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Out-of-Wedlock Fertility, Post-Pregnancy Choices and Contraceptive Usage*

Ana Nuevo-Chiquero†

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Abstract

This paper examines the evolution of out-of-wedlock conceptions and births for cohorts born in the US from 1955 to 1982 and the role that modern contraception played in these trends. Substantial increases in conception outside of marriage only partially account for the upward trend in illegitimacy. Among those who conceived out-of-wedlock, the incidence of shotgun (post-conception) marriage decreased sharply, as did the incidence of abortion. Contraceptive use and pregnancy planning do not appear to shape the trend in out-of-wedlock conception, but post-conception choices evolved differently for unplanned pregnancies, with a negligible decrease in shotgun marriages. Furthermore, conditional on own use of contraception and planning of the pregnancy, women in "premarital sexual intercourse markets" with high contraceptive use are less likely to give birth out-of-wedlock. The trend in out-of-wedlock motherhood over time is significantly steeper when modern contraceptive use in the woman's premarital sexual intercourse market is accounted for, suggesting that its generalization contributed to moderate the increase in out-of-wedlock motherhood.

JEL codes: J11, J12

Keywords: out-of-wedlock birth, post-conception marriage, modern contraception, abortion

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1 Introduction

The prevalence of single-headed households in the U.S. has substantially increased over the last decades, from 11% of all households with children under 18 in 1959 to 33% in 2010 (US Census Bureau 2010). However, their situation has not improved: in 1990, 44.5% of households whose head is a single women with children were below the poverty line, while this share was only 16.4% for all households with children below 18. In addition, growing up with a single parent might have negative effects on children's development.[1] A large proportion of the increase is explained by the rise in the number of births to unmarried women, which went from 3.8% of all births in the U.S. in 1940 to 39.7% in 2007 (Ventura 2009).[2] Understanding the evolution of out-of-wedlock childbearing contributes to shedding light on the origins of families suffering a high level of poverty.

Several explanations have been proposed for this extreme change in out-of-wedlock fertility, including the legalization of abortion and the introduction of modern contraception (see Lang (2007) for a summary of the literature). Family planning affects the proportion of out-of-wedlock childbearing, first of all, through changes in out-of-wedlock pregnancies, since it allowed women to have precise control over fertility. The pill reduced the cost of engaging in premarital sexual intercourse by decreasing the risk of unwanted pregnancy, increased women's labor force participation and access to higher education, and altered the marriage market, contributing to a delay in age at first marriage (Goldin and Katz 2002, Bailey 2006). Modern contraceptive methods are therefore likely to have shaped the evolution of out-of-wedlock fertility. Furthermore, the impact of modern contraceptive methods on family formation may have also extended to the incidence of "shotgun" (post-conception) marriage.[3] Decreases in post-conception marriage have been credited as one of the driving forces behind the increase in out-of-wedlock childbearing, with modern contraception playing a key role in explaining this decrease (Akerlof, Yellen and Katz 1996).

In this paper, I first examine separately the evolution of out-of-wedlock pregnancies and births in the U.S., to discern whether the upward trend in illegitimacy rates can be fully explained by changes in conception outside marriage, or whether the choice faced by women after

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[1]Children growing up with a single parent have lower academic achievement, and are more likely to have behavioral problems, use illegal substances or have early contact with the police (Sigle-Rushton and McLanahan 2004). However, there is little evidence of these disparities being caused by growing up with an absent parent rather than by differences in background characteristics (Lang and Zagorsky 2001).

[2]The other main force driving this increase, divorce, experienced a smaller increase during the first part of the period examined here, but a substantial increase after that. Bramlett and Mosher (2002) report a small increase in the probability of a marriage disruption during the first ten years of marriage for cohorts born between 1950 and 1969, but a substantial increase (over 10 percentage points) for women born after 1970.

[3]The expression "shotgun marriage" is based on a hypothetical scenario in which the pregnant female's father resorts to coercion (such as threatening with a shotgun) to ensure that the male partner who caused the pregnancy goes through with it, sometimes even following the man to the altar to prevent his escape.

pregnancy has changed significantly over time. The analysis includes all first pregnancies ending in birth or abortion, to prevent changes in the incidence of abortion confounding the estimates. Furthermore, I estimate separate trends for subsamples of pregnancies that were unplanned,[4] and that occurred to women who were contraceptive users from an early point in their lives, to shed light on the type of women or behavior driving the trends. The results indicate that increases in out-of-wedlock pregnancies account for only a part of the trend in births to single mothers, suggesting that choices after the pregnancy were also driving the upward trend in out-of-wedlock fertility. Neither unplanned pregnancies or women with a preference towards contraception appear to experience a significantly different trend.

I then explore trends in outcomes after an out-of-wedlock pregnancy. As expected by the divergence in trends in out-of-wedlock pregnancies and births, recent cohorts are more likely to become single mothers after an out-of-wedlock pregnancy, but this increase is compensated by both decreases in post-conception marriage and abortion. Unplanned pregnancies, however, did not experience a declining trend in post-conception marriage. Although contraceptive users are more likely to seek an abortion, contraceptive use does not appear to be correlated with a different trend by cohort.

In addition, I examine whether the impact of modern contraception occurred exclusively throughout the woman's period of decision-making, or whether the general level of contraceptive use also affected the evolution of post-pregnancy outcomes, through, for instance, changes in the woman's bargaining power (Akerlof et al. 1996). To be able to differentiate these effects, I take advantage of differences in adoption of modern contraception across marriage markets. In the United States, the marriage market, as well as the market for premarital, intimate relationships, is characterized by a high level of homogamy, i.e., men and women present strong preferences for matching with partners who share certain attributes, such as race, religion, age or education (Blackwell and Lichter 2004). Differences in the prevalence of contraception along these characteristics will be used to shed light on an additional potential channel for modern contraception to affect out-of-wedlock fertility.[5] Conditional on own use, women in "premarital sexual intercourse markets" with a high level of modern contraceptive use are less likely to become single mothers after an out-of-wedlock pregnancy. The spread of the pill and other highly effective methods appears to have contributed to slowing down the increase in single motherhood and the decrease in the incidence of shotgun marriage, while furthering the decreasing trend in abortion.

The drastic increase in out-of-wedlock fertility has received prolific attention from economics

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[4]As explained in detail below, a pregnancy will be considered unplanned if it occurred while any type of contraception was in use.

[5]Charles and Luoh (2010) follow a similar approach to estimate the impact of male incarceration on marriage.

and other social scientists. This paper contributes by reporting trends in conceptions -regardless of the outcome of the pregnancy- and births, shedding light on the relevance of women's choices both before and after conception. Furthermore, selecting samples by woman's characteristics allows our results to illustrate the impact of modern contraception and family planning in general as a potential driving force for these changes. The paper is organized as follows. Section 2 describes the data used in the analysis, while Section 3 explores the evolution of out-of-wedlock fertility. Section 4 examines the evolution of post-pregnancy outcomes, Section 5 analyzes the impact of modern contraception spread on post-pregnancy marriage, and Section 6 concludes.

2   Data

The data used in the analysis come from Cycles III to VII of the U.S. National Survey of Family Growth (NSFG), administered by the Center for Disease Control in 1982, 1988, 1995, 2002, and yearly from 2006 to 2010. The NSFG collects information on family life, infertility, contraceptive use and women's health. The third cycle was the first to survey never-married females. A nationally representative sample of non-institutionalized women aged 15 to 44 at the time of the survey were interviewed. Retrospective information was collected on every pregnancy experienced, including outcome (birth, abortion, miscarriage), year in which it occurred, and marital status. Demographic characteristics, such as race, religion, age, and the respondent's mother's education are also included.[6]

Information on marital status both at the time of conception and at the time of the outcome of the pregnancy is included in the data. It allows the examination of the evolution of out-of-wedlock births as well as conceptions that occurred to never-married women.[7] A conception will be considered out-of-wedlock if the woman reported being unmarried when the pregnancy occurred, and a birth will be considered out-of-wedlock if the woman was still formally unmarried at the outcome of the pregnancy. The last part of the sample period (Cycles VI to VII, covering women born from 1958 only) also includes information on informal marital status, including cohabiting as a distinct status.

A pregnant, single woman has three choices facing her: she might choose to get married if a proposal of marriage is received, she might become a single mother or she might obtain an abortion.[8] Due to data limitations, she will be considered to have gone through a shotgun

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[6]Education is measured at the time of the interview and therefore is likely to be endogenous to the occurrence of a pregnancy and its outcome. Hence, the level of education of the respondent's mother will be used as a proxy for own education.

[7]The first two cycles used in the analysis (1982 and 1988) recorded marital status at conception only for the first pregnancy the woman experienced, and therefore the sample will be restricted to first pregnancies for the entire sample period.

[8]She may also give the child away for adoption. However, these cases were very limited in the sample (60

wedding if she was single at conception but married at birth. There is abundant evidence in the medical and economic literature that spontaneous fetal losses (either miscarriages or stillbirths) are conditionally random (Hotz, Mullin and Sanders 1997). Pregnancies ending in miscarriage, around 10% of the sample, are therefore dropped from the sample. About 20% of the remaining women reported a post-conception wedding, around 25% sought an abortion, and the rest become single mothers.[9]

The NSFG records detailed data on sexual activity and contraceptive use. Unfortunately, the data included is not consistent across cycles, but it allows construction of an informative measure of the woman's attitude towards modern contraception. A woman will be considered a "contraceptive user" if the first contraceptive method ever used by the woman was highly effective and it happened before the woman reached age 25, but the results are robust to alternative age limits. The set of contraceptive methods available to women changed over the period of the data (1973 to 2006), with the introduction, for instance, of implants or contraception via injection. However, given that failure rates did not improve significantly, the use of these new methods will be treated as the same event. In particular, the following methods will be considered modern contraception: pill, intrauterine devices (IUD), implants and injectables.[10]

Given the extent of the sample period, the socially acceptable timing of fertility and marriage might have changed over time. To distinguish the effect of such a change, I define a second sample of unplanned first pregnancies which happened before marriage. A pregnancy will be considered unplanned if any contraception was in use at any point before the pregnancy and was not fully stopped. Unfortunately, the exact method being used before the pregnancy or whether it could be classified as highly effective cannot be determined with the available data, and contraceptive failures cannot be considered a random event. Nevertheless, defining the level of planning using factual information instead of self-reported pregnancy intentions prevents the outcome of the pregnancy and the marital status from affecting the classification, ensuring that all pregnancies included in this subsample were not actively sought.

Table 1 presents the descriptive statistics for the different samples used in the analysis. The first column includes all women born between 1955 and 1982 who ever had sexual intercourse. It contains 31,078 women, 55% of whom used modern contraception at their first intercourse,

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women choose this option) and were therefore dropped from the sample. Only a few women (29 cases) in the sample marry and then abort. These observations are likely to be therapeutic abortions and will be treated as miscarriages.

[9]The NSFG is obviously not free from under-reporting of abortions. However, given the share of pregnancies ending in abortion that are included in the data, and the time frame, it is unlikely that the results reported here are severely affected by such under-reports.

[10]A robustness check using a broader definition of highly effective contraception that includes barrier methods presents similar estimates. Some of these methods, such as the condom or diaphragm, present a typical-use failure rate that is higher than 10%, and are therefore excluded in the preferred specification.

while 81% used it early in their sexual activity. This sample will be used to estimate the market level of contraceptive use. Only pregnancies that happened to women 16 years and older are included in the first pregnancies sample, since 16 is the minimum legal age of marriage in most states. In order to ensure that all women had access to the pill and, moreover, to abortion, only pregnancies that happened after 1973 are included in the sample.[11] There are 16,881 first pregnancies, of which 12,113 ended in birth. Columns (2) and (3) present the descriptive statistics for unplanned pregnancies and pregnancies to contraceptive users respectively. More than 60% of first pregnancies occurred to unmarried women. This is 10,874 pregnancies, of which 3,816 happened while any type of contraception was in use, and 8,585 occurred to women who used modern contraception early in their lives.

Table 1 goes here

3 Trends in out-of-wedlock fertility

The rise in out-of-wedlock births has been well-documented in the literature (see, for instance, Lang (2007), England, Wu and Shafer (2013), or Lundberg and Pollak (2013)). This section attempts to shed light on whether this trend is driven by increases in conception outside of marriage or by choices the woman takes after pregnancy. Women might opt more often for single motherhood, but couples might choose to postpone marriage to pregnancy, but not to birth. Also, increases in out-of-wedlock pregnancies might fully explain increases in out-of-wedlock births, while the choices faced by a woman after an out-of-wedlock pregnancy remain unaffected. Therefore, I first examine separately the evolution of premarital conceptions and premarital births to assess whether factors before the pregnancy can fully explain the trend in births.

Empirical strategy

I estimate a probit model on the sample of all first pregnancies, in which the dependent variable is the woman's marital status when the pregnancy happened. To compare the evolution of the probability of being single at first conception and at first birth, a similar specification is run for a sample of first pregnancies that ended in birth. The equation to be estimated is

$$Y_i = \alpha + D_i\Gamma + A_i\Lambda + X_i\delta + \varepsilon_i \tag{1}$$

where Y_i takes value 1 if the woman was single at either first pregnancy or birth, and 0 if she

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[11]The Supreme Court decision *Roe v. Wade* in 1973 allowed access to abortion to all women in the US.

married before then. In each regression, a series of dummies for the woman's year of birth (D_i) and age at pregnancy (A_i) are included, along with personal characteristics (X_i), namely race, religion and education (proxied by the woman's mother's education), that control for changes in the composition of the sample. To provide a clear interpretation of the results, only marginal effects are reported hereafter.

In order to obtain consistent estimates of the trend over time and by age at pregnancy, I follow Donald and Lang (2007) and estimate a two-step procedure. The second stage regresses the marginal effects for the year of birth dummies, $\hat{\Gamma}$, on a time trend, $\hat{\Gamma}_t = \beta_0 + \beta_1 t + \epsilon_t$. A similar exercise is performed for age at pregnancy.

Results

The solid line in Figure 1 presents the smoothed trend by cohort of the probability of the first pregnancy occurring outside marriage. There is a significant upward trend in out-of-wedlock conceptions: a woman born in 1970 is 15 percentage points more likely to have never been married when she became pregnant for the first time than a woman born in 1955, even after controlling for age at pregnancy, personal characteristics, contraceptive use and planning of the pregnancy. On average, the probability of a pregnancy outside marriage increased by 0.9 percentage points per year of birth of the woman.

The dashed line in Figure 1 presents the evolution by cohort of the probability of a woman being single when her first pregnancy ended in birth. Later cohorts are more likely to have their first birth outside of marriage, with this probability increasing by as much as 1.4 percentage points per year. For instance, the difference in the probability of being single at first birth between a woman born in 1955 and a similar woman born in 1970 is 24 percentage points, while it was only 15 percentage points in the case of conception outside of marriage.

Figure 1 goes here

The sharp trends presented may be driven by women who failed to plan their fertility or chose not to do so. Table 2 attempts to shed light in the type of women or behavior associated with the upward trends on out-of-wedlock pregnancy and birth. The top panel includes the results for all first pregnancies (mentioned above), while the middle panel restricts the sample to first pregnancies that were unplanned. The bottom panel includes only pregnancies of women who were contraceptive users from an early point in their lives.

The probability of an unplanned pregnancy occurring out-of-wedlock rose at a similar rate to the case of all pregnancies: on average, a woman is 1.0 percentage point more likely to be unmarried at her first, unplanned pregnancy than a similar woman born the previous year.

6

Both contraceptive users (bottom panel) and non-users (not shown) present very similar trends by cohort. The upward trend in premarital pregnancies does not appear to be driven by women who fail to plan their pregnancies or who choose not to do so through modern contraception, although women's unobservable characteristics for those groups may be changing by cohort.

Column (2) of Table 2 presents the results for out-of-wedlock births. The probability of being single at first birth rises faster (0.5 percentage points per woman's year of birth) than the probability of being single at first conception, but this difference is larger (0.9 percentage points) when only unplanned pregnancies are included in the analysis. Women of different cohorts who experienced an unplanned pregnancy might have different unobservable characteristics, but all pregnancies included in this sample were not actively sought. This result suggests that the level of planning may have affected the evolution of post-pregnancy alternatives, either directly or through changes in the unobservable characteristics of women who experienced an unplanned pregnancy.[12] On the other hand, the trend in the case of pregnancies to contraceptive users and non-users are not significantly different.

<div align="center">Table 2 goes here</div>

These trends could be explained by changes in marriage and cohabiting patterns.[13] The decrease in the probability of marriage over the sample period come with a sharp increase in cohabitations. In the data, the probability of premarital cohabitation increased by 4.1% per year of birth, with a similar increase for women up to age 30 and no trend thereafter, although the share of the population born early in the sample who ever cohabited premaritally is smaller than the fraction that ever married (e.g., 34% of women born in 1960 ever cohabited versus 73% that ever married).[14] However, it is does not appear to be the case that the trends reported here are fully driven by women substituting formal marriage by informal marriage or cohabitation. Cohabitations still present different characteristics than marriages: they are significantly shorter, and younger cohorts do not appear to cohabit longer than older cohorts without transitioning to marriage. Furthermore, a robustness check considering cohabiting women at birth either as married or as single did not lead to significant differences in the trend by year of birth.

Finally, Table 3 presents the marginal effects of the personal characteristics on the probability of being single at first pregnancy and birth for the entire sample of first pregnancies. Differences between the probability of out-of-wedlock conception (Column (1)) and births (Col-

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[12]Changes in the level of planning may have affected married women as well. A decrease in unplanned pregnancies among married women would create a similar pattern.

[13]See Lundberg and Pollak (2013) for a review of the evidence on cohabitation.

[14]Data on whether the woman ever cohabited are only available from Cycle IV onwards, but still cover women born 1955 to 1982.

umn (2)) indicate differences by characteristics in the options faced by women after their pregnancies. As expected, women are more likely to be single at conception if the pregnancy was unplanned, by almost 15 percentage points, and less likely if they are classified as contraception users. African-American women are around 20 percentage points less likely to be married when they become pregnant for the first time than whites and women of other ethnicities (mainly Asians). Hispanics, on the other hand, are 5 percentage points less likely to be unmarried, on average, than the omitted group, although the effect is smaller and not significant when only unplanned pregnancies are considered. Women whose mothers were high school dropouts are more likely to be married at conception than women with more educated mothers, as expected by the fact that these women are less likely to be married for any given age (Aughinbaugh, Robles and Sun 2013).

Women who had their first pregnancy at a later age are significantly less likely to be unmarried, although this decrease is less pronounced for later ages. For instance, a woman who become pregnant at 25 is 35 percentage points less likely to be single than a comparable woman that become pregnant at 20, but only 15 percentage points more likely than a woman who become pregnant at 30.

Similarly, Column (2) of Table 3 presents the estimates for out-of-wedlock births. Unplanned pregnancies resulting in birth are still significantly more likely to be to single women than the rest of pregnancies, although the effect is smaller than in the case of pregnancy. On the other hand, contraceptive users are no longer less likely to be single at birth after an out-of-wedlock pregnancy. These results suggest that contraceptive use may be playing a role in the alternatives the woman faces after a pregnancy occurred out-of-wedlock. Conditional on giving birth, African-American women are much more likely than all other groups to give birth outside of marriage, especially if the pregnancy was unplanned or if they are not contraceptive users. African-Americans are, on average, 30 percentage points more likely to have a birth outside of marriage than whites or Hispanics. Unlike the case of out-of-wedlock conceptions, there are no significant differences by maternal education. Women who become pregnant at older ages are also less likely to be single at birth, but the decreasing trend with age is less pronounced than in the case of pregnancy.

<center>Table 3 goes here</center>

4 Trends in post-pregnancy outcomes

Increases in the probability of a conception being out-of-wedlock will necessarily imply an increase in out-of-wedlock births unless accompanied by other changes. In the data, however,

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the trend in the probability of being single at first birth is significantly steeper than the trend for first conception, suggesting that changes experienced by women born between 1955 and 1982 did not only affect the proportion of pregnancies outside of marriage, but also choices once such pregnancies occurred. This section examines the evolution of out-of-wedlock motherhood and its alternatives (either abortion or shotgun marriage) when a pregnancy occurred out-of-wedlock, contributing to the understanding of the channels behind the sharp trends in premarital childbearing. In addition, pregnancy planning and the woman's attitudes towards contraception are examined as potential factors that may have shaped the evolution of the outcomes.

Empirical strategy

For all cohorts included in the sample, a single, pregnant woman may opt between terminating the pregnancy through an abortion, marry her partner or become a single mother.[15] In order to examine how cohort and personal characteristics affect women's choices, I estimate a multinomial choice model on the sample of women who become pregnant prior to marriage. The data used in the analysis do not include alternative-varying information. The following equation

$$Z_i = \alpha + D_i\Gamma + A_i\Lambda + X_i\delta + \varepsilon_i \tag{2}$$

is estimated using a multinomial logit model.[16] Here, Z_i takes a different value for each potential outcome, namely becoming a single mother, seeking an abortion or marrying her partner. In addition to personal characteristics (X_i), series of dummies for the woman's year of birth (D_i) and age at pregnancy (A_i) are included. As in the previous estimation, in order to obtain consistent estimates of the trend by cohort of the different outcomes after an out-of-wedlock conception, a second stage is performed regressing the marginal effects of the year of birth dummies on a time trend.

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[15]For simplicity, I will assume that every woman has the choice of marrying her sexual partner: every never-married, pregnant woman will received an offer of marriage with an associated within-marriage transfer, that might be positive or negative. Not receiving an offer of marriage will be equivalent to receiving an offer with a transfer from the woman to the man equal to infinity.

[16]Multinomial logit models assume independence of irrelevant alternatives (IIA), which requires that the choice between two of the alternatives is not affected by the presence of the third alternative (for instance, that a woman's choice between single motherhood and marriage will be the same whether or not abortion is available). In order to test if this assumption is satisfied, Appendix A presents the results for the probability of choosing single motherhood over marriage, with and without the choice of abortion, in columns (1) and (2), and for the probability of choosing birth over abortion, with and without the choice of marriage, in columns (3) and (4). The results are in no case significantly different, and the point estimates are very close, endorsing the use of multinomial logit models.

Results

Table 4 presents the trends by the woman's year of birth in the probability of becoming a single mother, marrying or having an abortion after an out-of-wedlock pregnancy. The top panel includes the results for the entire sample of all first pregnancies that occurred to single women born from 1955 to 1982. There is an average increase of 1.5 percentage points per year of birth in the probability of becoming a single mother (the omitted category in the table), even after controlling for the level of planning of the pregnancy and the woman being a contraceptive user, along with other personal characteristics. This increase in single motherhood is compensated by a similar decrease in the incidence of shotgun marriage (0.7 percentage points per year of birth) and of abortion (0.8 percentage points). Although the best fit in the year of birth series is a linear trend, there is weak evidence of non-linearities.

A woman born in 1970 is 14 percentage points more likely to become a single mother if she became pregnant while unmarried than a comparable woman born in 1955. This increase corresponds to decreases in the incidence of abortion, explaining about 10 percentage points, and of shotgun marriage, accounting for the remaining 4. These differences are larger in the second part of the sample period: a woman born just 5 years later is 8 additional percentage points more likely to have an out-of-wedlock birth if she became pregnant before marriage, corresponding with being 2 percentage points less likely to obtain an abortion and 6 percentage points less likely to have a shotgun wedding. Women born in later years opt more often to become single mothers after an out-of-wedlock pregnancy, signalling that they may be facing worse perspectives in case of marriage, or better perspectives in its absence. The improvement in the perspectives in absence of marriage would be explained by an improvement in the situation of single mothers, rather than by a decrease in the cost of abortion, since the prevalence of this outcome is also decreasing.

These trends control for the level of planning of the pregnancy and the woman's attitude toward contraception, but it may be the case that these features have affected how post-pregnancy outcomes evolved by cohort. The middle and bottom panels of Table 4 present the results for the subsamples of unplanned pregnancies and of pregnancies to contraceptive users. The probability of an unmarried woman's unplanned pregnancy becoming an out-of-wedlock birth increased at a similar rate, 1.4 percentage points per year, than when all pregnancies were considered. However, this upward trend appears to be compensated by a decrease in the incidence of abortion (1.0 percentage point per year), and by a much smaller decrease in the incidence of shotgun marriage, whose probability is only reduced by 0.4 percentage points per year, a decrease which fails to be significant. The selection of this sample ensures that all pregnancies included were not actively sought, but it may be the case that unobservable characteristics of

women who experienced this type of pregnancy are changing by cohort. In the entire sample, unplanned pregnancies are negatively correlated with a shotgun marriage, but the less pronounced trend suggests that women may be more likely to actively seek a premarital birth, while post-pregnancy marriage still operates up to a certain point as an insurance mechanism for those women who choose not to seek an abortion.

On the other hand, there are no differences in trends for women who use modern contraceptive methods early in their lives. Contraceptive users are more likely to seek an abortion than non-contraceptive users, but the trends by year of birth in outcomes after an out-of-wedlock pregnancy did not differ significantly.

Table 4 goes here

Table 5 presents the marginal effects of personal characteristics on different outcomes for the sample including all first pregnancies. Again, the omitted category is becoming a single mother. Although the trend over time is significantly smoother, on average, women who experienced an unplanned pregnancy are 7.2 percentage points less likely to have a shotgun wedding, and 8.6 percentage points more likely to seek an abortion. The impact on the probability of becoming a single mother is not statistically significant. Contraceptive users are also more likely to opt for an abortion after an out-of-wedlock pregnancy (by 3.9 percentage points), but effects on other outcomes fail to be significant. Women who use contraception might have a more positive attitude towards birth control in general (or a lower cost of abortion) and may be more willing to seek an abortion, rather than become single mothers or accept an offer of marriage.

Conditional on out-of-wedlock pregnancy, African-American women are 15 percentage points less likely to choose a shotgun marriage than whites or women from other ethnicities, but this decrease is compensated by increases in the probability of becoming single mothers, with no significant differences in the incidence of abortion. On the other hand, Hispanic women are less likely to choose abortion, even after controlling for religion, opting more frequently to become single mothers. Other personal characteristics are also correlated with the outcomes after an out-of-wedlock pregnancy in the expected manner. For example, Protestants are less likely to obtain an abortion and more likely to go through with a shotgun wedding, and women with more educated mothers are more likely to seek an abortion and less likely to become single mothers or marry their partners than daughters of high school dropouts.

Finally, the probability of becoming a single mother increases with age at pregnancy. A woman is around 2.6 percentage points more likely to choose single motherhood per year of age. As in the cohort trends, the increase comes from both decreases in the incidence of abortion (1.1 percentage points per year of age) and shotgun marriage (1.5 percentage points).

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Table 5 goes here

5   Contraceptive use and post-pregnancy alternatives

Post-pregnancy alternatives appear to have substantially changed over time, with new cohorts facing worse expected outcomes in case of marriage or better perspectives in its absence. These trends are significantly different if the pregnancy was unplanned, but not depending on the woman's attitudes towards contraception. Nevertheless, modern contraceptive methods may also have had a second order effect in post-pregnancy alternatives through its generalization, as previously proposed in the literature. For instance, Akerlof et al. (1996) argued that the widespread adoption of modern contraceptive methods harmed the possibility of obtaining an acceptable promise of marriage for women who choose to seek one. This section explores whether the dissemination of the pill played a significant role in the trends documented above, which already take into account the woman's own contraceptive use.

To identify this channel, I take advantage of the existence of differentiated marriage markets, or, more precisely, markets of "premarital sexual intercourse". Differences in adoption of modern contraception across markets will allow identification of the effect of increased modern contraceptive use. There is a large sociological literature studying the tendency of individuals to marry within their social group, or to marry people with similar characteristics, such as race, religion, education, or socioeconomic status (Schoen and Wooldredge 1989, Kalmijn 1991, Blackwell 1998).[17] Dating or cohabiting couples might however diverge from the homogamy pattern that appears in married couples. Blackwell and Lichter (2004) use data from the 1995 NSFG to estimate educational, racial and religious homogamy through different degrees of commitment: dating couples, cohabiting couples and married couples. Here, dating is defined broadly to include sexual activity among a non-cohabiting couple. Both Catholics and Protestants are at least four times more likely to be dating, cohabiting or married to a partner with the same beliefs, and homogamy is even stronger for people of other religious backgrounds. Couples match strongly on race, with African-Americans being 46 times more likely to be involved in a dating relationship with another African-American than other ethnicities. Similarly, all types of couples match strongly on education, especially at both ends of the educational distribution: high school dropouts and individuals with a graduate degree.

Therefore, when engaging in premarital sexual intercourse (either in a dating relationship or during a cohabitation), individuals are likely to look for partners within a set of demographic

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[17]Various explanations have been proposed for this phenomenon (Kalmijn 1998), such as the preference of individuals for certain characteristics in a spouse, the influence of the social group they belong to, or the constraints of the marriage market in which they are searching for a spouse.

characteristics. If the extent of modern contraceptive use determines the bargaining power of a woman for a promise of marriage or a transfer within marriage, the relevant level of birth control use in each case will be one of women sharing the pertinent characteristics.

Empirical strategy

In order to obtain a measure of the market level of contraceptive use, whether a woman can be classified as a contraceptive user is regressed on female characteristics that determine the "pre-marital sexual intercourse" market: race, religion, education (proxied by maternal education) and year of birth. The equation to estimate is

$$C_i = \pi_0 + D_i \pi_1 + X_i \Pi + \epsilon \tag{3}$$

where C_i takes value 1 if the woman was an "contraceptive user", D_i is year of birth, and X_i are other personal characteristics. The predicted value of contraceptive use, $\hat{C}$, will be used as the measure of use in the relevant "premarital sexual intercourse" market, and it is included in a multinomial logit regression, similar to the one described in the previous section, with the non-linearity of the probit allowing for identification. Standard errors in the second stage are corrected for the inclusion of a predicted variable (Murphy and Topel 1985). In this case, the trends obtained will measure changes by cohort in each of the outcomes when the level of modern contraceptive use is kept constant.

Results

The estimates for the level of contraceptive use by "premarital sexual intercourse" market are presented in Table 8 in the Appendix. As expected, the variables included in the specification are strongly significant,[18] but the measures of goodness of fit are small. For different specifications, the Pseudo-R^2 goes from 0.08 to 0.15, and the correlation between actual and predicted use goes from 0.30 to 0.39. Unfortunately, there is no other data containing information on contraceptive use and women's characteristics for such a long period of time, and the covariates included in the NSFG are only able to explain a small part of the variation in contraceptive use. However, the effects of the predicted use is robust to different specifications, and so are the results relating to the trends once the level of market use is controlled for. For simplicity, the predicted value of use included in the estimation corresponds to the specification including a linear trend in the woman's year of birth for the restricted definition of modern contraception.

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[18]For instance, later cohorts are more likely to use contraception, by 0.9 percentage points per year; white women are more likely to be contraceptive users, as are daughters of women with higher education.

Figure 2 presents the impact of controlling for the market level of contraceptive use in the estimated trends of post-pregnancy alternatives. The solid lines show the evolution by cohort of the incidence of single motherhood, shotgun marriage and abortion, controlling for personal characteristics and own contraceptive use, corresponding to the results presented in Table 4. The dashed lines present the trends in outcomes by cohort when the level of contraceptive use at the "premarital sexual intercourse" market is differenced out. The increase in single motherhood is even more pronounced in this case, suggesting that, had contraceptive use not increased, the observed rise would have been larger. Furthermore, this increase would have been explained by a further drop in the incidence of shotgun marriage, particularly for women born in the second half of the sample period. On the other hand, the trend in abortion would have been significantly smoother, with a decrease of only 0.4 instead of 0.8 percentage points.

Figure 2 goes here

Table 6 presents the results for this estimation. As it can be inferred from the graphs, the increase in the incidence of single motherhood per year of birth would have risen from 1.5 to 1.9 percentage points. The trend in shotgun marriage would have been much steeper, going from 0.7 to 1.5 percentage points of decrease per year of birth. A woman born in 1975 is around 28.5 percentage points more likely to become a single mother than a comparable woman born in 1955 in this estimation, while it was only 22.6 when the market level of contraception was not taken into account. However, this difference is even more pronounced in the second part of the sample period: in only five more years, the gap between both estimations increases from 6 to 10 percentage points.

The level of use of modern contraceptive methods in a woman's market for "premarital sexual intercourse" appears to influence the trends in post-pregnancy outcomes. Alternatives are not only affected by the woman's own contraceptive choice, but also the choice of women with similar characteristics. As it is shown in Table 8, younger cohorts are more likely to be classified as modern contraceptive users, suggesting that the dissemination of the use of modern contraceptive methods contributed to slowing down increases in the incidence of single motherhood after an out-of-wedlock pregnancy. Furthermore, the decreasing trend in shotgun marriages would have been significantly steeper.

On the other hand, the trend in abortion after an out-of-wedlock pregnancy had been much smoother if the level of contraceptive use would have not increased by cohort. This may suggest that women in markets where abortion is more costly, the rate of contraception adoption has been consistently higher. This potential explanation would be consistent with the lack of effect of the market level of contraception in the trend for abortion in the case of unplanned pregnancies. Contraceptive users, on the other hand, do not present a particular pattern.

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Table 6 goes here

6 Discussion

Although the consequences of growing up with a single parent are still subject to debate, the increase in single-headed households in the U.S., and the high level of poverty they suffer has raised significant concern amongst economist and policy makers over the last decades. Increases in out-of-wedlock births, which went from being a rare event to a common one, account for a significant share of this trend.

Changes in the probability of conception occurring outside of marriage explain part of the trend in illegitimacy. Even with absolutely no changes in the choices faced after such a pregnancy, the probability of having a birth outside of marriage would have risen significantly. Over the sample period being considered, a woman was on average around 0.9 percentage points more likely to be unmarried when she became pregnant for the first time than a woman born the previous year, even after controlling for age at pregnancy and personal characteristics. This trend is accompanied by increases in the rate of modern contraceptive use, which is also higher for later cohorts. Increases in the probability of engaging in premarital sexual intercourse might account for this increase, as well as changes in the relative cost of single motherhood that could have made this choice more attractive for women. Nevertheless, the probability of being single at first birth increased at a significantly faster rate. On average, a woman was 1.4 percentage points more likely to be single when she became a mother than a comparable woman born a year earlier. Therefore, this trend is also driven by changes in the choices taken after the pregnancy occurred.

The probability of becoming a single mother after an out-of-wedlock pregnancy substantially increased for the cohorts included in the analysis, corresponding with decreases in the incidence of abortion and shotgun marriage. This trend is not driven by unplanned pregnancies or women who choose not to use contraception, with those groups presenting the same probability of going through with a shotgun marriage, although a different probability of seeking abortion.

Changes in the welfare system relating to single mothers might be responsible for the increase. However, this is unlikely: the trends over time in overall expenditure in Aids to Families with Dependant Children (ADFC), or Temporary Aid for Needy Families (TANF) later on, are not parallel with the path of single motherhood. While the probability of being single at first birth increased for women born during the entire sample period, the amount spent in welfare has substantially decreased since 1975 (Scholz, Moffitt and Cowan 2009). However, the reduction in the number of recipients of the program did not occur until the Personal Responsibility and

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Work Opportunity Reconciliation Act (PRWORA) in 1996. This reform would operate against the trend observed even for women born later in the sample period, since it entails restriction in the access conditions to welfare and a limitation in the number of years that a woman can benefit from it.[19] Additionally, studies using variation across states in the generosity of the benefits only find a small effect on single motherhood (Moffitt 1995).

Several theories have been proposed in the literature regarding the channels through which modern contraceptive methods and its spread may affect post-pregnancy alternatives, in particular regarding the decline in shotgun marriages. Akerlof et al. (1996) argue that the ability to control fertility through abortion and contraception reduced shotgun marriage, immiserizing women who wanted to bear children. The reduction in the probability of an unplanned birth deteriorated their competitive position prior to the pregnancy and their ability to bargain for a promise of marriage. The impact of contraception operates as a decrease in the supply of eligible males, since this new technology created more opportunities for men to engage in sexual intercourse without offering a promise of marriage, and therefore reduced the fraction of men willing to get married in case of pregnancy.

However, in the data, the reduction in the incidence of shotgun marriage is stronger when the level of market contraception is taken into account, contrary to what would be expected if the spread of modern contraception caused a decrease in quality of the offer of marriage. Chiappori and Oreffice (2008) take into account that the reduction in the probability of unwanted pregnancies did not only occur during premarital sexual intercourse but also within a marriage or cohabitation. They proposed a marriage market model of frictionless matching, in which men who enjoy children need to compensate the woman for the cost of childbearing. In this context, men are no longer able to take advantage of unplanned births to derive costless utility from children, and therefore they face a higher expected compensation for a child with the new contraception technology.[20]

Neither own contraceptive behavior or the market level of use are able to fully explain the sharp decrease in the incidence in post-conception marriage, suggesting that other mechanisms affecting marriage, abortion or single motherhood may play key roles in the trends presented here. However, the steeper increasing trend in out-of-wedlock births and decreasing shotgun marriage when changes in market level contraceptive use are controlled for suggests that the spread of modern contraceptive methods may have contributed to improve the woman's bar-

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[19]The second order effect found by Bitler, Gelbach, Hoynes and Zavodny (2004), which would cause women to marry less because they have joined the labor market due to the PRWORA requirements and are less in need of the income provided by the husband, does not apply here, since the sample is restricted to first pregnancies, and therefore, to women who would have not been in welfare themselves before.

[20]Both mechanisms require the existence of women's bargaining ability prior to the coming of modern contraception, which will not be the case if there is a shortage of eligible males in either case.

gaining position.

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The shadow areas correspond to the 95% confidence interval of the trend on the marginal estimates for woman's year of birth. The first stage probit estimation controls for woman's characteristics.
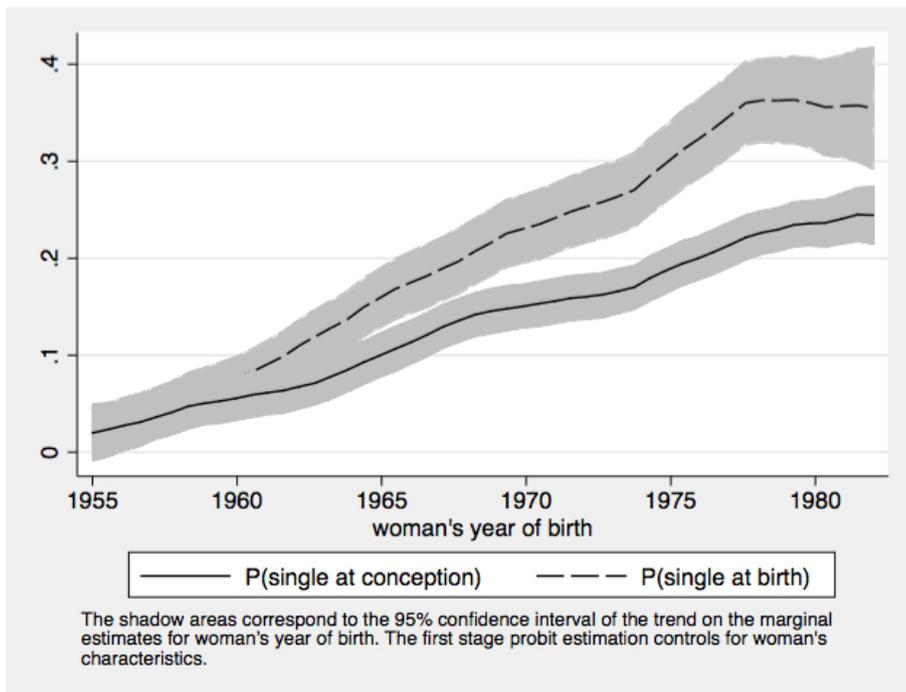
Figure 1: Trend in out-of-wedlock conceptions and births.

Single Motherhood

Shotgun Marriage

Abortion

The shadow areas correspond to the 95% confidence interval of the trend on the marginal estimates.
The first step multinomial logit controls for woman's characteristics.

Only controlling for own contraceptive use

Controlling for own and market contraceptive use
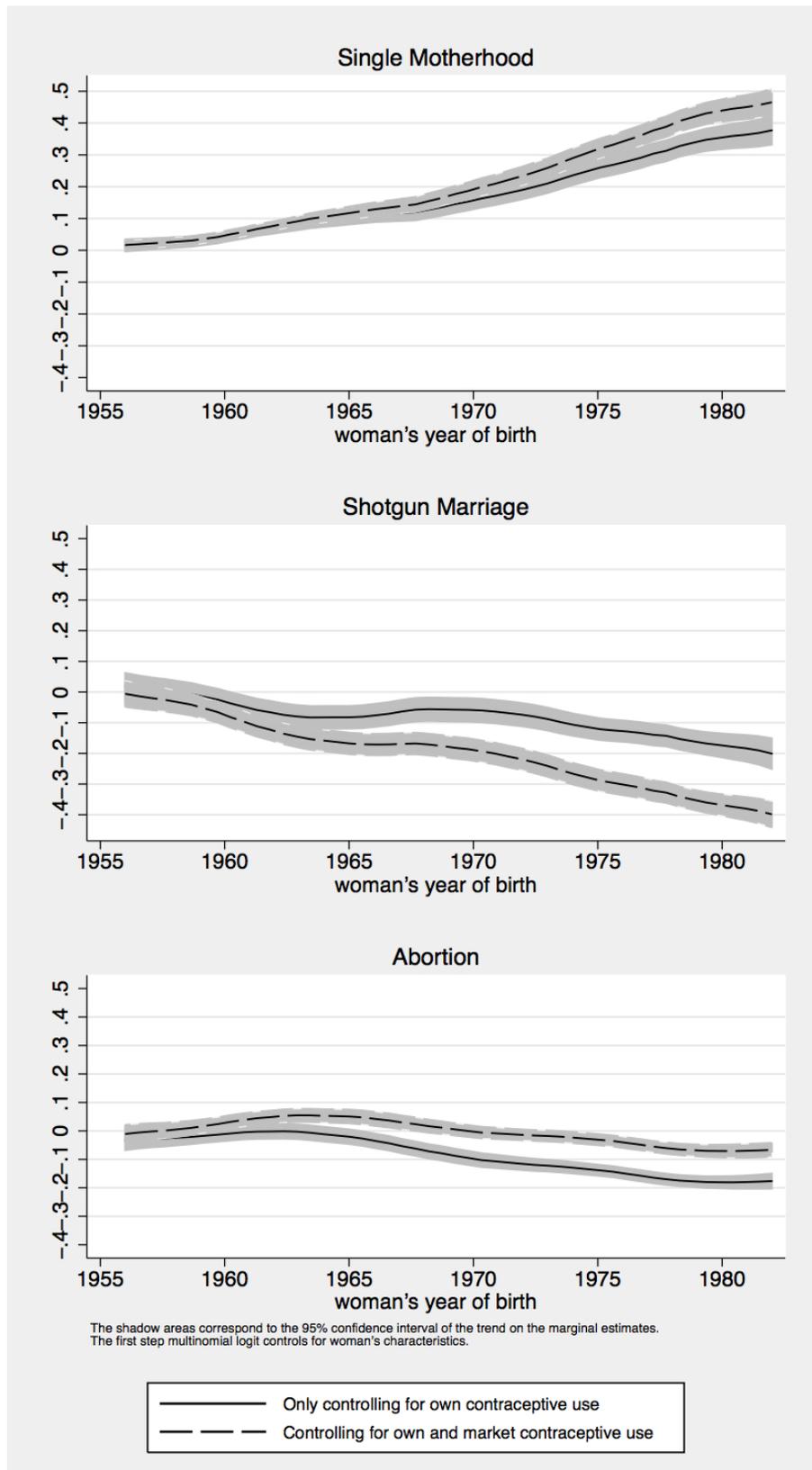
Figure 2: Trends in outcomes after an out-of-wedlock pregnancy.

| | All women | First pregnancies (to women aged 16 and over) | | | |
| | | All | Unplanned | Contraceptive users | Out-of-wedlock |
	(1)	(2)	(3)	(4)	(5)
Year of birth	1969.661	1968.316	1969.051	1969.117	1969.445
	(7.919)	(7.194)	(7.232)	(7.060)	(7.259)
White	0.662	0.626	0.680	0.641	0.563
	(0.473)	(0.484)	(0.466)	(0.359)	(0.496)
African-American	0.141	0.147	0.157	0.152	0.211
	(0.348)	(0.354)	(0.363)	(0.359)	(0.408)
Hispanic	0.144	0.170	0.121	0.157	0.173
	(0.351)	(0.376)	(0.327)	(0.364)	(0.378)
Catholic	0.340	0.346	0.311	0.328	0.340
	(0.474)	(0.476)	(0.463)	(0.469)	(0.474)
Protestant	0.510	0.514	0.546	0.530	0.523
	(0.500)	(0.500)	(0.498)	(0.499)	(0.500)
Education	13.304	12.989	13.132	13.077	12.615
	(2.610)	(2.496)	(2.379)	(2.449)	(2.323)
Maternal education					
High school dropout	0.266	0.315	0.257	0.295	0.319
	(0.442)	(0.465)	(0.437)	(0.456)	(0.466)
High school graduate	0.381	0.387	0.406	0.392	0.391
	(0.486)	(0.487)	(0.491)	(0.488)	(0.488)
Some college	0.186	0.165	0.195	0.177	0.165
	(0.389)	(0.372)	(0.397)	(0.382)	(0.372)
College graduate	0.161	0.127	0.138	0.130	0.116
	(0.368)	(0.333)	(0.345)	(0.337)	(0.321)
Contraceptive user	0.816	0.815	0.825		0.822
	(0.387)	(0.388)	(0.380)		(0.382)
Unplanned		0.286		0.290	0.365
		(0.452)		(0.454)	(0.481)
Year of pregnancy		1989.674	1989.596	1990.462	1989.214
		(7.873)	(7.809)	(7.666)	(7.808)
Age at pregnancy outcome		21.359	20.546	21.345	19.770
		(3.784)	(3.358)	(3.763)	(2.987)
Never married at conception		0.602	0.767	0.607	
		(0.490)	(0.422)	(0.488)	
Observations	31078	16881	4810	13240	10874

Sample averages and standard deviations. The "all women" sample includes all women who ever had sexual intercourse. A pregnancy is considered unplanned if the woman was using any type of contraception before pregnancy and did not stop its use. A woman is considered a contraceptive user if the first contraceptive method she ever used was highly effective and she used it before age 25.

Table 2: Trends in out-of-wedlock fertility: probability of a women being single at first pregnancy and birth

	P(single at conception)	P(single at birth)
	(1)	(2)
All pregnancies		
Year of birth	0.009***	0.014***
	(0.001)	(0.001)
N	16881	12113
Unplanned pregnancies		
Year of birth	0.010***	0.019***
	(0.001)	(0.001)
N	4810	3036
Pregnancies to contraceptive users		
Year of birth	0.009***	0.014***
	(0.001)	(0.001)
N	13240	9451

Robust standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5% and * at 10%. The estimates correspond to the 2nd stages of regressing the marginal effects of a series of year of birth dummies on a linear trend. The first stage (probit estimation) controls for race, religion, maternal education, survey year, and dummies for age at pregnancy. Top panel also controls for contraceptive use and planning of the pregnancy. The trend of year of birth is set to 0 at 1950.

Table 3: Impact of characteristics on out-of-wedlock fertility (probit marginal effects)

	P(single at conception)	P(single at birth)
	(1)	(2)
Unplanned pregnancy	0.149***	0.077***
	(0.011)	(0.015)
Contraceptive user	-0.028**	-0.010
	(0.012)	(0.016)
White	-0.028	-0.061**
	(0.025)	(0.030)
African-American	0.233***	0.304***
	(0.028)	(0.033)
Hispanic	-0.049*	-0.010
	(0.027)	(0.033)
Protestant	-0.015	-0.008
	(0.016)	(0.021)
Catholic	0.054***	0.039*
	(0.017)	(0.022)
Mother HS graduate	0.045***	0.015
	(0.013)	(0.016)
Mother some college	0.034**	0.018
	(0.016)	(0.022)
Mother college graduate	0.048***	-0.020
	(0.017)	(0.022)
Age at pregnancy	-0.092***	-0.080***
	(0.009)	(0.006)
(Age at pregnancy)^2	0.002***	0.002***
	(0.001)	(0.000)
N	16881	12113

Robust standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5% and * at 10%. Age at pregnancy starts at 15, and the estimates reported correspond to a quadratic trend on the marginal estimates of a series of dummies. The probit estimation also controls for year of birth of the respondent, absence of mother figure, and survey year.

Table 4: Trends in outcomes after an out-of-wedlock conception

	Shotgun marriage (1)	Abortion (2)
All pregnancies		
Year of birth	-0.007***	-0.008***
	(0.001)	(0.001)
N	9581	9581
Unplanned pregnancies		
Year of birth	-0.004	-0.010***
	(0.002)	(0.002)
N	3332	3332
Pregnancies to contraceptive users		
Year of birth	-0.007***	-0.008***
	(0.001)	(0.001)
N	7546	7546

Robust standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5%, and * at 10%. The estimates correspond to the second stage of regressing the marginal effects of a series of year and age dummies on linear trends. The first stage (multinomial logit estimation) controls for contraceptive use, level of planning of pregnancy, age at pregnancy, race, religion, maternal education, absence of mother figure for the respondent, and survey year. The trend of year of birth is set to 0 at 1950.

Table 5: Marginal effects of characteristics after a conception out-of-wedlock (multinomial logit estimation)

	Shotgun marriage	Abortion
	(1)	(2)
Unplanned	-0.072***	0.086***
	(0.018)	(0.015)
Contraceptive user	-0.030	0.039**
	(0.022)	(0.018)
White	-0.008	0.053
	(0.043)	(0.035)
African-American	-0.149***	-0.040
	(0.044)	(0.037)
Hispanic	0.012	-0.082**
	(0.046)	(0.039)
Protestant	0.126***	-0.104***
	(0.027)	(0.021)
Catholic	0.059*	-0.024
	(0.030)	(0.024)
R's mother high-school graduate	-0.085***	0.137***
	(0.020)	(0.018)
R's mother some college	-0.125***	0.193***
	(0.027)	(0.022)
R's mother college graduate	-0.169***	0.283***
	(0.029)	(0.022)
Age at pregnancy	-0.015**	-0.011***
	(0.005)	(0.003)
N	9581	9581

Robust standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5% and * at 10%. Age at pregnancy starts at 15, and the estimates correspond to the trend on the marginal estimates from a series of dummies. The multinomial logit estimation includes dummies for year of birth, as well as survey dummies, and control for absence of the woman's mother figure.

Table 6: Trends in outcomes after an out-of-wedlock conception, controlling for contraceptive market use

	Shotgun marriage	Abortion
	(1)	(2)
All pregnancies		
Year of birth	-0.015***	-0.004***
	(0.001)	(0.001)
N	9581	9581
Unplanned pregnancies		
Year of birth	-0.009***	-0.011***
	(0.002)	(0.002)
N	3332	3332
Pregnancies to contraceptive users		
Year of birth	-0.014***	-0.003**
	(0.001)	(0.001)
N	7546	7546

Robust standard errors reported in parentheses. *** denotes significance at 1%, ** at 5%, and * at 10%. The estimates correspond to the second stage of regressing the marginal effects of a series of year and age dummies on linear trends. The first stage (logit estimation) controls for contraceptive use, level of planning of pregnancy, age at pregnancy, race, religion, maternal education, absence of mother figure, and survey year. The trend of year of birth is set to 0 at 1950.

Appendix

Table 7: Independence of Irrelevant Alternatives

| | Birth v. shotgun marriage | | Birth v. abortion | |
	Multinomial logit	Mlogit no abortions	Multinomial logit	Mlogit no shotgun marriages
Unplanned	0.063	0.050	-0.482***	-0.502***
	(0.060)	(0.062)	(0.069)	(0.069)
Contraceptive user	0.010	0.028	-0.229**	-0.174*
	(0.078)	(0.080)	(0.092)	(0.095)
White	-0.218*	-0.257*	-0.484***	-0.555***
	(0.129)	(0.132)	(0.154)	(0.154)
African-American	1.271***	1.297***	1.173***	1.134***
	(0.134)	(0.137)	(0.164)	(0.163)
Hispanic	0.341**	0.352**	0.753***	0.708***
	(0.141)	(0.144)	(0.175)	(0.175)
Catholic	-0.298***	-0.314***	-0.072	-0.021
	(0.096)	(0.099)	(0.106)	(0.106)
Protestant	-0.362***	-0.356***	0.374***	0.377***
	(0.087)	(0.089)	(0.097)	(0.098)
Mother HS graduate	-0.104	-0.144**	-0.917***	-0.907***
	(0.068)	(0.069)	(0.086)	(0.087)
Mother some college	-0.115	-0.066	-1.268***	-1.291***
	(0.087)	(0.089)	(0.105)	(0.105)
Mother college graduate	-0.270**	-0.315***	-1.936***	-1.927***
	(0.109)	(0.111)	(0.121)	(0.121)
N	9581	7180	9581	7852
χ^2	61.39		62.59	
p-value	0.390		0.350	

Robust standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5% and * at 10%. All specifications include dummies for woman's year of birth and age at pregnancy.

Table 8: Modern contraceptive use: marginal effects of personal characteristics

	Restricted definition		Broad definition	
	(1)	(2)	(3)	(4)
White	0.360***	0.356***	0.513***	0.511***
	(0.064)	(0.064)	(0.069)	(0.068)
African-American	0.356***	0.353***	0.457***	0.456***
	(0.069)	(0.069)	(0.074)	(0.073)
Hispanic	0.047	0.037	0.186**	0.179**
	(0.070)	(0.070)	(0.076)	(0.075)
Protestant	0.112***	0.111***	0.068	0.065
	(0.042)	(0.042)	(0.047)	(0.046)
Catholic	0.015	0.019	-0.059	-0.056
	(0.044)	(0.044)	(0.049)	(0.049)
R's mother high school graduate	0.135***	0.136***	0.199***	0.201***
	(0.033)	(0.033)	(0.035)	(0.035)
R's mother some college	0.206***	0.208***	0.237***	0.240***
	(0.040)	(0.040)	(0.045)	(0.045)
R's mother college graduate	0.162***	0.161***	0.177***	0.176***
	(0.043)	(0.043)	(0.048)	(0.048)
Year of birth	0.027***		0.037***	
	(0.002)		(0.002)	
N	31078	31078	31078	31078
Year of birth dummies	✗	✓	✗	✓
Goodness of fit				
Pseudo-R^2	0.078	0.080	0.125	0.128
Corr(use, $\hat{use}$)	0.314	0.316	0.391	0.392

Standard errors are reported in parentheses. *** denotes significance at 1%, ** at 5% and * at 10%. All specifications control for year of survey to control for age composition of the sample, which includes all women who ever had sexual intercourse. Broad definition of modern contraception includes the pill, injectables, implants and barrier methods, such as condoms and diaphragm, while the restricted definition excludes barrier methods.