\ & P(d_t^{2sce} = 1 \ \cap \ M_t = M^2 \ )^{d_t^{2sce}} \Bigg) f_w(w_t)^{\mathbb{1}[e_t=2]} f_{y1}(y_t^1)^{\mathbb{1}[m_t=1]} f_{y2}(y_t^2)^{\mathbb{1}[m_t=2]} f_Y(Y_t) \\ & P(F_t = 1, a_t = 1)^{F_t a_t} P(F_t = 1, a_t = 0)^{F_t(1-a_t)} P(F_t = 0, a_t = 0)^{(1-F_t)(1-a_t)} \end{aligned} \tag{24}$$

The following subsection discusses how the joint probabilities of observed pregnancy ($F_t = f \in \{0, 1\}$) and abortion ($a_t = a \in \{0, 1\}$) enter the likelihood function in such a way to correct for underreporting of abortion in the sample.

The full likelihood contribution for individual i conditional on μ is:

$$L_i(\Theta|\mu) = \prod_{t=1}^{T_i} L_{i,t}(\Theta|\mu) \tag{25}$$

[47] Conditioning variables are implicit on the right-hand side of the likelihood function. The individual's likelihood contribution conditional on unobserved type is shown to make explicit the integration over unobserved types that occurs when calculating the likelihood function.

Hence, the unconditional likelihood contribution for individual i is:

$$L_i(\Theta) = \sum_{z=1}^{Z} \pi_z L_i(\Theta|\mu_z) \tag{26}$$

5.1.4 Correcting for Underreporting of Abortion

In any given period, an individual in the sample reports a pregnancy, abortion, miscarriage, and birth outcome. Table 5 outlines my assumptions for the possible set of true outcomes associated with each of the combinations of reported outcomes. I assume that if an individual reports a birth or abortion that this was the true outcome. For those who report no pregnancy or a miscarriage, it is possible that they are not reporting an abortion that truly occurred. As discussed below, a potentially strong assumption is that individuals do not systematically underreport miscarriages that they are aware of.

Let F_t and a_t represent the reported pregnancy and abortion outcomes and F_t^* and a_t^* represent the true pregnancy and abortion outcomes. The model is solved for $P(a_t^* = 1|F_t^* = 1)$ and $P(F_t^* = 1)$ because the parameters that one would like to estimate are those representing the true abortion choice probability and pregnancy probability. However, the likelihood function is constructed using the probability of observing reported F_t and a_t. For example, $P(F_t = 0, a_t = 0)$, which enters the likelihood function, is not the same as $P(F_t^* = 0, a_t^* = 0)$. The joint probabilities that enter the likelihood function can be rewritten as:

$$\begin{aligned} P(F_t = f, a_t = a) = {} & P(F_t = f, a_t = a|F_t^* = 1, a_t^* = 1)P(F_t^* = 1, a_t^* = 1) + \\ & P(F_t = f, a_t = a|F_t^* = 1, a_t^* = 0)P(F_t^* = 1, a_t^* = 0) + \\ & P(F_t = f, a_t = a|F_t^* = 0, a_t^* = 0)P(F_t^* = 0, a_t^* = 0) \end{aligned} \tag{27}$$

As noted, it is assumed that individuals report an abortion or birth only if one actually occurred. Hence, some of the above conditional probabilities, for example $P(F_t = 1, a_t = 1|F_t^* = 1, a_t^* = 0)$ and $P(F_t = 1, a_t = 1|F_t^* = 0, a_t^* = 0)$, are assumed to equal zero.

Considering Table 5, if one is able to calculate the proportion of the sample (or any observable group) that is included in each of A, B, C, D, E, and F, then one is able to identify the misreporting probabilities in the above equations. For example, an estimator for the probability of reporting no pregnancy given that an abortion occurred, $P(F_t = 0, a_t = 0|F_t^* = 1, a_t^* = 1)$, is $B/(B+D+F)$. For each of the four combinations of reported outcomes, I am able to observe the proportion in the sample (or observable group) that reports that combination. Hence, I observe $A + B$, C, D, and $E + F$. From the Ventura et al. (2012) report I also observe estimates of $P(F_t^* = 1)$, $P(a_t^* = 1)$, and $P(mi_t^* = 1)$ and it is known that $P(F_t^* = 1) = B + C + D + E + F$, $P(a_t^* = 1) = B + D + F$, and $P(mi_t^* = 1) = E$. It is noted that if I allowed for individuals to systematically report no pregnancy when they experienced a miscarriage there would not be enough information to solve the system. Hence, I allow for the possibility of overreporting miscarriage (due to misreporting abortions as miscarriages), but do not attempt to correct for underreporting of miscarriage.[48]

To correct for underreporting of abortion during estimation, the above conditional probabilities are estimated outside of the maximum likelihood procedure for age groups 15-17, 18-19, 20-24, 25-29, and 30-34, for each year and race.[49] These estimated conditional probabilities are then used to calculate equation (27) which enters the likelihood function as the joint probability of observing $F_t = f$ and $a_t = a$. This procedure will provide consistent estimates for the model parameters if the estimates of the conditional probabilities are consistent and an individual's probability of misreporting abortion varies by year, age group, and race, but is otherwise independent of her characteristics. The second assumption is strong, but is necessary due to a lack of information on pregnancy rates, abortion rates, and miscarriage rates that breakdown the rates by year, age, race, *and* other characteristics (e.g., religiosity).

The strategy used to correct for classification error is similar to papers that estimate multinomial logit models and assume that a consistent estimate of the misclassification probability can be calculated using an exogenous source.[50] Hausman et al. (1998) note that using this strategy raises two concerns: (1) if the assumed misclassification probabilities are not consistent estimators of the the true misclassification probabilities then parameter estimates are likely to be inconsistent, and (2) the Fisher information matrix is nonstandard, which leads to understated standard errors of the estimates if no correction is performed.[51]

[48]The primary concern in making this assumption is that an observed underreporting of pregnancy due to underreporting of miscarriage could be attributed to underreporting of abortion. To mitigate this concern, when I solve the system, I use the greater of the observed $E + F$ (reported miscarriages) and the estimated true miscarriage rate from Ventura et al. (2012). This prevents underreporting of miscarriages from being attributed to underreporting of abortion.

[49]Race categories are black, Hispanic, and non-black, non-Hispanic. Ventura et al. (2012) breaks the population rates into year, age and race categories. However, because this breakdown is only available through 2008, the rates for 2008 are used to calculate the estimates for 2009, 2010, and 2011.

[50]A notable example is Poterba and Summers (1995), who correct for misclassification of labor market status in the Current Population Survey using a second survey that serves as validation data.

[51]Bootstrapping the standard errors for this paper would be prohibitively time consuming. However, it may be possible to analytically derive the non-standard Fisher information matrix that results from using the correction.

5.2 Identification

5.2.1 Preference Parameters

The parameters in the utility functions, equations (3) and (4), are identified by the optimization framework and the observed behavior of individuals across the state space. For example, the parameters in the vector α_3 are identified by variation in employment and schooling choices and how the popularity of these choices varies with number of children, birth in the prior period, and the jointly chosen partnership status. The preference parameters in α_1 and α_2 are identified in a similar manner. The preference parameters in U_a are identified using variation in abortion choices by *pregnant* women in different parts of the state space.

5.2.2 Wage and Budget Constraint Parameters

Parameters determining the distribution of wage offers and partner's income are identified by covariation in observed incomes and work experience and schooling. The model accounts for selection into working by modeling the employment decision, with the joint probability of working and observing the individual's wage entering the likelihood function.[52] The partner's employment decision is not modeled; hence, the identified partner's wage distribution is equivalent to the distribution of accepted wages.

The parameters in the income sharing function can be identified by covariation in employment and marital decisions. However, this variation also identifies the complementarity of work and partnership in the utility function. Hence, the constant in the sharing equation, λ_0^m, is only identified by the nonlinearity of the sharing equation.

The parameters representing the pecuniary cost of abortion, γ_0, γ_1, and γ_2, can not all be separately identified from the base utility cost of abortion, α_4. Hence, γ_0, the average cost of abortion for individuals who are not Medicaid eligible is fixed at \$500.

5.2.3 Partner Offers and the Distribution of Partnership Information

Partner offers are not observed. For those who are observed to be single it is unknown whether they received an offer and rejected it, or did not receive an offer. To identify the parameters in the partner offer equations (represented by equation (2)) there must be an observable characteristic that shifts the probability of receiving an offer, but not the expected

[52] The model assumes many exclusions restrictions that affect the decision to work but do not directly impact the wage offer distribution. For example, number of children impacts the decision to work, but does not affect productivity directly. Of course, number of children and other exclusions may affect wages indirectly through their dynamic impact on the accumulation of human capital.

utility of accepting an offer through another channel.[53] For example, the supply of men in an individual's age range and county of residence affects the probability of receiving an offer, but not the probability of accepting an offer except through effects on future offer probabilities. Hence, any changes in observed partnership rates that are correlated with supply of men are attributed to the parameter on supply of men in the offer function.

To see the intuition for why such exclusion restrictions provide identification, consider the likelihood contribution of an individual who is observed to be unmarried and not cohabiting. This individual's contribution from her choice of $m_t = 0$, $s_t = s$, $c_t = c$, and $e_t = e$ is:

$$P(d_t^{0sce} = 1|\cdot) = \sum_{k=0}^{2} P(M_t = M^k) P(d_t^{0sce} = 1|\cdot, M_t = M^k)$$

Suppose one is interested in the effect of an abortion policy on the probability of receiving a marriage offer, $P(M_t = M^2)$. If it is observed that marriage rates are negatively correlated with the abortion policy, it could be that the policy decreases $P(M_t = M^2)$ or increases $P(d_t^{0sce} = 1|\cdot, M_t = M^2)$, the probability of choosing to reject an offer that was received. Now, suppose a valid exclusion restriction exists that affects $P(M_t = M^2)$, but not $P(d_t^{0sce} = 1|\Omega_t, \mu, M_t = M^2)$ directly. Consider two groups of individuals who are observably identical except for having different values of the excluded variable. The difference in the excluded variable results in the two groups holding a different amount of marriage offers. In the case where the abortion policy affects only offer probabilities, then the change in marriage rates should be the same for the two groups.[54] However, if the change in policy increases $P(d_t^{0sce} = 1|\cdot, M_t = M^2)$, the probability of rejecting a marriage offer, then there should be a greater impact on marriage rates for the group of individuals that holds more offers. Therefore, changes in the covariation between abortion policy and the marriage rate across the distribution of the exclusion restriction provide information about how much of the covariation is due to effects on the expected utility of partnership relative to effects on the probability of receiving an offer.[55]

The identification of the distribution of partnership signals, Φ^m, follows from jointly

[53] A characteristic that affected the flow utility of partnership but not the offer probability would serve the same purpose.

[54] At corners, where the offer probability reaches either 0 or 1, there could be differential effects.

[55] French and Taber (2011) prove that in the classical labor search model, where job offers are not observed, an exclusion restriction that enters the probability of receiving offers, but does not enter the expected utility from accepting an offer identifies the arrival rate of offers. A very similar identification strategy is also utilized in the literature on consideration sets, where the products that an individual considers are not observed. Ching (2009) uses price as an exclusion restriction that affects the probability of purchase given that a product is considered, but not the probability of considering the product, to identify the parameters in both probabilities.

modeling fertility, partnership and abortion decisions and the panel nature of the data. Recall that these signals represent information that is not known prior to pregnancy about a partner's commitment to a relationship in the next period and is only realized after a pregnancy occurs. The data include women who have the same state vector and behave in the same way at the beginning of the period. This behavior suggests that these women are willing to take the same risk of becoming pregnant and given that they have the same state vector are expected to make the same abortion decision given a pregnancy. However, some of these women are observed to abort and some observed to not abort the pregnancy. Based on the model, this variation could be explained by either the preference shock for abortion or by the information about partner offers that the women learned after becoming pregnant.[56] However, the preference shock for abortion does not also have an effect on the likelihood of being in a partnership in the next period. Hence, identification stems from observably identical women who choose the same probability of pregnancy but make different abortion decisions and variation in partnership status for these women in the period following pregnancy. In the likelihood function, when a pregnancy occurs in period t, the signal distribution affects both $P(a_t = 1|\cdot)$ in period t *and* $P(M_{t+1} = M^i)$ for $i \in \{1, 2\}$ in period $t + 1$.

6 Results and Policy Simulations

Note: The current results are preliminary and parameter estimates are sensitive to starting values. The parameters presented here are those that result in the highest value of the likelihood function that I have found up to this point.

The goal of this section is threefold. First, I present and discuss the parameter estimates in light of the mechanisms of interest. Next, I give evidence that the estimated model is able to adequately represent the underlying data generating process by which observed fertility and partnership outcomes and transitions are determined. Finally, I present the model's predictions for the impacts of removing abortion restrictions on behavior and outcomes over the life-cycle and decompose the impacts into the mechanisms of interest. I end the section with a summary of the findings and reconcile the results to the effects of abortion policy found in the literature.

[56] Since behavior was the same at the beginning of the period, the variation in abortion decisions for these women is not due to unobserved information about partner commitment that was known at the time of the sex and contraception decision. Otherwise, those who expected to have an abortion would be expected to choose lower probabilities of becoming pregnant on average (assuming that abortion is costly). This also separates the signal distribution from the known and non-random effect of birth on partnership probabilities.

6.1 Parameter Estimates

The top panel of Table 6a presents preference parameters associated with partnership, sex, contraception, and school/employment alternatives. Women receive positive flow utility from moderate and high levels of sexual activity, but this utility decreases with contraceptive use. The combination of a positive flow utility from sexual activity and disutility from contraceptive use allows for the possibility that some women accept a positive probability of pregnancy even if the realization of pregnancy would lower lifetime utility.[57] Flow utility from children depends on a woman's current partnership type, with the utility from children being highest for married women and lowest for single women. Children and recent births make employment and school attendance less attractive. Hence, children impact earnings both in the current period and over the life-cycle via impacts on human capital.

The bottom two panels of Table 6a present the utility parameters associated with abortion alternatives and budget constraint parameters, which are the parameters in the model that could result in a price effect. The parameters in U_1 on parental consent laws and mandatory counseling and delay laws are negative, indicating that these restrictions make abortion less attractive. In the budget constraint, Medicaid-eligible individuals who live in a state without a public funding restriction are estimated to pay negative 57 dollars for an abortion, whereas Medicaid-eligibile individuals who live in a state with a public funding restriction are estimated to pay 570 dollars.[58] Hence, the estimates are consistent with the possibility of a price effect for all three types of restrictions. Across the types of restrictions, the utility costs associated with a binding parental consent law are the highest. The utility costs of public funding restrictions depend on an individual's level of consumption due to curvature in the utility function. Given the estimated CRRA parameter of 0.99, the negative utility costs associated with a mandatory counseling law are equivalent to the utility costs of a public funding restriction for those with family income at roughly the 33rd percentile of the income distribution for Medicaid eligible individuals.[59]

Table 6b presents the parameters that represent the partner offer distribution. Interactions of sexual activity, partnership status, and abortion policies allow for the possibility of a competitive effect as described in subsections 3.3 and 4.2.4. Using the estimated partner offer distribution I am able to simulate offers across levels of sexual activity, partnership

[57]That is, women may experience unintended pregnancies, where an unintended pregnancy is defined as any pregnancy that decreases lifetime utility relative to the counterfactual of not becoming pregnant at all.

[58]The average cost of abortion for individuals who are not Medicaid eligible is normalized to $500 in estimation.

[59]Hence, the utility costs of public funding restrictions are higher than the costs associated with mandatory counseling laws for about one third of the affected population and lower for about two thirds of the affected population. The size of a price effect will also depend on the number of women in each affected group who are close to the margin.

status, and abortion policies.[60] Such simulations indicate that the slope of marriage offer probabilities with respect to sexual activity *increases* when mandatory counseling laws are removed. Hence, some women may be incentivized to increase sexual activity when mandatory counseling laws are removed. The simulations also indicate that the removal of parental consent laws substantially *increases* the slope of cohabitation offers with respect to sexual activity, while the slope of marriage offer probabilities decreases to a much smaller degree.[61] Again, this suggests that it is possible that the removal of parental consent laws could result in some young women increasing sexual behavior in order to improve the probability of having a partner. Finally, with respect to public funding restrictions, the simulations indicate that the slope of marriage probabilities *decreases* when public funding restrictions are removed. Hence, it is unlikely that public funding restrictions impact the market for partners in a way that is consistent with the existence of a competitive effect. These results are consistent with those found in the exercise in subsection 4.2.4.

Finally, Table 6c shows the distribution of partnership information that is revealed to single and cohabiting women who become pregnant. For both single and cohabiting women, there are four possible draws from the discrete distribution of partner information that can be realized, which are labeled Outcome 1 through Outcome 4. The distribution for single women, suggests that in most cases a single woman will either realize that she is less likely to receive a marriage offer in the next period (Outcome 1) or is less likely to receive a cohabitation offer (Outcomes 2 and 3). Negative shocks to offer probabilities such as these will not lead to an information effect if the lifetime utility associated with giving birth is higher when partnership offers are available. However, 18 percent of single women who become pregnant realize a draw such that the probability of marriage increase by 20 percent. The distribution of partnership information for cohabiting women has two outcomes (Outcome 3 and 4) at which a woman realizes that either a cohabitation offer (23 percent of the time) or a marriage offer (34 percent of the time) is much more likely, while the probability of the other is lower. Depending on the relative values of marriage or cohabitation for a woman, either of these shocks could result in births via the information effect. The possibility that the information effect is more relevant for cohabiting women is supported by the results in subsection 4.2.3.

[60] A detailed analysis of these simulations are not presented in the paper to preserve space, but more detailed information is available upon request.

[61] Cohabitation is likely the relevant partnership for which women around the age of 18 are competing given the proportion of young women who are cohabiting relative to married.

6.2 Model Fit

Tables 7 and 8 show how well the model is able to match selected features of the data. The simulated data is for 10 sets of 2,632 women whose exogenous characteristics match those observed in the sample. Table 7 shows observed and simulated partnership and fertility decisions and outcomes over the life-cycle, while Table 8 shows observed and simulated partnership transitions from one period to the next. The model does reasonably well at matching the life-cycle patterns of cohabitation and marriage, accumulation of children, and single and unwed births seen in the sample. The model does overpredict marriage and underpredict cohabitation at young ages. The bottom panel of Table 7 indicates that the underreporting correction is allowing the model to match *population* pregnancy rates and abortion choices. Finally, Table 8 suggests that the model is able to match partnership transition probabilities well, with the exception that the model overpredicts the probability of transiting from marriage to being single, particularly at young ages.

6.3 Policy Simulations

In this subsection I analyze the impacts of state-level abortion restrictions on single parenthood over the life-cycle. For each restriction on abortion, I forward simulate behavior and outcomes under two policy regimes. The first regime is one in which all women face the restriction at every age. In the second regime, women do not face the restriction at any age. I will refer to these as the high cost and low cost regimes, respectively. The simulated data is first used to consider the total effect of moving from a high cost regime to a low cost regime on the percent of women who have children and are not married at each age. Next, I examine the relevance of each of the mechanisms across the policy types, which provides insight into the channels that are driving the total effects.

6.3.1 Total Effects on Unwed Parenthood

Figures 1, 2, and 3 show the percent of women at each age who are unwed mothers and the percent who are unwed and give birth in both the high and low cost regimes for each policy type.[62] The percentages shown in the figures are reported in Tables 9 and 10, along with the difference between the high and low cost regimes. Figure 1 shows that when public funding restrictions are removed unwed motherhood decreases. Initially the difference in unwed motherhood between the high and low cost regimes increases with age, but then decreases such that by age 30 there is little difference between the two regimes. The figure also

[62]Changes in both of these outcomes— the percent of women who are unwed and have positive children and the percent of women who are unwed and give birth— could be a result of a combination of changes to partnership rates, the percent of pregnancies aborted, the pregnancy rate itself, and/or birth rates.

shows that when public funding restrictions are removed fewer women are both unwed and give birth. In contrast to public funding restrictions, Figure 2 indicates that the removal of mandatory counseling and delay laws increases unwed motherhood and the percent of women who are unmarried and give birth. However, the effects on unwed motherhood do not compound over the life-cycle and are smaller in absolute magnitude than the effects of public funding restrictions. Finally, Figure 3 indicates that parental consent laws initially increase unwed motherhood, but the effect diminishes with age and there is little effect by age 26. The removal of parental consent laws appears to decrease unwed births both for those under 18 who are directly affected by the law and continues to decrease unwed births through age 21. The following subsections explore the mechanisms behind the effects shown in these three figures.

6.3.2 Price and Insurance Effects

Figures 4 and 5 show for each age the percent of pregnancies aborted and the percent of women who experience a pregnancy in both the high and low cost regimes for each policy type. To separate pregnancies that occur via the insurance effect from those that occur via the competitive effect, the comparisons in these figures are between the standard high cost regime and a low cost regime in which partner offer probabilities are set to the level they would take in the high cost regime.[63]

The graphs presenting the abortion ratio in Figure 4 show that the removal of public funding laws increase the percent of pregnancies aborted by roughly 5 percentage points at most ages. The removal of mandatory counseling laws exhibits a similar, but slightly smaller, impact on the abortion ratio. Finally, the removal of parental consent laws increases the percent of pregnancies aborted among minors by slightly more than 10 percentage points. Hence, the impact on the abortion ratio for the affected group is largest for parental consent laws, which is consistent with the flow utility costs associated with the restrictions.[64] Not presented in the figure are the difference in total abortion rates between the high and low cost regimes. Averaging over all ages from 16 to 30, the high cost regime decreases the annual abortion rate by 0.7 abortions per 100 women for public funding restrictions (a 15.5 percent decline) and 0.8 abortions per 100 women for mandatory counseling and delay laws (a 17.4 percent decline). The high cost regime for parental consent laws is associated with

[63]After fixing offer probabilities, the only way in which abortion restrictions impact behavior is through effects on the flow utility costs of abortion (and changes in the state vector over the life that result from the change in the flow utility).

[64]These changes in the abortion ratio are driven both by more women becoming pregnant who choose abortion and by some who were pregnant in both regimes but switch from giving birth to aborting. The latter accounts for 46 percent of the change in the abortion ratio for public funding restrictions, 69 percent of the change for mandatory counseling laws, and essentially all of the change for parental consent laws.

an average reduction of 0.6 abortions per 100 women (a 22 percent decline) for 16 and 17 year olds and a reduction of 0.1 (a 2.7 percent decline) over all ages.

The result that the price effects are similar for public funding restrictions and mandatory counseling laws, while at the same time these two types of restrictions have opposite total effects on unwed motherhood, suggests that the other mechanisms have a larger offsetting effect for mandatory counseling laws.

Figure 5 indicates that the removal of both public funding restrictions and mandatory counseling and delay laws results in an increase in pregnancies. Averaging over all ages from 16 to 30, the high cost regime decreases the occurrence of pregnancy by 0.8 percentage points (5.4 percent) for public funding laws and 0.9 percentage points (6.4 percent) for mandatory counseling and delay laws. For parental consent laws, there is no effect on the pregnancy rate for minors when considering women in all partnership types. After age 17, when the parental consent laws are no longer binding, individuals experience more pregnancies in the high cost regime. When focusing on single individuals, the pregnancy rate does slightly increase for minors when parental consent laws are removed.[65] The finding that parental consent laws have little effect on the average pregnancy rate for all minors appears to be stemming from more individuals choosing to accept offers of cohabitation and marriage at younger ages in the high cost regime.[66] These changes in partnership state also explain the impacts on the pregnancy rate and abortion ratio after age 17 when parental consent laws are no longer binding. Overall, these results are consistent with those found in the difference-in-differences model from subsection 4.2.1.

6.3.3 Information Effects

For the information effect to increase a woman's probability of giving birth, she must be uncertain whether or not she would abort a pregnancy under both the high and low cost regimes.[67] Hence, to isolate the information effect, it is necessary to identify women who switch from no pregnancy to becoming pregnant, would abort a pregnancy given some but not all draws of Φ_t^m, and ultimately realize one of the draws of Φ_t^m such that birth is optimal. An individual's abortion choice under every possible realization of Φ_t^m can not be obtained using a typical simulation because a draw is only realized if a pregnancy occurs and when a pregnancy does occur only one draw is realized. However, it is possible to calculate the

[65] Graphs of the pregnancy rate for single individuals for public funding restrictions and mandatory counseling laws show a similar pattern to those shown for all individuals, with the difference between the two regimes being slightly larger.

[66] The increase in partnership in the high cost regime is driven by both an increase in births to young women and an increase in the value of partnership when abortion costs are high.

[67] Refer to the comparative statics section of the online appendix for a simple model that illustrates why the probability of giving birth only increases for this group of women.

value functions associated with each of the counterfactual draws of Φ_t^m, and thus determine the abortion choice that would have been made for each possible realization. Hence, I am able to identify women who meet the above criteria.

Table 11 shows the percent of women at each age who give birth as a result of the information effect when moving from a high cost to a low cost regime for each type of policy. Consistent with the evidence in subsection 4.2.3 and the estimated distribution of partnership information, the model predicts a larger information effect for women who are cohabiting than those who are single. At some ages, 0.75 percent or more of cohabiting women experience a birth as a result of the information effect. Recall that these births are to women who realize that they are more likely to partner in the next period and, therefore, a higher percentage of information effect births are to women who are cohabiting or married in the next period relative to the cohabitation and marriage rates for all women with a given state vector.

6.3.4 Competitive Effects

To quantify the importance of the competitive effect, I first separate changes in sexual activity that occur because of the competitive effect from changes in sexual activity that occur because of other mechanisms in the model. This exercise involves three steps. First, I simulate each woman's change in sexual activity at each age when policy moves from the high cost to the low cost regime. This change in sexual activity could arise due to multiple factors, including both the insurance effect and the competitive effect, as well as changes in the woman's state that occur by a given age due to the policy change. Second, I simulate the change in sexual activity that occurs when policy moves from a high cost regime to a low cost regime where offer probabilities are fixed at the level they would take if the competitive effect entered as in the high cost regime. This change in sexual activity will include all of the factors affecting sexual activity from the first step except for the competitive effect. Third, I take the difference in these differences to isolate those individuals who increase sexual activity due to the competitive effect. After identifying those women who increase sexual activity due to the competitive effect, I must determine how many of these women are on the margin and become pregnant due to this change in sexual activity. Hence, I identify the women in this group who do not become pregnant in either the high cost regime *or* the low cost regime where partner offer probabilities are fixed as above, but do become pregnant in the low cost regime where the competitive effect is allowed to change offer probabilities.

Because the parameters in the partner offer distribution are not restricted in any way, the model allows for the possibility that a decrease in abortion costs could influence the partner offer distribution in such a way that some women decrease sexual activity. Table 12 shows the percent of women at each age who give birth outside of a partnership as a result of the competitive effect minus the percent of women who no longer become pregnant as a result and would have given birth had a pregnancy occurred. The model predicts that the impact of public funding laws on the market for partners has little impact on behavior, with the competitive effect resulting in fewer births at some ages and more births at some ages. In contrast, mandatory counseling and delay laws impact the partner offer distribution in such a way that more single and cohabiting women become pregnant and give birth. At some ages, as many as 1 percent of single women in the low cost regime give birth as a result of the competitive effect. For parental consent laws, the competitive effect results in additional births for cohabiting minors, but not for single minors. The effects for cohabiting women are large, with as many as 1.6 percent of cohabiting women giving birth as a result of the competitive effect; however, only 2 percent of all 15 to 17 year old women in the estimation sample are cohabiting.

6.3.5 Dynamic Selection Effects

Finally, I consider the possibility that women who experience a birth as a result of the information or competitive effect are more or less likely to spend time as a single parent in the future than comparable women who give birth at the same age and have the same next period partnership status. Table 13 shows that, at most ages, those women who experience births as a result of the information effect and are cohabiting in the following period spend less time through age 30 as a single parent than the average woman who gives birth and is cohabiting in the next period. This suggests that additional births that occur as a result of the information effect could increase the total number of children, but are not likely to increase the proportion of total children who are in single parent homes. With respect to the competitive effect, Table 13 indicates that women who give birth as a result of the competitive effect at an age younger than 23 are more likely to remain single into the future than the average woman who gives birth at the same age and is single in the next period.

6.4 Summary of the Results

In summary, I find that the removal of public funding restrictions would decrease unwed parenthood because the price effect is significant and is not offset by a competitive effect. Some additional births occur as a result of the information effect, but these births are to women who are more likely to be partnered over the life-course. In contrast, the removal of mandatory counseling and delay laws is predicted to increase unwed motherhood. Although the price effect is similar in magnitude to that from public funding restrictions, the competitive effect is significant and results in additional births to single women. The difference in competitive effects for public funding restrictions and mandatory counseling laws is consistent with the finding that the insurance effect is larger in magnitude for mandatory counseling laws, as measured by both the pregnancy rate and sexual activity. If population levels of sexual activity are shifted to a greater degree by mandatory counseling laws, this supports that the associated competitive effect may be larger.[68] Finally, the removal of parental consent laws is predicted to decrease unwed motherhood at young ages, which is driven by a relatively large price effect. The removal of parental consent laws is predicted to result in some births to cohabiting women as a result of the competitive effect, but the percent of minors who are cohabiting is small so that this has little effect on population averages.

6.5 Reconciling the Results with Existing Evidence

Coming soon.

7 Conclusion

Coming soon.

8 References

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[68]The difference-in-differences model discussed in subsection 4.2.4 provides additional evidence that mandatory counseling laws have a larger impact on individuals' risky sexual behavior.

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A Tables

Table 1: Underreporting of Abortion in the Sample
Abortion rates by race, age, and year[a].
Reference: Subsection 4.1

White

	Sample				Ventura et al. (2012) [b]			
	15-17	18-19	20-24	25-29	15-17	18-19	20-24	25-29
1998	7.2	4.7	—	—	10.7	26.3	—	—
2000	6.9	14.8	9.4	—	8.5	24.1	26.3	—
2002	—	17.3	9.3	—	—	21.0	23.4	—
2004	—	—	12.8	—	—	—	22.4	—
2006	—	—	8.2	12.5	—	—	22.9	15.3
2008	—	—	17.2	10.6	—	—	22.5	15.3
2010	—	—	—	5.4	—	—	—	15.3

Black

	Sample				Ventura et al. (2012) [b]			
	15-17	18-19	20-24	25-29	15-17	18-19	20-24	25-29
1998	13.2	13.7	—	—	38.0	89.4	—	—
2000	24.5	17.8	27.4	—	37.3	86.8	120.2	—
2002	—	9.2	28.1	—	—	78.1	108.8	—
2004	—	—	19.9	—	—	—	100.6	—
2006	—	—	16.8	10.8	—	—	100.4	85.1
2008	—	—	41.4	15.4	—	—	97.7	80.1
2010	—	—	—	14.8	—	—	—	80.1

Hispanic

	Sample				Ventura et al. (2012) [b]			
	15-17	18-19	20-24	25-29	15-17	18-19	20-24	25-29
1998	13.0	11.5	—	—	21.5	51.6	—	—
2000	4.5	21.1	—	—	18.4	47.3	—	—
2002	—	4.5	15.4	—	—	43.3	56.6	—
2004	—	—	3.7	—	—	—	52.8	—
2006	—	—	14.2	0.0	—	—	50.6	37.9
2008	—	—	9.0	13.8	—	—	46.4	34.0
2010	—	—	—	17.4	—	—	—	34.0

Note: For brevity, the statistics are reported only for even years. The statistics for odd years show a similar level of underreporting. Statistics for each year are used when correcting for underreporting in the sample. The statistics reported in Ventura et al (2012) are only through 2008. Hence, for 2010, the national statistics for 2008 are listed. The CDC's reported abortion rate declines slightly between 2008 and 2011.

[a] The abortion rate is the number of abortions per 1000 women.

[b] The report by Ventura et al (2012) is discussed in subsection 4.1. It provides estimates of the national abortion rate by year, age, and race using data collected by both the Center for Disease Control and the Guttmacher Institute.

Table 2: Motivation for the Insurance Effect.
Reference: Subsection 4.2

	Unprotected Sex 1 Full Sample N=23,297		Unprotected Sex 1 Single N=13,373		Unprotected Sex 2 Full Sample N=23,297		Unprotected Sex 2 Single N=13,373	
PF_{ist}	-3.823*	(1.990)	-6.092***	(2.036)	-7.712***	(2.964)	-5.613**	(2.992)
CL_{ist}	-9.933***	(3.611)	-7.833*	(4.062)	-8.985**	(5.845)	-8.652***	(3.222)
PR_{ist}	-2.209	(3.567)	-1.246	(3.063)	1.371	(4.761)	2.610	(4.729)

Notes: See subsection 4.2 for a discussion of the models estimated, and specification tests that were performed. Standard errors are in parentheses. The models were estimated on the sample of individuals who are sexually active and report having sex fewer than 365 times. Quantity of unprotected sex is the dependent variable. The two columns labeled "Unprotected Sex 1" report results from random effects regressions, while those labeled "Unprotected Sex 2" report random effects tobit models that account for the mass of sexually active individuals who always use contraception.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

Table 3: Motivation for the Information and Price Effects.
Reference: Subsection 4.2

	Random Effects LPM $P(a_t = 1 \mid F_t = 1)$			Multinomial Logit 1			
				Cohabiting$_{t+1}$		Married$_{t+1}$	
	Coef.	S.E.		Coef.	S.E.	Coef.	S.E.
UPSI†	-0.001**	(0.000)	$\hat{\nu}_{it}^{a}$ ††	-2.165***	(0.567)	-0.765*	(0.450)
(UPSI)^2	0.000	(0.000)					
(UPSI)^3	0.000	(0.000)		Multinomial Logit 2			
Age	0.018	(0.034)		Cohabiting$_{t+1}$		Married$_{t+1}$	
(Age)^2	-0.001	(0.001)	$\hat{\nu}_{it}^{a}$	-1.290	(0.823)	0.479	(0.582)
PF_t	-0.071***	(0.020)	$\hat{\nu}_{it}^{a} \times \mathbb{1}[m=1]$	-0.942	(0.949)	-1.967***	(0.545)
CL_t	-0.049**	(0.019)					
PR_t	-0.099**	(0.049)					
R_t	-0.015***	(0.005)					

Notes: See subsection 4.2 for a full description of the results presented in this table and their interpretation. The linear probability model for abortion is estimated on the sample of pregnant women who are single or cohabiting, which consists of 2,015 observations. The multinomial logit models are estimated on the full sample, which consists of 35,647 observations.

† UPSI stands for the total number of times an individual reports engaging in unprotected sexual intercourse.

†† $\hat{\nu}_{it}^{a}$ is the residual from the linear probability model of abortion.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

Table 4a: Predictive Margins from a Multinomial Logit of Partnership Outcomes
Probabilities of Cohabitation and Marriage by Level of Sex and Abortion Policy

	Predictive Margins for Cohabitation in $t+1$					**Predictive Margins for Marriage in $t+1$**				
	Conditional on Public Funding Being Restricted									
Sex	P($m_{t+1}=1$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	P($m_{t+1}=2$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.107	—	—	—	—	0.161	—	—	—	—
2	0.127	18.69	—	—	—	0.160	-0.62	—	—	—
3	0.140	30.84	10.24	—	—	0.172	6.83	7.50	—	—
4	0.170	58.88	33.86	21.43	—	0.194	20.50	21.25	12.79	—
5	0.200	86.92	57.48	42.86	17.65	0.203	26.09	26.88	18.02	4.64
	Conditional on Public Funding *Not* Being Restricted									
Sex	P($m_{t+1}=1$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	P($m_{t+1}=2$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.116	—	—	—	—	0.140	—	—	—	—
2	0.146	25.86	—	—	—	0.129	-7.86	—	—	—
3	0.159	37.07	8.90	—	—	0.141	0.71	9.30	—	—
4	0.182	56.90	24.66	14.47	—	0.156	11.43	20.93	10.64	—
5	0.211	81.90	44.52	32.70	15.93	0.173	23.57	34.11	22.70	10.90

Notes: Please refer to subsection 4.2.4 for a discussion of the calculations presented in this table. Sex is discretized into five mutually exclusive levels: 1— abstinence, 2— greater than zero, but less than once every four weeks, 3— greater than once every four weeks, but less than every two weeks, 4—greater than every two weeks, but less than every week, and 5— every week or more. P($m_{t+1}=1$) and P($m_{t+1}=2$) refer to the average predicted probability of cohabitation and marriage conditional on the level of sexual activity and on the restriction either being in place (top panel) or not being in place (bottom panel). "%Δ Sex=1" is the percent change in P($m_{t+1}=1$) or P($m_{t+1}=2$) when moving from abstinence to a given level of sexual activity; similar columns are defined likewise.

Table 4b: Predictive Margins from a Multinomial Logit of Partnership Outcomes
Probabilities of Cohabitation and Marriage by Level of Sex and Abortion Policy

	Predictive Margins for Cohabitation in $t+1$					**Predictive Margins for Marriage in $t+1$**				
	Conditional on Presence of Mandatory Counseling and Delay Law									
Sex	P($m_{t+1}=1$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	P($m_{t+1}=2$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.118	—	—	—	—	0.189	—	—	—	—
2	0.130	10.17	—	—	—	0.181	-4.23	—	—	—
3	0.150	27.12	15.38	—	—	0.199	5.29	9.94	—	—
4	0.181	53.39	39.23	20.67	—	0.225	19.04	24.31	13.07	—
5	0.212	79.66	63.08	41.33	17.13	0.230	21.69	27.07	15.58	2.22
	Conditional on *No* Mandatory Counseling and Delay Law									
Sex	P($m_{t+1}=1$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	P($m_{t+1}=2$)	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.104	—	—	—	—	0.124	—	—	—	—
2	0.138	32.69	—	—	—	0.121	-2.42	—	—	—
3	0.145	39.42	5.07	—	—	0.128	3.22	5.79	—	—
4	0.169	62.50	22.46	16.55	—	0.143	15.32	18.18	11.72	—
5	0.198	90.38	43.48	36.55	17.16	0.161	29.84	33.06	25.78	12.59

Notes: Please refer to subsection 4.2.4 for a discussion of the calculations presented in this table. Sex is discretized into five mutually exclusive levels: 1— abstinence, 2— greater than zero, but less than once every four weeks, 3— greater than once every four weeks, but less than every two weeks, 4—greater than every two weeks, but less than every week, and 5— every week or more. P($m_{t+1}=1$) and P($m_{t+1}=2$) refer to the average predicted probability of cohabitation and marriage conditional on the level of sexual activity and on the restriction either being in place (top panel) or not being in place (bottom panel). "%Δ Sex=1" is the percent change in P($m_{t+1}=1$) or P($m_{t+1}=2$) when moving from abstinence to a given level of sexual activity; similar columns are defined likewise.

Table 4c: Predictive Margins from a Multinomial Logit of Partnership Outcomes

Probabilities of Cohabitation and Marriage by Level of Sex and Abortion Policy

	Predictive Margins for Cohabitation in $t+1$					**Predictive Margins for Marriage in $t+1$**				
	Conditional on Presence of Parental Consent Law									
Sex	$P(m_{t+1}=1)$	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	$P(m_{t+1}=2)$	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.073	—	—	—	—	0.106	—	—	—	—
2	0.111	52.05	—	—	—	0.130	22.64	—	—	—
3	0.142	94.52	27.93	—	—	0.168	58.49	29.23	—	—
4	0.188	157.53	69.37	32.39	—	0.225	112.26	73.08	33.93	—
5	0.232	217.81	109.01	63.38	23.40	0.278	162.26	113.85	65.48	23.56
	Conditional on *No* Parental Consent Law									
Sex	$P(m_{t+1}=1)$	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4	$P(m_{t+1}=2)$	%Δ Sex=1	%Δ Sex=2	%Δ Sex=3	%Δ Sex=4
1	0.059	—	—	—	—	0.067	—	—	—	—
2	0.109	84.75	—	—	—	0.079	17.91	—	—	—
3	0.130	120.34	19.27	—	—	0.090	34.33	13.92	—	—
4	0.171	189.83	56.88	31.54	—	0.128	91.04	62.03	42.22	—
5	0.220	272.88	101.83	69.23	28.65	0.180	168.66	127.85	100.00	40.63

Notes: Please refer to subsection 4.2.4 for a discussion of the calculations presented in this table. Sex is discretized into five mutually exclusive levels: 1— abstinence, 2— greater than zero, but less than once every four weeks, 3— greater than once every four weeks, but less than every two weeks, 4—greater than every two weeks, but less than every week, and 5— every week or more. $P(m_{t+1}=1)$ and $P(m_{t+1}=2)$ refer to the average predicted probability of cohabitation and marriage conditional on the level of sexual activity and on the restriction either being in place (top panel) or not being in place (bottom panel). "%Δ Sex=1" is the percent change in $P(m_{t+1}=1)$ or $P(m_{t+1}=2)$ when moving from abstinence to a given level of sexual activity; similar columns are defined likewise.

Table 5: Fertility Reporting
Reference: Subsection 5.1.4

Reported Outcomes				True Outcomes				
F_t	a_t	mi_t	B_t	F_t^*	a_t^*	mi_t^*	B_t^*	Label[a]
0	0	0	0	0	0	0	0	A
				1	1	0	0	B
1	0	0	1	1	0	0	1	C
1	1	0	0	1	1	0	0	D
1	0	1	0	1	0	1	0	E
				1	1	0	0	F

Note: There are four possible combinations of pregnancy, abortion, miscarriage, and birth that an individual can report. This table details the true values of these outcomes that could be associated with each of the possible reported combinations. The reported pregnancy outcome is denoted F_t, while the truth is F_t^*, and likewise for the other outcomes: abortion, a_t and a_t^*, miscarriage, mi_t and mi_t^*, and birth, B_t and B_t^*.
[a] The labels A, B, C, D, E, and F are used to refer to the possible reporting outcomes. For example, B represents the possibility that no pregnancy is reported, but the true (unobserved) outcome is a pregnancy and abortion.

Table 6a: Parameter Estimates

Preferences and Constraints. Reference: Section 6

Parameters in $\mathbf{U_{msce}}$

Children			Partnership			Sexual Activity			Work/School		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.		Coef.	S.E.
N_t	-0.100	(0.000)	$\mathbb{1}[m_t = 1]$	-0.399	(0.018)	$\mathbb{1}[s_t = 1]$	1.292	(0.020)	$\mathbb{1}[e_t = 1]$	2.409	(0.017)
$(N_t)^2$	0.000	(0.000)	$'' \times N_t$	0.177	(0.009)	$'' \times \mathbb{1}[m_t = 0]$	-0.786	(0.029)	$'' \times N_t$	-1.929	(0.014)
			$'' \times (1 - \mathbb{1}[m_{t-1}=1])$	-0.944	(0.033)	$'' \times \mathbb{1}[m_t = 1]$	0.251	(0.009)	$'' \times B_{t-1}$	-0.609	(0.021)
			$\mathbb{1}[m_t = 2]$	0.936	(0.038)	$'' \times \mathbb{1}[m_t = 1]R_t$	-0.117	(0.004)	$'' \times \mathbb{1}[m_t = 0]$	0.230	(0.007)
			$'' \times N_t$	0.355	(0.013)	$'' \times \mathbb{1}[m_t = 2]R_t$	0.021	(0.001)	$'' \times \mathbb{1}[m_t = 1]$	0.068	(0.002)
			$'' \times (1 - \mathbb{1}[m_{t-1}=2])$	-9.894	(0.278)	$'' \times \mathbb{1}[c_t = 1]$	-0.512	(0.020)	$\mathbb{1}[e_t = 2]$	1.495	(0.015)
						$'' \times \mathbb{1}[c_t = 2]$	-0.398	(0.014)	$'' \times N_t$	-0.487	(0.007)
						$\mathbb{1}[s_t = 2]$	0.425	(0.015)	$'' \times B_{t-1}$	-0.415	(0.016)
						$'' \times \mathbb{1}[m_t = 0]$	-0.574	(0.021)	$'' \times \mathbb{1}[m_t = 0]$	-0.090	(0.003)
						$'' \times \mathbb{1}[m_t = 1]$	0.639	(0.025)	$'' \times \mathbb{1}[m_t = 1]$	-0.020	(0.001)
						$'' \times \mathbb{1}[m_t = 1]R_t$	-0.160	(0.007)			
						$'' \times \mathbb{1}[m_t = 2]R_t$	0.009	(0.003)			
						$'' \times \mathbb{1}[c_t = 1]$	-0.135	(0.006)			
						$'' \times \mathbb{1}[c_t = 2]$	0.040	(0.002)			

Parameters in $\mathbf{U_a}$

U_1			U_0		
	Coef.	S.E.		Coef.	S.E.
Cons.	-12.500	(0.219)	LB_t	-0.278	(0.009)
R_t	-0.403	(0.032)	LB_t^2	-0.020	(0.001)
A_t	0.374	(0.020)			
$(A_t)^2$	-0.001	(0.001)			
PR_t	-0.511	(0.064)			
CL_t	-0.163	(0.017)			

Parameters in the Budget Constraint

Cost of Abortion			College Tuition			CRRA Parameter		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.
Cons.	500*	—	$\mathbb{1}[e_t{=}1]\mathbb{1}[K_{1t}{\geq}12]$	3,501	126.465	σ	0.999	(0.000)
H_t	-557	8.084			—			—
H_tPF_t	627	25.860			—			—

Table 6b: Parameter Estimates

Partner Offer Latent Variables. Reference: Section 6

Parameters in Marriage Offer Latent Variable, $\mathbf{M^{2*}_{t+1}}$

Current partnership & sexual activity, and interactions with policy						Other Exogenous†			Other Endogenous		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.		Coef.	S.E.
$\mathbb{1}[s_t=0, m_t=0]$	-4.692	(0.040)	$\mathbb{1}[s_t=0, m_t=1]$	-3.542	(0.036)	Sex Ratio 1	1.805	(0.033)	$D_{1,t}$	0.099	(0.004)
$'' \times PF_t$	-0.304	(0.010)	$'' \times PF_t$	-0.034	(0.001)	Sex Ratio 2	-0.133	(0.006)	$D_{2,t}$	0.011	(0.000)
$'' \times CL_t$	0.300	(0.011)	$'' \times CL_t$	0.778	(0.026)	County Relig.	-0.090	(0.004)	$D_{0,t}$	-0.163	(0.006)
$'' \times PR_t$	0.278	(0.011)	$'' \times PR_t$	-0.904	(0.034)	$'' \times R_t$	0.018	(0.000)	N_t	-0.043	(0.002)
$\mathbb{1}[s_t=1, m_t=0]$	-4.849	(0.042)	$\mathbb{1}[s_t=1, m_t=1]$	-2.306	(0.048)	R_t	0.124	(0.003)	$'' \times \mathbb{1}[m_t=0]$	-0.012	(0.001)
$'' \times PF_t$	0.402	(0.017)	$'' \times PF_t$	0.282	(0.008)	$A_t/100$	-13.51	(0.659)	$'' \times \mathbb{1}[m_t=1]$	-0.174	(0.006)
$'' \times CL_t$	-0.116	(0.007)	$'' \times CL_t$	-0.035	(0.001)	$(A_t)^2/100$	0.683	(0.024)	$K_{1,t}/100$	-0.000	(0.000)
$'' \times PR_t$	-0.068	(0.003)	$'' \times PR_t$	0.343	(0.014)	r^1_t	-0.771	(0.020)	B_t	0.958	(0.013)
$\mathbb{1}[s_t=2, m_t=0]$	-5.657	(0.046)	$\mathbb{1}[s_t=2, m_t=1]$	-1.876	(0.044)	r^2_t	-0.049	(0.002)	a_t	-0.470	(0.020)
$'' \times PF_t$	0.731	(0.030)	$'' \times PF_t$	-0.014	(0.001)	PF_t	-0.136	(0.006)			
$'' \times CL_t$	-0.186	(0.009)	$'' \times CL_t$	-0.205	(0.011)	CL_t	0.357	(0.011)			
$'' \times PR_t$	0.066	(0.003)	$'' \times PR_t$	0.531	(0.020)	PR_t	-0.046	(0.002)			

Parameters in Cohabitation Offer Latent Variable, $\mathbf{M^{1*}_{t+1}}$

Current partnership & sexual activity, and interactions with policy						Other Exogenous†			Other Endogenous		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.		Coef.	S.E.
$\mathbb{1}[s_t=0, m_t=0]$	-0.887	(0.027)	$\mathbb{1}[s_t=0, m_t=1]$	2.678	(0.078)	Sex Ratio 1	0.404	(0.012)	$D_{1,t}$	0.172	(0.004)
$'' \times PF_t$	-0.277	(0.013)	$'' \times PF_t$	0.136	(0.006)	Sex Ratio 2	-0.020	(0.001)	$D_{2,t}$	-0.014	(0.001)
$'' \times CL_t$	-0.303	(0.003)	$'' \times CL_t$	0.121	(0.004)	County Relig.	-0.079	(0.003)	$D_{0,t}$	0.016	(0.001)
$'' \times PR_t$	0.712	(0.023)	$'' \times PR_t$	-0.199	(0.009)	$'' \times R_t$	0.031	(0.012)	N_t	0.158	(0.006)
$\mathbb{1}[s_t=1, m_t=0]$	0.329	(0.015)	$\mathbb{1}[s_t=1, m_t=1]$	3.273	(0.061)	R_t	-0.148	(0.005)	$'' \times \mathbb{1}[m_t=0]$	-0.114	(0.006)
$'' \times PF_t$	-0.298	(0.009)	$'' \times PF_t$	-0.414	(0.017)	$A_t/100$	18.752	(1.500)	$'' \times \mathbb{1}[m_t=1]$	-0.184	(0.008)
$'' \times CL_t$	-0.335	(0.016)	$'' \times CL_t$	0.020	(0.001)	$(A_t)^2/100$	-0.166	(0.037)	$K_{1,t}/100$	0.000	(0.000)
$'' \times PR_t$	0.515	(0.022)	$'' \times PR_t$	0.516	(0.014)	r^1_t	-0.445	(0.017)	B_t	0.590	(0.024)
$\mathbb{1}[s_t=2, m_t=0]$	0.511	(0.019)	$\mathbb{1}[s_t=2, m_t=1]$	3.570	(0.056)	r^2_t	0.015	(0.001)	a_t	0.112	(0.005)
$'' \times PF_t$	-0.194	(0.008)	$'' \times PF_t$	-0.451	(0.019)	PF_t	0.372	(0.016)			
$'' \times CL_t$	-0.012	(0.000)	$'' \times CL_t$	-0.080	(0.004)	CL_t	0.375	(0.018)			
$'' \times PR_t$	0.167	(0.009)	$'' \times PR_t$	0.291	(0.011)	PR_t	0.183	(0.008)			

Table 6c: Parameter Estimates

Distribution of Partnership Information and Notes. Reference: Section 6

Distribution of Φ_t^0 (Realized by single, pregnant women)

Outcome 1			Outcome 2			Outcome 3			Outcome 4		
	Est.	S.E.		Est.	S.E.		Est.	S.E.		Est.	S.E.
Prob (i.e., $\rho_{0,1}$)	0.264	—	Prob (i.e., $\rho_{0,2}$)	0.263	—	Prob (i.e., $\rho_{0,3}$)	0.294	—	Prob (i.e., $\rho_{0,4}$)	0.179	—
ϕ^1	-0.187	—	ϕ^1	-0.555	—	ϕ^1	-1.599	—	ϕ^1	0.459	—
ϕ^2	-2.316	—	ϕ^2	-0.857	—	ϕ^2	-0.236	—	ϕ^2	1.400	—
Marginal Effects:‡			Marginal Effects:			Marginal Effects:			Marginal Effects:		
$\Delta P(M_{t+1} = M^1)$	-0.005	—	$\Delta P(M_{t+1} = M^1)$	-0.198	—	$\Delta P(M_{t+1} = M^1)$	-0.218	—	$\Delta P(M_{t+1} = M^1)$	0.010	—
$\Delta P(M_{t+1} = M^2)$	-0.106	—	$\Delta P(M_{t+1} = M^2)$	0.005	—	$\Delta P(M_{t+1} = M^2)$	0.051	—	$\Delta P(M_{t+1} = M^2)$	0.200	—

Distribution of Φ_t^1 (Realized by cohabiting, pregnant women)

Outcome 1			Outcome 2			Outcome 3			Outcome 4		
	Est.	S.E.		Est.	S.E.		Est.	S.E.		Est.	S.E.
Prob (i.e., $\rho_{1,1}$)	0.230	—	Prob (i.e., $\rho_{1,2}$)	0.203	—	Prob (i.e., $\rho_{1,3}$)	0.232	—	Prob (i.e., $\rho_{1,4}$)	0.336	—
ϕ^1	-0.225	—	ϕ^1	-1.073	—	ϕ^1	2.182	—	ϕ^1	0.318	—
ϕ^2	-0.617	—	ϕ^2	1.402	—	ϕ^2	-1.042	—	ϕ^2	2.155	—
Marginal Effects:			Marginal Effects:			Marginal Effects:			Marginal Effects:		
$\Delta P(M_{t+1} = M^1)$	0.045	-	$\Delta P(M_{t+1} = M^1)$	0.094	—	$\Delta P(M_{t+1} = M^1)$	0.279	—	$\Delta P(M_{t+1} = M^1)$	-0.385	—
$\Delta P(M_{t+1} = M^2)$	-0.067	—	$\Delta P(M_{t+1} = M^2)$	-0.081	—	$\Delta P(M_{t+1} = M^2)$	-0.224	—	$\Delta P(M_{t+1} = M^2)$	0.429	—

Notes: Please see section 6 for a discussion of the parameters. Standard errors are asymptotic standard errors calculated using the outer product of the score vectors to approximate the inverse Hessian.

† r_t^1 is an indicator of being black and r_t^2 is an indicator of being Hispanic. "Sex Ratio 1" is the sex ratio within an individual's age range. "Sex Ratio 2" is within the age range and of the same race. "County Relig." is county religiosity as described in section 4 divided by 100.

††

††† In estimation, consumption values are divided by $10,000.

‡ Marginal effects of a realization of partnership information on marriage and cohabitation offer probabilities are calculated for a 22 year old woman with no children who has the sample average among 22 year olds for other state variables.

§ Constrained to be in the unit interval.

Table 7: Observed and Simulated Decisions and Outcomes.
Reference: Subsection 6.2

	Sample	Simulated		Sample	Simulated
% Cohabiting			% Married		
Age 18-20	9.94	6.21	Age 18-20	4.56	9.00
Age 21-23	17.06	13.22	Age 21-23	15.46	15.78
Age 24-27	21.31	19.66	Age 24-27	27.39	27.93
Age 28-31	18.30	19.28	Age 28-31	38.44	43.28
% Single Birth†			% Unwed Birth†		
Age 15-17	3.40	1.45	Age 15-17	3.97	2.22
Age 18-20	5.89	4.61	Age 18-20	8.17	6.42
Age 21-23	4.98	6.19	Age 21-23	7.84	8.95
Age 24-27	3.29	4.04	Age 24-27	5.68	6.63
Age 28-31	1.85	2.06	Age 28-31	3.34	3.32
Children					
By Age 20	0.30	0.25			
By Age 23	0.63	0.63			
By Age 26	0.95	1.02			
By Age 29	1.28	1.26			

	Population	Simulated		Population	Simulated
% Pregnant††			Abortion Ratio††		
Age 15-17	6.19	5.61	Age 15-17	34.02	36.52
Age 18-19	13.31	12.88	Age 18-19	33.66	34.22
Age 20-24	16.24	18.22	Age 20-24	31.82	28.90
Age 25-29	13.71	13.11	Age 25-29	27.77	26.01

† A single birth is a birth that occurs when not married or cohabiting. An unwed birth is a birth that occurs when not married. The numbers reported in these columns are the proportion of all annual observations within an age range that experience a single or unwed birth.
†† Abortion Ratio is the percent of *pregnancies* ending in abortion. The numbers for pregnancy and the abortion ratio presented in the "Population" columns are calculated using the population rates in Ventura et. al (2012). As there are individuals in the listed age groups across multiple years in the sample, a weighted average of the rates in Ventura (2012) is shown. As miscarriage is not modeled, the population abortion ratio and pregnancy rate are adjusted for the sake of comparison.

Table 8: Observed and Simulated Partnership Transition Probabilities By Age
Reference: Subsection 6.2

18 to 20 years old

	Partnership at t					
	Observed			Simulated		
Partnership at $t-1$	Single	Cohabiting	Married	Single	Cohabiting	Married
Single	91.32	6.61	2.07	93.51	3.89	2.61
Cohabiting	25.40	60.89	13.71	24.73	56.87	18.41
Married	10.37	3.05	86.59	18.91	2.21	78.88

21 to 23 years old

	Partnership at t					
	Observed			Simulated		
Partnership at $t-1$	Single	Cohabiting	Married	Single	Cohabiting	Married
Single	86.92	9.19	3.89	88.09	7.69	4.21
Cohabiting	19.73	66.75	13.52	18.29	66.03	15.68
Married	9.02	1.40	89.58	13.67	2.34	83.98

24 to 27 years old

	Partnership at t					
	Observed			Simulated		
Partnership at $t-1$	Single	Cohabiting	Married	Single	Cohabiting	Married
Single	84.49	11.43	4.08	83.31	11.87	4.82
Cohabiting	16.30	71.13	12.57	14.44	67.38	18.18
Married	5.94	0.75	93.31	8.29	2.22	89.49

28 to 31 years old

	Partnership at t					
	Observed			Simulated		
Partnership at $t-1$	Single	Cohabiting	Married	Single	Cohabiting	Married
Single	85.82	9.87	4.30	79.43	11.97	8.59
Cohabiting	15.53	71.35	13.12	11.97	66.54	21.49
Married	5.77	0.55	93.67	4.86	1.66	93.49

Table 9: Unwed Motherhood (Percent) By Counterfactual Policy Regimes and Age
Reference: Subsection 6.3

	Public Funding			Counseling			Parental Consent		
Age	Low Cost	High Cost	Diff.	Low Cost	High Cost	Diff.	Low Cost	High Cost	Diff.
16	0.66	0.78	-0.12	0.76	0.82	-0.06	0.67	0.81	-0.15
17	1.82	2.24	-0.43	2.08	2.10	-0.02	1.78	2.29	-0.51
18	3.99	4.80	-0.81	4.84	4.37	0.48	4.19	5.10	-0.91
19	7.09	8.40	-1.31	8.08	7.42	0.65	7.39	8.63	-1.23
20	10.58	12.79	-2.20	12.06	11.38	0.68	11.51	12.86	-1.35
21	15.43	17.96	-2.52	16.86	16.00	0.86	16.36	17.92	-1.56
22	19.79	23.18	-3.40	22.07	21.06	1.02	21.78	22.99	-1.21
23	23.88	27.37	-3.49	26.59	25.74	0.85	26.38	27.39	-1.01
24	27.37	30.40	-3.02	29.52	29.30	0.22	30.24	30.69	-0.45
25	29.81	32.80	-2.99	32.31	31.57	0.74	32.55	32.51	0.04
26	31.79	34.26	-2.46	33.21	33.28	-0.07	34.31	34.04	0.26
27	32.51	33.66	-1.15	33.10	33.52	-0.42	34.56	34.08	0.48
28	31.70	33.09	-1.40	32.40	32.56	-0.16	33.33	33.81	-0.48
29	30.56	31.06	-0.51	30.74	30.70	0.04	32.29	31.89	0.40
30	28.16	28.41	-0.25	29.23	28.22	1.01	29.70	29.72	-0.02

This table shows the percent of women at each age who are unmarried and have at least one child under the high and low cost simulation for each policy type.

Table 10: Unwed Births (Percent) By Counterfactual Policy Regimes and Age
Reference: Subsection 6.3

	Public Funding			Counseling			Parental Consent		
Age	Low Cost	High Cost	Diff.	Low Cost	High Cost	Diff.	Low Cost	High Cost	Diff.
16	1.84	2.44	-0.59	2.21	2.12	0.09	1.78	2.53	-0.75
17	2.82	3.42	-0.60	3.50	2.64	0.86	2.86	3.64	-0.78
18	3.89	4.79	-0.90	4.69	3.81	0.87	4.13	4.93	-0.81
19	5.05	6.83	-1.78	6.32	5.11	1.21	5.68	6.83	-1.16
20	6.63	8.30	-1.67	7.80	6.91	0.90	7.06	8.13	-1.06
21	7.52	9.43	-1.91	9.38	8.14	1.25	8.90	9.02	-0.11
22	8.03	10.36	-2.33	9.24	8.85	0.39	9.43	10.22	-0.79
23	8.09	10.27	-2.17	9.16	9.04	0.11	9.67	9.25	0.41
24	7.48	8.84	-1.37	8.31	8.01	0.30	8.61	8.72	-0.11
25	6.19	7.62	-1.43	7.61	7.44	0.17	7.45	6.80	0.65
26	5.29	6.03	-0.74	5.88	5.88	0.00	5.83	6.38	-0.54
27	4.30	5.32	-1.02	4.62	4.36	0.27	5.14	5.18	-0.04
28	3.66	4.20	-0.53	4.03	3.82	0.21	3.98	4.53	-0.55
29	2.79	3.09	-0.29	2.99	2.66	0.33	2.93	2.95	-0.03
30	2.14	1.93	0.21	2.15	1.79	0.36	2.21	2.38	-0.17

Notes: This table reports the percent of women at each age who are not married and give birth under the high and low cost regime for each policy type. Based on the model, births occur at the end of the period in which the pregnancy occurred and number of children update at the beginning of the following period. Hence, the unwed births at a given age only affect unwed motherhood in the following period for women who remain unmarried.

Table 11: Information Effect By Policy Type, Age, and Partnership
Reference: Subsection 6.3

	Public Funding		Counseling		Parental Consent	
Age	Cohabiting	Single	Cohabiting	Single	Cohabiting	Single
All	0.31	0.12	0.40	0.13	0.48	0.01
16	0.25	0.04	0.00	0.03	0.00	0.02
17	0.32	0.03	0.55	0.05	0.85	0.01
18	0.53	0.07	0.41	0.16	—	—
19	0.49	0.18	0.96	0.14	—	—
20	0.72	0.15	0.78	0.19	—	—
21	0.75	0.10	0.75	0.18	—	—
22	0.38	0.23	0.76	0.25	—	—
23	0.25	0.23	0.68	0.17	—	—
24	0.26	0.22	0.20	0.19	—	—
25	0.38	0.11	0.26	0.22	—	—
26	0.13	0.12	0.30	0.12	—	—
27	0.19	0.18	0.18	0.10	—	—
28	0.16	0.17	0.27	0.12	—	—
29	0.23	0.14	0.07	0.15	—	—
30	0.11	0.00	0.11	0.06	—	—

Notes: This table shows the percent of women at each age who give birth as a result of the information effect when policy moves from a high cost to a low cost regime. How such births are defined is discussed in subsection 6.3. The "All" row averages over all ages (over the ages 16 to 17 for parental consent laws).

Table 12: Simulated Competitive Effect By Policy Type, Age, and Partnership
Reference: Subsection 6.3

	Public Funding		Counseling		Parental Consent	
Age	Cohabiting	Single	Cohabiting	Single	Cohabiting	Single
All	0.19	0.10	0.29	0.65	1.58	-0.11
16	0.99	-0.49	3.21	0.05	1.68	-0.17
17	1.92	-0.31	0.55	0.10	1.49	-0.06
18	0.94	-0.02	0.82	0.40	—	—
19	0.39	-0.35	0.64	0.43	—	—
20	0.08	0.13	1.12	0.77	—	—
21	-0.06	0.28	1.02	1.17	—	—
22	0.09	0.18	-0.11	1.08	—	—
23	0.00	0.33	-0.27	1.07	—	—
24	0.07	0.68	0.04	1.43	—	—
25	-0.03	0.67	0.23	1.15	—	—
26	0.13	0.67	0.00	0.83	—	—
27	0.16	0.41	0.28	0.50	—	—
28	0.16	0.26	0.13	0.71	—	—
29	0.00	0.11	0.13	0.36	—	—
30	0.11	0.19	-0.11	0.19	—	—

Notes: This table shows the percent of women at each age who become pregnant and give birth because of the effects of low abortion costs on partner offer probabilities *minus* the percent of women at the same age who do not become pregnant because of the effect of low abortion costs on partner offer probabilities. How such pregnancies and births are defined is discussed in subsection 6.3. The "All" row averages over all ages (over the ages 16 to 17 for parental consent laws).

Table 13: Simulated Dynamic Selection Effects

Reference: Subsection 6.3

Average Years of Single Parenthood Through Age 30
Information Effect vs. General Population

	Birth in t and Married at $t+1$						Birth in t and Cohabiting at $t+1$					
	Public Funding		Counseling		Parental Consent		Public Funding		Counseling		Parental Consent	
Age	Info Effect	All	Info Effect	All	Info Effect	All	Info Effect	All	Info Effect	All	Info Effect	All
16	3.36	3.31	2.88	3.28	3.20	3.67	2.60	2.73	1.29	1.76	3.67	3.63
17	2.69	2.90	2.24	2.85	2.98	3.23	2.64	2.27	2.93	2.41	3.04	3.06
18	2.27	2.45	2.03	2.42	—	—	1.38	1.86	1.58	1.99	—	—
19	2.07	2.08	2.05	2.03	—	—	1.16	1.58	1.97	1.76	—	—
20	1.53	1.66	1.31	1.59	—	—	0.90	1.33	1.19	1.38	—	—
21	1.61	1.31	1.44	1.24	—	—	0.85	1.09	0.69	1.15	—	—
22	0.96	0.95	1.24	0.94	—	—	0.73	0.88	0.67	0.96	—	—
23	0.82	0.69	0.70	0.66	—	—	0.55	0.71	0.51	0.77	—	—
24	0.49	0.47	0.48	0.45	—	—	0.41	0.52	0.26	0.55	—	—
25	0.23	0.28	0.22	0.26	—	—	0.22	0.38	0.21	0.37	—	—
26	0.09	0.15	0.09	0.14	—	—	0.16	0.24	0.25	0.23	—	—
27	0.12	0.09	0.08	0.08	—	—	0.04	0.16	0.11	0.17	—	—
28	0.03	0.04	0.02	0.04	—	—	0.02	0.10	0.00	0.09	—	—
29	0.00	0.01	0.03	0.02	—	—	0.07	0.06	0.00	0.05	—	—

Average Years of Single Parenthood Through Age 30
Competitive Effect vs. General Population

	Birth in t and Single at $t+1$					
	Public Funding		Counseling		Parental Consent	
Age	Comp Effect	All	Comp Effect	All	Comp Effect	All
16	7.83	7.66	7.73	7.61	8.34	8.36
17	7.41	7.30	7.25	7.10	7.78	7.65
18	6.81	6.58	6.60	6.42	—	—
19	6.21	5.93	5.96	5.76	—	—
20	5.57	5.35	5.40	5.18	—	—
21	5.01	4.82	4.88	4.76	—	—
22	4.49	4.38	4.38	4.31	—	—
23	3.93	3.96	4.11	4.07	—	—
24	3.37	3.45	3.83	3.86	—	—
25	2.78	2.89	3.34	3.38	—	—
26	2.24	2.27	2.77	2.85	—	—
27	1.95	2.00	2.19	2.23	—	—
28	1.70	1.73	1.94	1.96	—	—
29	1.40	1.40	1.64	1.69	—	—

B Figures

Figure 1: Public Funding Restrictions, Unwed Motherhood, and Unwed Births
Total Effects of Moving from a High Cost to a Low Cost Regime

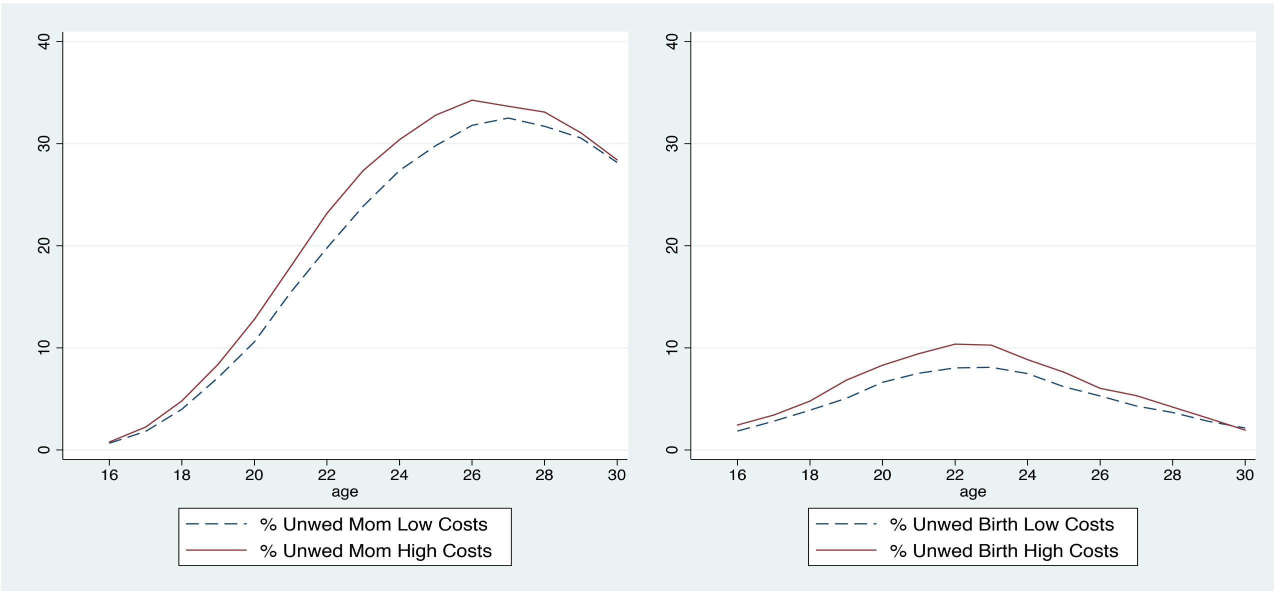


Figure 2: Mandatory Counseling and Delay Laws, Unwed Motherhood, and Unwed Births
Total Effects of Moving from a High Cost to a Low Cost Regime

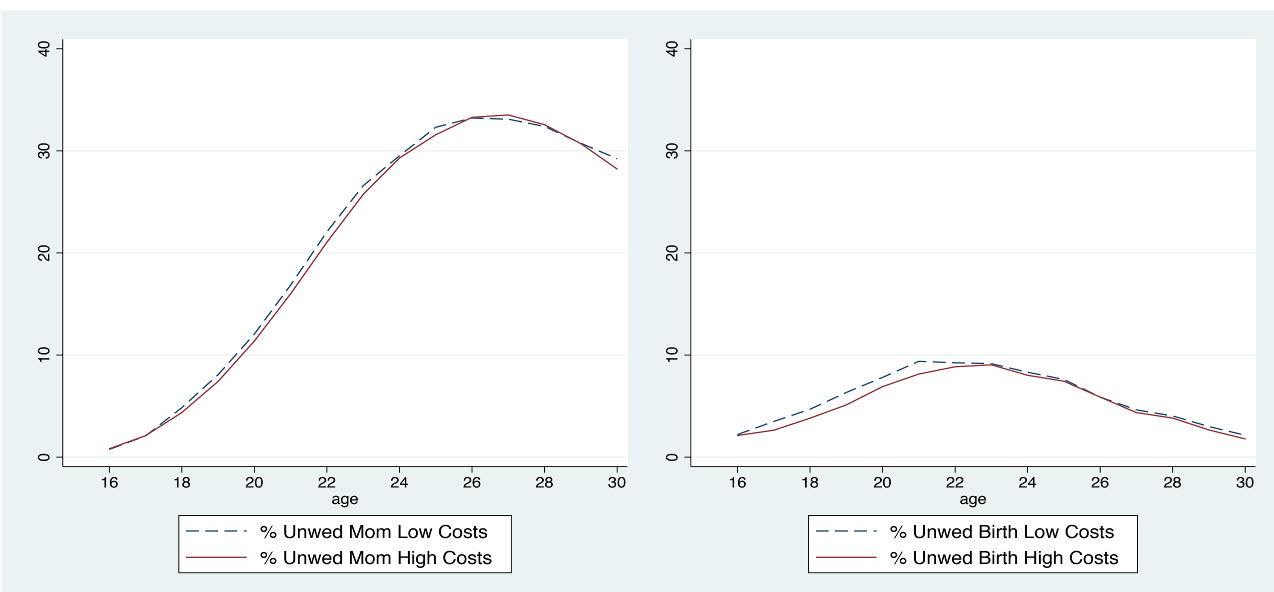


Figure 3: Parental Consent Laws, Unwed Motherhood, and Unwed Births
Total Effects of Moving from a High Cost to a Low Cost Regime

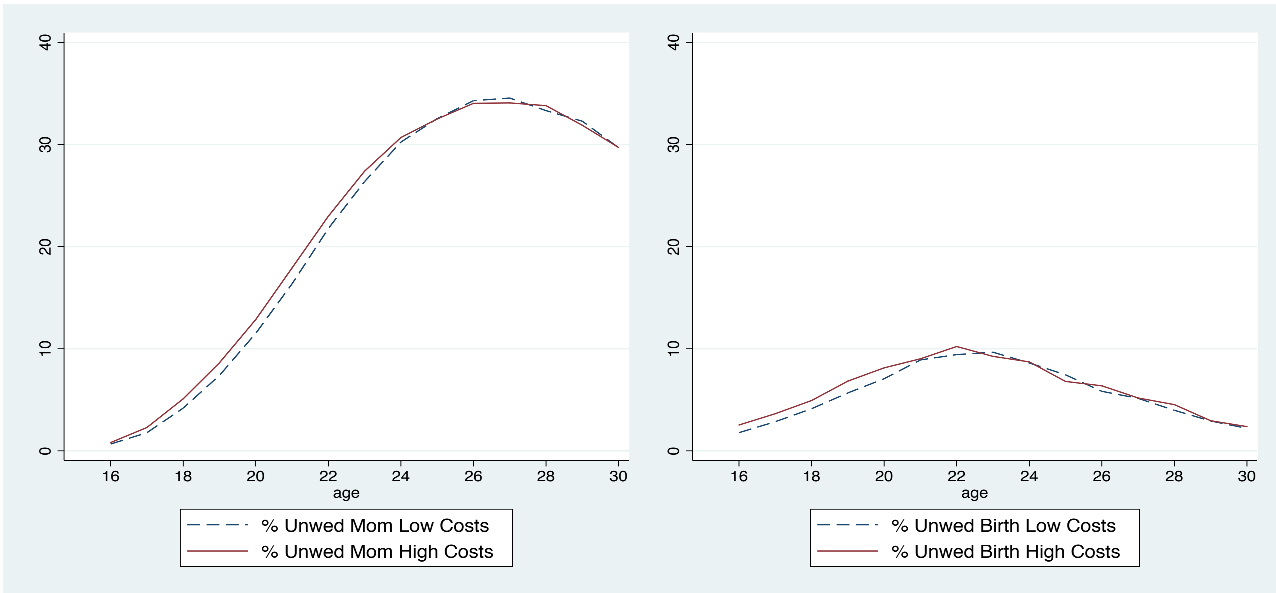
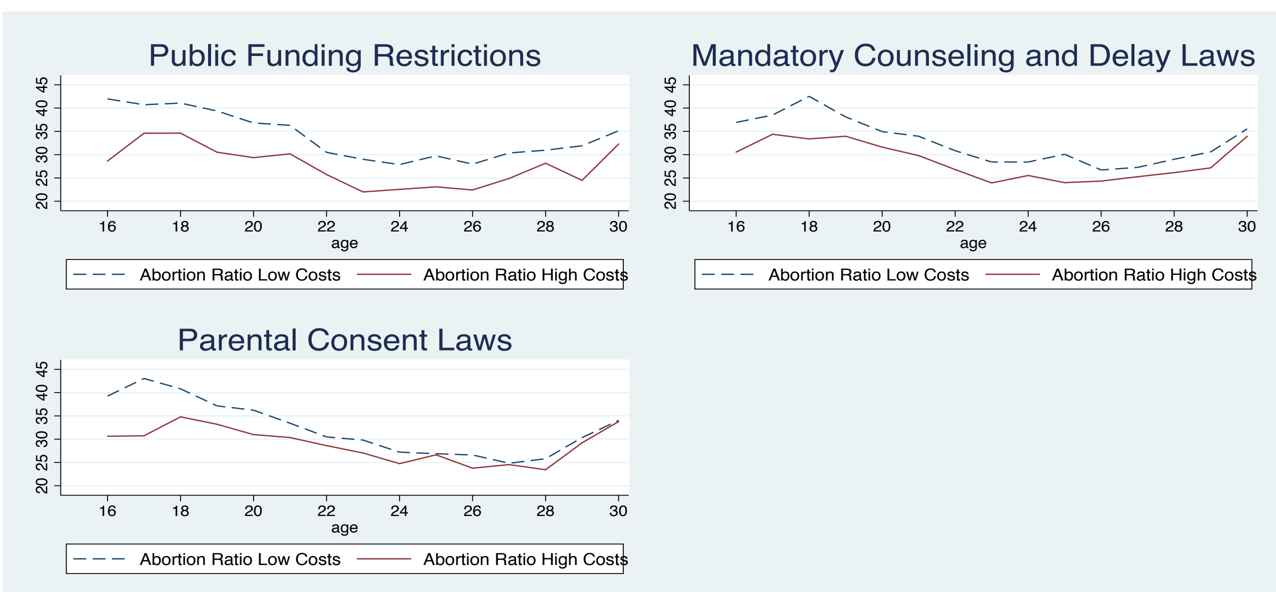


Figure 4: Simulated Abortion *Ratios* in the High Cost and Low Cost Regimes



The abortion ratio is the percent of pregnancies aborted.

Figure 5: Simulated Pregnancy in the High Cost and Low Cost Regimes