The Pill and the College Attainment of American Women and Men*

Heinrich Hock†

Florida State University

October 9, 2007

Abstract

This paper considers the educational consequences of the increased ability of young women to delay childbearing as a result of the birth control pill. In order to identify the effects of the pill, I utilize quasi-experimental variation in U.S. state laws governing access to contraception among female adolescents during the 1960s and 1970s. Inference based on these laws indicates that unconstrained access to the pill increased female college enrollment rates by over 2 percentage points and reduced the dropout rate by over 5 percentage points. Further, early pill access led to a rise in college completion of approximately three quarters of a percentage point among women over the age of thirty. Finally, I analyze the outcomes of men in relation to the contraceptive laws, finding evidence that male educational opportunities also improved due to reductions in undesired early fertility among their female partners.

JEL Classification Numbers: I21, J13, N32, N42

* This work was funded in part through an NICHD training grant, administered through the Population Studies and Training Center at Brown University, for which I am very grateful. I would like to thank Joshua Angrist, Andrew Foster, Rachel Friedberg, Delia Furtado, Isaac Mbiti, Sarah Turner, Dietrich Vollrath, and, especially, David N. Weil for their many useful comments and suggestions. This paper has also benefited from the constructive criticism provided by participants at workshops at Brown University, Florida State University, and the University of Connecticut, as well as the 2006 annual meetings of the Population Association of America and the Society of Labor Economists. Elizabeth Nash at the Allan Guttmacher Institute was very helpful in clarifying a number of legal questions regarding minors' access to contraception, and Pamela Dowd provided excellent research assistance. Any errors are, of course, my own.

†Department of Economics, 288 Bellamy Bldg., Florida State University, Tallahassee, FL 32308-2180. Tel: 850-644-1737. E-mail: hhock@fsu.edu

1 Introduction

Oral contraception was introduced in the United States in 1960, and within two years 1.2 million prescriptions were sold. The birth control pill had become the leading form of contraception by 1965, and at the end of the decade it was used by more than one out of five married American women of reproductive age (Westoff and Ryder, 1977). By the late 1980s approximately 80 percent of all women in their reproductive years had used oral contraceptives at some point in their lives (Dawson, 1990). The rapid diffusion and widespread use of the pill reflects the unprecedented degree of autonomy and control it offered women over their reproductive lives, particularly with respect to the timing of their fertility. In this paper, I consider educational consequences of the increased ability of women to defer childbearing resulting from access to the pill.

Early fertility can alter the set of human capital accumulation opportunities available to a woman. Child-rearing is time-consuming and is spread out over a number of years after a child is born. Consequently, many women may find it optimal to delay childbearing to later stages of the lifecycle and undertake career investments first.[1] As highlighted by Goldin and Katz (2002), in a world of imperfect fertility control, young women desiring to invest in their careers must choose between two second-best scenarios. They must either forgo sexual activity or run a substantial risk of an early pregnancy, which could mean delaying or forgoing human capital investments. After the pill became widely available one would expect to see more women attaining a first-best outcome in which they were able to both be sexually active and undertake early career investments. Goldin and Katz found that career investments increased due to adolescent contraceptive access in a sample of college gradutes, women who were more likely to have forgone sexual activity without access to the pill. My focus is essentially on women in the other second-best outcome if the pill were not available. Sexually active adolescent women would have been better able to avoid early fertility upon the introduction of the pill, and so able to attend and complete college.

[1] This pattern is consistent with the theoretical results of Mullin and Wang (2002), who develop a dynamic general equilibrium model of fertility timing and human capital investment. It also might arise from the notion that if learning ability diminishes over the lifecourse, as Weinberg's (2004) results might suggest, human capital investments should be undertaken as early in life as possible.

In this paper, I find a strong and significant increase in female college attainment due to the pill, an effect that seems to persist over the lifecourse. Further, my results indicate that the most significant impact of the pill came through reductions in the college dropout rate, which suggests that declining early fertility was the proximate link between early contraceptive access and increases in educational attainment. An indirect least squares comparison of my results with existing estimates of the effect of the pill on early fertility (Bailey 2006, Ananat and Hungerman 2007) further corroborates this.[2] Finally, I also take some first strides toward understanding the effects of female fertility on the educational attainment of their male partners. While the direct effect of the pill was female-specific, I find evidence of a strong *indirect* effect on male educational attainment attributable to its impact on female fertility. This represents a novel contribution to the literature on the consequences of early fertility.

Inference based on actual use of the pill is likely subject to substantial self-selection biases. As a result, my analysis relies on differences among young women in their *access* to oral contraceptives. In particular, I utilize quasi-experimental variation in state laws governing consent for medical and family planning services during the 1960s and 1970s. The framework is similar to that employed by Goldin and Katz (2002), as well as by Bailey (2006), who analyzes the effects of the pill on female labor supply. The panel of legal changes that I have constructed represents a substantially broadened and updated set of measures as compared to that used in previous research.

The remainder of the paper proceeds as follows. Section 2 describes the changes to adolescent contraceptive consent laws during the 1960s and early 1970s, arguing that they can be used to identify a causal effect of the pill. I also recapitulate the existing evidence on how these legal changes affected early fertility for later comparison with the empirical results of the paper. In Section 3, I estimate the impact of access to oral contraceptives on the rates of college enrollment and dropout. Section 4 establishes that the increased enrollment rates due to early pill access translated into persistent differences in college completion among adult American women. Section 5 shifts

[2]The recent work by Ananat and Hungerman (2007) also briefly considers the relationship between pill access and educational attainment. While they do not find a significant relationship, their focus is largely on child welfare, and the estimation framework they implement does not incorporate the richer set of controls that I employ in this paper.

the focus to men, providing evidence supporting the hypothesis that early female contraceptive access also had beneficial educational effects on their male partners. Section 6 provides additional discussion and concluding remarks.

2 Identifying the Impact of the Pill

Oral contraceptives dramatically reduced the risk of an unintended pregnancy for sexually active women. According to data from clinical trials submitted to the FDA (U.S. Food and Drug Administration, 1997), the annual contraceptive failure rate for birth control pill users is 1-2%. This represents a five-fold reduction in the likelihood of an unintended pregnancy as compared to the male latex condom. Thus, the pill represented a dramatic technology shock to the set of fertility control options available to women.

This paper is primarily interested in estimating the causal impact of this improvement in contraceptive technology on college attainment. Choices regarding sexual activity and birth control methods are jointly determined with educational aspirations. Thus, any observed correlation between the actual use of contraceptives and educational attainment might simply reflect unobserved differences between individuals in preferences and abilities. In order to assess the structural impact of the pill, my analysis relies on variation in laws governing access to contraceptives among college-age women. As argued below, the changes to these laws that occurred during the 1960s and 1970s were largely unrelated to preferences over fertility and education. This implies that the legal changes constituted a natural experiment that can be used to assess the role that the pill played in educational outcomes.

2.1 Late-Adolescent Contraceptive Consent Laws

While the pill diffused relatively quickly among adult American women, there were a number of state-imposed legal barriers that served to dampen the pace of diffusion among young single women. Oral contraceptives were initially available only by prescription from a licensed physician. Based on either common law or explicit legislation, unemancipated individuals below the age of

majority (historically 21 in most states) were required to obtain parental consent for any medical services.[3] Thus, when oral contraceptives were introduced in America, parental consent would be required for the typical young woman wanting to "go on the pill" if she were under the age of 21.

The primary measure used in this paper is the capacity of a single "late adolescent" (defined here as ages 18 to 19) to consent for contraceptives.[4] By 1977, all restrictions on the ability of such women to obtain the pill had been removed. Moreover, changes in access laws came overwhelmingly through reductions in the age of majority and the introduction of "mature minor" laws, which granted young people the right to consent for all forms of medical care. Changes of this nature, as pointed out by Bailey (2006), were not typically undertaken with the explicit intent of granting young women access to contraception. In fact, family planning legislation served as a basis for consent among late adolescent women in only three states. Instead, these changes were brought about as part of a general movement of empowering young adults, a movement that was at least partially a response to the war in Vietnam. There are, however, a few potential issues in using these legal changes as measures of access to the pill.

There is naturally the issue of salience. Goldin and Katz (2002) provide a number of pieces of cross-sectional and time-series evidence that suggest that parental consent laws were, indeed, well-correlated with actual use of the pill among adolescents. Nonetheless, the importance of these consent laws with respect to fertility outcomes is ultimately an empirical question. Employing a slightly different coding of the laws than utilized in this paper, Bailey (2006) analyzes the effects of early legal access to the pill on the likelihood of giving birth to a child before the age of 22. Her estimates indicate a 7 to 9 percentage point reduction in early fertility among women residing in states where they would have been granted early legal contraceptive access. While Bailey's approach considers cohort fertility, Ananat and Hungerman (2007) consider the effects of early pill access on the period fertility of 14 to 20 year-old women over the 1960s and 1970s. Their estimates indicate that contraceptive access led to a reduction in the annual birth rate of 8.8 children

[3] While marriage served to emancipate minors in many states, this was not universally the case. Further, data from the U.S. Census (Ruggles et al., 2004) indicate that in 1960 only 41% of women were married at the age of 19.

[4] Appendix A describes the evolution of laws governing access to contraceptives across the states in detail, as well as the sources used to construct these measures.

per thousand young women. Based on my calculations this potentially explains approximately one fifth of the secular decline in the teenage birth rate during the period in question. Thus, there is strong reason to believe that the consent laws detailed above actually mattered a great deal in terms of early fertility.

The remaining two concerns have to do with the validity of the legal changes described above in the natural experiment setting. The first concern stems precisely from the argument that contraceptive consent was a by-product of the youth movement of the 1960s and 1970s. It is possible that states with a stronger anti-war sentiment might have been more swift to enact youth-empowering legislation and also had a greater proportion of men avoiding the draft via schooling deferments. This, in turn, might have encouraged a greater proportion of females to remain in school as well.[5] To address this issue, I incorporate direct and indirect measures of draft-avoidance behavior across states into my estimation framework, finding that their inclusion has little impact on the results.

Second, early access to the pill was the result of changes in laws governing the age of majority in over two-thirds of the states. As a result, in addition to contraceptive consent, adolescents might have gained additional legal privileges reserved for adults. In particular, full adulthood established the right to contract, which could affect educational opportunities through other mechanisms such as an increased ability to borrow. In Section 5, I find that the direct impact of the consent laws, as well as an alternative set of contracting-based laws, was limited to females, affecting males only indirectly through their female partners.

3 Female College Enrollment

Late-adolescent contraceptive availability is particularly relevant to human capital accumulation, as it potentially allowed women to defer childbearing during a portion of the lifecourse pivotal to education decisions. Given that most women had unconditional access to the pill by the age of 21,

[5] I am grateful to Joshua Angrist and Sarah Turner for bringing this point to my attention.

this paper considers the outcomes of women at or above that age to achieve maximal differentiation. In this section I limit the analysis to the enrollment patterns of 21 to 22 year-old women who, if enrolled, would be likely in their final years of college. In Section 4, I consider the patterns of college completion among older women.

Figure 1 plots the rate of college enrollment of 21 to 22 year-old American women between 1969 and 1979, based on data from the October Current Population Survey.[6] The fastest rate of growth occurred between 1973 and 1976, which corresponds to the birth cohorts experiencing the greatest increases in late-adolescent contraceptive access. To assess the causal effects of consent laws on enrollment patterns, I utilize a differences-in-differences (DD) approach.

3.1 Estimation Framework

Consider a woman i who lived in state s during late adolescence and turned age $a \in (21, 22)$ during year t. Her school enrollment status (E) could be specified according to

$$\Pr\left(E_{iast} = 1\right) = F\left(\mu_t + \mu_{as} + \gamma'_{as}t + \delta' X_i + \beta P_{ast} + \theta' R_{ast}\right) , \tag{1}$$

where $F\left(\cdot\right)$ is a cumulative density function, μ_t is a vector of year fixed effects, and μ_{as} is a set of state fixed effects for each age. Smooth evolution of the age-specific unobservables affecting schooling decisions is captured by a series of state-specific trends, $\gamma'_{as}t$, while X_i consists of racial indicators. The variable P_{ast} is a binary variable indicating an affirmative late-adolescent contraceptive law in state s at the beginning of the year in which the woman turned 18, with β representing the coefficient of interest.

The vector R_{ast} accounts for other changes to reproductive law affecting adolescents that occurred during the 1960s and 1970s (see Appendix A for a full discussion). The specific measures included in R_{ast} are: (a) indicators for legalized contraception and legalized abortion in state s at the beginning of the years in which a sample woman turned 16, 18 and 21; (b) indicators for the

[6] All Current Population Survey data used in this paper are drawn from the Unicon (2005) distribution. In Figure 1, a 3-year moving average is applied to smooth year-to-year fluctuations.

capacity of a woman living in state s to have consented for abortion at the beginning of the years in which she turned ages 16 and 18; and (c) an indicator of the ability of a woman living in state s to have unrestricted access to contraceptives at the beginning of the year in which she turned age 16. These additional changes to reproductive law might, in principle, offer additional sources of variation to assess the impact of fertility control on the human capital investments of young women. However, with the exception of legalized abortion, it is difficult to justify them as quasi-experimental in nature, and the primary focus of this paper is on the causal effect of the pill. Hence, I include these measures to alleviate any bias in estimation, but focus on the natural experiment in late-adolescent pill access.

3.1.1 Vietnam Draft Avoidance

Due to the availability of schooling deferments we would expect to see a higher rate of male enrollment during or immediately following the peak of hostilities in Vietnam (e.g. Card and Lemieux 2001). In states with a stronger anti-war sentiment there would be greater pressure to enact youth-empowering legislation, and there would simultaneously be more intense draft-avoidance behavior. Thus, male enrollment patterns might be correlated with the timing of contraceptive access for late-adolescent females. In the presence of male-female peer effects this potentially induces an upward bias in the estimates of the impact of pill access.

To account for this possibility, I create a set of control variables that directly measure or proxy for educational responses to the Vietnam war. This vector, V_{st}, includes current value and five time lags of the following measures for each state: (a) the rate of schooling deferments per draft-age male, which directly accounts for any male-led effects on education due to the Vietnam war; (b) the change in the stock of Class III-A family deferments per draft-age male, which potentially captures the potential effect of draft-avoidance on female fertility; and (c) the number of casualties per draft-age male, which potentially proxy for sharp changes in local attitudes toward the Vietnam war (Gartner, Segura and Wilkening 1997).[7]

[7]These series were constructed from printed reports of the U.S. Selective Service System, electronic databases from the U.S. National Archives, and a combination of U.S. Census printed tables and microdata. The data and documentation are available upon request.

3.1.2 Aggregation

The Current Population Survey (CPS) is the only large-scale source of data on enrollment during the time in which most of the variation in pill access laws occurred, and hence will be used to implement the DD estimation. Using these data necessitates two small changes to the empirical specification. First, the woman's state of residence at the time of observation (r) must be used as a proxy for her residence during late adolescence (s). Second, during the early 1970s the CPS grouped together states such that it is only possible to identify 21 consistent state-groups. Using state-groups as the base geographic unit necessitates forming measures of reproductive law at a higher level of aggregation.

In particular, for each state group g, I construct $\bar{P}_{agt} = \sum_{r \in g} \pi_{rt} P_{art}$, where π_{rt} is the fraction of the 18 to 21 year-old population of group g living in state r in year t, and P_{art} is as described above.[8] To the extent that the distribution of women in the CPS state-groups is representative of the underlying population distribution, $\bar{P}_{agt}$ should provide a reasonable measure of late-adolescent pill access for the average woman aged a living in state-group g in year t. Aggregating the additional controls in a similar manner and assuming a standard normal distribution, the final estimating equation is

$$\Pr\left(E_{iagt} = 1\right) = \Phi\left(\mu_t + \mu_{ag} + \gamma'_{ag} t + \delta' X_i + \beta \bar{P}_{agt} + \theta' \bar{R}_{agt} + \omega' \bar{V}_{agt}\right) . \tag{2}$$

3.2 Results

The sample used to estimate (2) is comprised of women ages 21 to 22 drawn from the October schooling supplement to the CPS. I utilize data from 1968, the first year in which the schooling supplement was offered, through 1979. Excluded from the sample are women with allocated schooling variables (see Bollinger and Hirsch 2006), women who reported that their major activity last week was "retired" or "unable to work", and women who reported that they were not enrolled despite listing their major activity as "in school".

[8] The population weights π_{rt} are based on estimates from the U.S. Census Bureau's P-25 series of population estimates.

The first two columns of Table 1 report estimates of the impact of the pill on the gross enrollment rate with and without the measures of male draft avoidance. In both cases, the estimates are substantial and statistically significant.[9] The marginal effects indicate a 2.5 percentage point increase in the likelihood of being enrolled at ages 21 to 22 due to access to the pill as a late adolescent. This represents an increase in enrollment of almost 12%, relative to the mean. The controls for male Vietnam draft avoidance are significant predictors of female educational behavior, but their inclusion has a minimal impact on the coefficient estimates. While this pattern holds in all of the remaining specifications estimated in this paper, I retain the Vietnam-associated controls as a measure of precaution.

The remainder of Table 1 examines college enrollment, defined as attending a grade higher than 12, but not attending a CPS-defined special school. In the full sample of women, the estimated effect of pill access on college enrollment remains significant, but declines slightly in comparison to the effect on the gross enrollment rate. Still, the estimated 2 percentage point marginal effect represents an equivalent proportional increase relative to the mean. Moreover, it implies that late-adolescent pill access potentially explains up to one third of the secular increase in college enrollment depicted in Figure 1.

The third and fourth columns of Table 1 establish that the effect of the contraceptive consent laws was concentrated on precisely the single women to whom the laws should have been applicable. Late-adolescent pill access was associated with a rise in college attendance among the never-married of over 5 percentage points (p-value < 0.001). By contrast, the effect on ever-married women is very close to zero and entirely insignificant (p-value > 0.95).[10] The final two columns of Table 1 indicate that there was very little anticipatory behavior among women with respect to pill access. In the full sample of women, the estimated impact of the pill on the likelihood

[9] I report significance levels based on the the usual cluster-robust standard error correction suggested by Bertrand, Duflo, and Mullainathan (2004). Cameron, Gelbach, and Miller (2007) indicate that bootstrap methods might reduce the Type I error due to within-group error when there are fewer than 30 clusters. However, implementing the cluster robust bootstrap-t method using 1000 replications yields p-values that are actually lower than cluster-robust p-values across all specifications.

[10] Part of this effect might arise from reduced selection into marriage by career-oriented women with pill access (Goldin and Katz 2002).

of ever having attended college is economically and statistically trivial. However, contraceptive access mattered a good deal for the likelihood of staying in college. I define dropouts as women who started but did not complete a year of school. Conditional on having attended college, access to the pill reduced the dropout rate by 5.2 percentage points (p-value = 0.014), a 35% reduction relative to the mean.

Are these results plausible? Two pieces of evidence suggest that they are. First, my full-population estimates of the effects of late-adolescent contraceptive consent on enrollment fall in between the existing estimates of access to the pill on early fertility described in Section 2.1. The second piece of evidence comes from considering the local-average treatment effect (LATE) identified by the legal changes utilized in this paper. Parental consent laws were only applicable to sexually active, never-pregnant single women desiring to go to college. According 1970 U.S. Census data (Ruggles et al. 2004), approximately 83% of women were single and childless at ages 17 to 18. Data from a 1971 survey (Zelnik and Kantner 1982) indicate that approximately 45% of such young women aspired to complete college and that 35% of single college-enrolled women were sexually active at age 19. Combined, these numbers suggest that during 1970s roughly 13% of the population was potentially affected by the consent laws.

For this sub-population the legal changes generally reduced the age of consent for oral contraceptives from 21 to 18. This implies that the LATE for unwanted pregnancies would be the change in the 3-year probability of birth control failure due to changing from a condom to the pill, which amounts to 23.6 percentage points. Multiplying the LATE by the proportion of the population affected by the consent laws yields a theoretical population-level reduction in fertility of approximately 3.1 percentage points. My full-sample estimates of the marginal effect of the pill on enrollment is well within this bound. In sum, the effect sizes I obtain are quite plausible, and the results implicate an increased ability to avoid unwanted or mis-timed pregnancies as the link between the contraceptive consent laws and increased enrollment.

4 The Pill and Female College Completion

The time intensity of childrearing activities by mothers tends to decline as their children grow older (e.g., Hotz and Miller 1988). So, while there might be differences in educational attainment based on pill access among young women, the differential might dissipate as women age. In this section, I extend the basic DD framework to account for this possibility. I find that late-adolescent access to the pill was still associated with a substantial increase in the likelihood of college completion among women above the age of 30. The evidence does not support a catch-up dynamic among women without early contraceptive access, implying that the pill-induced educational gains were more or less permanent.

In my analysis I employ data from the Census Public Use Microsamples (PUMS; Ruggles et al. 2004), in which respondents are coded according to their state of birth. The birth state of a woman (b) is generally well-correlated with her state of residence at age 18 (s).[11] From the 5-percent-count PUMS samples of the 1990 and 2000 Census, I draw data on women born in America between April 1940 and April 1959. The lower bound is chosen so that the earliest birth cohort would reach the age of 20 in 1960, the year in which the pill was approved by the FDA. This minimizes inter-cohort variation in terms of the availability of the pill at age 21. The upper bound is based on a sample restriction that results from including abortion consent laws in the specification (see Appendix A). Each birth cohort is observed twice, once in 1990, at which point ages range from 31 to 49, and again in 2000 when the individuals are ten years older.

4.1 An Expanded DD Framework

To estimate the educational effects of the pill over the lifecycle, the DD estimation framework needs to be modified slightly to account for the substantial heterogeneity in age. As a starting point, consider a general DD framework that estimates the effects of pill access on some continuous measure of educational attainment H observed at a some *uniform* age $\hat{a}$ (above 21). For a woman

[11] According to data from the 1970 Census, over three fourths of late adolescent women still lived in their state of birth.

i born in state b and in year t and is observed at age $\hat{a}$, the standard DD specification would be

$$H_{ibt}^{\hat{a}} = \mu_t + \mu_b + \gamma_b t + \delta' X_i + \beta P_{bt} + \theta' R_{bt} + \omega' V_{bt} + \varepsilon_{ibt} \ . \tag{3}$$

The explanatory variables are analogous to those defined in Section (3.1) with state of birth substituted for state of residence.

In specifying the growth in H for ages a above $\hat{a}$, I include a set of common fixedeffects, λ_{ta}, for each age and year-of-birth cohort. Based on the Census data employed, each birth cohort is only observed at two ages, and there is only a small set of ages at which a cohort is observed twice. This implies that allowing λ_{ta} to vary by state is not feasible; doing so would fully identify inter-cohort variation in pill access. Consequently, I set

$$\left.\frac{dH_{iabt}}{da}\right|_{a>\hat{a}} = \lambda_{ta} + \lambda_b + \rho_b t + \sigma X_i + \psi P_{bt} + \phi' R_{bt} + \chi V_{bt} + \varepsilon_{iabt} \ . \tag{4}$$

The vector of parameters λ_b accounts for state-specific linear age deviations of growth in H from the common age-path set by λ_{ta}, capturing inter-state differences in the degree to which women are more likely to defer schooling to older ages. Further, ρ_b allows for inter-cohort drift in the state-specific slope coefficients on age. The parameter σ accounts for systematic linear differences in the age-path of education across racial groups. Finally, the reproductive laws and Vietnam controls are included to allow for lifecycle differences in the likelihood of returning to school based on differential early fertility and education outcomes. For simplicity, age effects of the control variables are assumed to be linear, although my results are robust to polynomial specifications.

4.2 Results

Estimation is based on the mean rate of college completion for each state-of-birth/year-of-birth/age cell, denoted by C_{bta} and computed using Census-provided weights for representativeness. Com-

bining equations (3) and (4), the estimating equation is

$$\begin{aligned} C_{abt} &= \mu_{ta} + \mu_b + \gamma_b t + \delta' \tilde{X}_{bt} + \beta P_{bt} + \theta' R_{bt} + \omega' \tilde{V}_{bt} \\ &\quad + \left(\lambda_b + \rho_b t + \sigma' \tilde{X}_{bt} + \psi P_{st} + \phi' R_{st} + \chi' \tilde{V}_{bt} \right) (a - \underline{a}) + \varepsilon_{iabt} \,, \end{aligned} \tag{5}$$

where $\underline{a}$ is the lowest age observed in the sample, $\tilde{X}_{bt}$ denotes the racial and ethnic composition of state/year birth cohort bt and $\tilde{V}_{bt}$ denotes a five-year moving average of the measures of draft-avoidance centered on the women's nineteenth year.[12] While $\tilde{X}_{bt}$ includes the same measures of racial status as used in the CPS estimation (African-American and "other non-white", with white as the omitted category), it has been expanded to include proportion of Hispanics in cohort bt.

The two parameters of interest are β and ψ. In this set-up, β captures the effect of the pill on college completion at age $\underline{a}$ (31 in the sample use here), while ψ reflects differential increases in completion as women age based on early access to oral contraceptives. Since early fertility is thought to prevent women from attending school at younger ages, β should continue to be positive. A negative value of ψ would reflect the return of such women to school as their children grow up.

The first column of Table 2 presents the results of OLS applied to (5) for the full sample of women described above. Focusing first on β, the estimated coefficient is positive and highly significant (p-value = 0.011) and indicates that women with late-adolescent pill access are approximately 0.78 percentage points more likely to have obtained a bachelors degree by the age of 31.[13] The second column of the table limits the sample to birth cohorts corresponding to the women analyzed in Section 3.2, resulting in a comparable point estimate. These numbers indicate that the effect of the pill was generally stable over time and resulted in an increase in BA completion of just over 3%, relative to the mean.

However, the estimated marginal effects reported here are substantially lower than what was

[12] Because the coding of race changed between the 1990 and 2000 Census, I use the means from the 1990 Census as the measure of racial characteristics for the state/year birth cohort at each of the two survey dates. The draft-avoidance measures now also span the pre-Vietnam era.

[13] Marginal effects derived from a grouped logistic regression based on (5) yields results identical to those obtained using a regression with simple proportions. The latter results are presented here for ease of exposition.

obtained in the college enrollment analysis above. This might indicate that a number of women without late-adolescent pill access were able to return to school by age 30. While the estimates of ψ reported in Table 3 are indeed negative, they are not at all significant. This implies that a "catch-up" dynamic for those women without early pill access is not very strong at the ages considered here.[14] Even if one takes the point estimates seriously, women without early pill access would not catch up to women with early access until their late 60s, which is well out of the sample range. Thus, for women over the age of 30, the increase in college completion due to early pill access is essentially fixed.

5 Bringing Men Back In

The evidence presented so far indicates that, by decreasing early fertility, the pill enabled more women to invest in their higher education. An early unanticipated pregnancy also potentially has consequences for a female's partner: men usually contribute money, and very often contribute a substantial amount of time, to raising their children. Since college is financially costly and time-intensive, the ability of a young male to invest in higher education might also be constrained after a birth to his partner. Thus, through its effects on female fertility, the pill may have affected the educational outcomes of males. To my knowledge no work to date has addressed this topic.

As noted by Goldscheider and Kaufman (1996), there is a paucity of data that can be used to analyze the connection between men and fertility.[15] In fact, all of the data in which male outcomes can be linked to female fertility come from surveys of married couples. The consent laws used to identify the impact of the pill in this paper primarily applied to contraceptive access among young *single* women, which makes the legal changes mostly irrelevant for analzying the effects of the pill on husbands.[16] Even so, late adolescent contraceptive consent laws might have implications for the sexual partners of young unmarried women. A pregnancy might reinforce male commitment to

[14] Higher-order polynomials in age do not remedy the lack of differential effect of late-adolescenct pill access among these older women.

[15] The heading of this section is drawn from the title of the Goldscheider and Kaufman paper.

[16] There is little reason to believe that most marital formation and fertility is the result of the shotgun effect described below.

the mother and child. Alternatively, male commitment could be enforced by a "shotgun marriage" effect (Akerloff, Yellen and Katz 1996) or legally imposed child support obligations.

While there are no data linking single males to their actual female partners during adolescence, the analysis undertaken in Section 5.2 below provides evidence that male educational outcomes are affected by the contraceptive consent laws governing their *likely* adolescent partners. First, however, I rule out a direct effect of contraceptive consent laws on male educational outcomes. This further validates the use of contraceptive consent laws as measures of female access to contraception and indicates that their effect on males is indirect, operating through early female fertility.

5.1 Contraception vs. Contracting

Reductions in the age of majority were the most common mechanism by which late adolescents acquired the ability to consent for contraception. Adults are empowered to sign contracts, so that the legal changes providing identification could also have allowed late adolescents to take out educational loans in their own name. Additionally, reductions in the age of majority may have reflected a "culture of youth". In both scenarios young adults might have felt more empowered to undertake educational investments. If there is a direct impact of attaining legal adulthood on educational outcomes, then the empirical approach undertaken in this paper would not be legitimately capturing the effect of oral contraceptives per se.

To address this, I consider the direct relationship between male educational attainment and the contraceptive access of same-age females. Using the same data and methods described in Section 4.2, I estimate (5) using the rate of BA completion of males as the dependent variable. The results are of this regression are presented in the first column of Table 3. The estimates of both β and ψ are small and entirely insignificant, which indicates that affirmative contraceptive consent laws did not have a substantial direct effect on male college completion. I additionally construct a pure measure, A, of the ability of late-adolescent males to sign contracts as adults. (This is distinct from P due to occasional male-female differences in the age of majority, as well

as the fact that contracting law differs from medical consent law.) In the second column of Table 3, I re-estimate (5) for males with A_{bt} substituted in place of P_{bt}. The estimated coefficients on the ability of late-adolescent male to contract are also insignificant and end up having have the "wrong" sign. Further, in results not reported here, the direct effects of both P and A on male enrollment status are also insignificant. Thus, the data do not support the idea that educational outcomes were affected by the capacity to contract or other privileges of adulthood.

5.2 The Pill, Female Fertility, and Male College Completion

The direct impact of contraceptive laws on college attendance and completion seems to be female-specific, further confirming that they affected female educational outcomes through late-adolescent fertility. In the typical couple, however, the male is generally older than the female. That is, men should not be affected by the contraceptive access of women their own age, but rather by that of their slightly younger partners.

All of the available survey data only provide information on an adult male's current spouse, who might be an entirely different woman than his partner during late adolescence. Further, they provide no information on previous marriages or on unions other than marriage. In addition to attenuating the estimates of contraceptive consent on male outcomes, using such data would also likely bias them. Most problematic is the well-established tendency for couples to sort on education: women who were able to complete college as a result of the pill may simply have married more educated men. A positive partial correlation between an adult male's educational attainment and his wife's adolescent access to contraception could simply be the result of assortative mate selection later in life. In order to work around these limitations, I analyze the likelihood of college completion for a male in relation to the contraceptive consent laws governing a pool of his *potential* partners during his college years.

There are no data from the 1960s and 1970s linking unmarried sexual partners, so using marriage data is a best guess at the age gaps between partners. In order to determine the male-female age difference at marriage for men in their college years, I draw data from the 1970 U.S.

Vital Statistics Marriage Detail File (MDF; ICPSR 1997). The particular year chosen represents the midpoint of the time-frame in which the underlying sample of women turned 21.[17] Figure 2 plots the distribution of the husband-wife age difference for college age (19-24 year-old) American-born men. As seen in the figure, the bulk of men marry younger women. Further, the mean age difference at marriage is 1.41 years, while the mode is one year.

In order to assess the impact of female contraceptive access on male educational completion, I use the consent laws in the man's state of birth that would have been applicable to the laws governing younger females in the same birth state.[18] Specifically, I re-estimate (5) with the bulk of controls remaining the same. The main difference is that time-series-leaded values of the measures of reproductive laws governing females, $P_{b,t+d}$ and $R_{b,t+d}$ are substituted in place of P_{bt} and R_{bt}, where d measures the difference in age between males and their potential partners. Note that this implies shifting the span of male birth cohorts according to d. For example, when d equals one, I use males born between 1939 and 1958, since the underlying laws are applicable to females born between 1940 and 1959.

The first three columns of Table 4 present the results of estimating the effects of the pill on male college completion using reproductive laws led by one, two, and three years. The estimates of β are positive and significant in all three columns. The point estimates reported imply an effect of the leaded laws on the likelihood of male BA attainment that is between 0.66 and 0.74 percentage points.[19] This corresponds to an increase of approximately 2.5% relative to the mean. Moreover, the highest effect size is obtained with a one year lead, which implies a one year male-female age difference. This is the modal age difference in marriage based on the data depicted in Figure 2. As the length of the lead increases, the effect size decreases, paralleling the pattern of mass points in the distribution of age gaps.[20] As with females, there is little evidence of a catch-up dynamic: in

[17]The Marriage Detail File covers 44 out of the 51 states and regions used in this paper. Using a smaller sample of recently-married couples in all states drawn from the 1970 Census PUMS (Ruggles et al., 2004) leads to comparable, although noisier, estimates.

[18]The data in the 1970 MDF provide some evidence for this: in approximately 60% of the marriages occurring to college-age males both the bride and groom were born in the same state.

[19]The the findings on male college completion also extend to college enrollment. I do not report the latter set of results since they do not provide much additional insight to those presented here.

[20]Time-series leads, and implied age differences, greater than four result in insignificant estimates. Using a broader

none of the three columns does the estimate of ψ attain significance at any meaningful level.

I also consider the relationship between female BA attainment and time-series-leaded measures of contraceptive access, which serves as an additional robustness check. If the legal changes were indicative of a shift in underlying preferences over fertility and education, then leaded values of the laws should have some predictive power in explaining female outcomes. The results, however, indicate that this is not the case. Leading the laws by even one year results in coefficient estimates that, though of the right sign, are insignificant at any meaningful level. This further adds to the case that variation in late-adolescent consent laws was quasi-experimental in nature, rather than a reflection of differentially evolving group-level preferences.

Thus, in addition to reducing fertility, late adolescent contraceptive consent laws seem to affect female educational attainment solely in an "age-appropriate" manner, and have no such direct effect on men. Male educational attainment is only affected by the consent laws when they are applied so as to reflect a gap in age between males and the females directly affected by the laws. Taken together, these findings implicate reductions in unintended adolescent female childbearing as being beneficial to male educational attainment.

6 Conclusion

In her social history of the pill, Watkins (1998) states that "[t]he image of the oral contraceptive as revolutionary persists in popular culture, yet the nature of the changes it supposedly brought about has not been fully investigated" (p. 1). The findings I present here imply that oral contraceptives did indeed have powerful consequences for investments in higher education among both women and men. My results rely primarily on the relationships between measures of educational attainment and late-adolescent medical and contraceptive consent laws during the 1960s and 1970s. Goldin and Katz have empirically related consent laws with the use of contraceptives, and in this paper I show that their direct association with educational attainment is female-specific. As a result, the

segment of the support of the distribution of male-female age differences in marriage instead of individual mass points, yields a slightly larger, but noiser, estimate.

variation in late-adolescent consent laws is strongly justified as a natural experiment in access to contraceptives.

In the analysis of educational outcomes, the local average treatment effect identified is that of oral contraceptives on women who (a) desired delay their fertility and invest in their human capital, and (b) were unable to obtain the pill with a parental consent law in place. Laws requiring parental consent were not necessarily binding for all single minors and would not be applicable to late-adolescents who were married. Thus the identification strategy will tend to understate the effects of the pill, relative to the total benefit it provided in the full population of women.

Despite the potentially limited group to which the consent laws applied, unrestricted access to contraceptives during late adolescence potentially accounted for almost one third of the secular increase in college enrollment during the 1970s. My results suggest that these educational gains came primarily through a lower likelihood of dropping out of college because of pregnancy. Further, my estimates imply that, as of 2000, more than 250,000 women over the age of 30 were able to obtain a bachelor's degree due to the ability to consent for contraception as late adolescents. Taken in combination with the findings by Bailey (2006) that link early access to the pill to increases in the labor force participation of adult women, this implies considerable female labor-market gains as a result of access to oral contraceptives.

The behavioral changes witnessed in response to better availability of contraception indicated a latent desire among many women to avoid early fertility and invest in education. To be sure, a number of other factors may have shaped the underlying preferences during the study period, for example the growing feminist movement. However, by substantially reducing the likelihood of an unwanted pregnancy, the pill acted as a catalyst in allowing women to implement a more optimal plan of fertility and human capital investment. These findings support previous research that has shown the negative effects of undesired adolescent fertility on the educational attainment of young women (e.g., Klepinger, Lundberg and Plotnick 1995 and 1999).

By contrast, the consequences of early fertility for male human capital investment decisions are rather less well understood in the economics literature. The evidence I present indicates that

the introduction of oral contraceptives proved beneficial for male college completion and that this effect was channelled through their adolescent female partners. A law granting unconstrained pill access to late adolescent females led to increases in male college completion comparable in magnitude to the rise in completion among the women directly affected by the law. The connection between female contraceptive access and male schooling established in this paper represents a new contribution to the understanding of the effects of early childbearing. It also suggests that better data need to be collected, and more work needs to be done, to bring men back into the analysis of fertility.

Appendix A: Additional Detail and Discussion of State Reproductive Laws

A.1 Sources

The following secondary sources were used in order to determine minors' access to contraception between 1960 and 1979: Pilpel and Wechsler (1969 and 1971); Dienes (1972); U.S. Department of Health, Education and Welfare (1974, 1978); Paul, Pilpel and Wechsler (1974, 1976); and Paul and Pilpel (1979). Each source typically gives snapshot of laws at the time of writing, often with no indication of the date as to when the governing jurisprudence came into effect. The secondary sources also do not generally reflect the existence and content of any previous or superseded law. Some of the gaps and missing histories were filled in using the annotated codes available on-line via Lexis-Nexis. For the remainder, librarians at numerous state law libraries were very helpful in providing the text of session laws and historical sections of code. These librarians were also helpful in interpreting certain ambiguities, as was Elizabeth Nash at the Alan Guttmacher Institute. In addition to the sources listed above, my understanding of abortion laws is based on the following secondary sources: Merz, Jackson, and Klerman (1995); Merz, Klerman, and Jackson (1996); and Bitler and Zavodny (2002). Taken together, these sources proved sufficient for coding the abortion access variables used in this paper.

A.2 Comstock Laws

A few states repealed or revised the interpretation of legislation prohibiting the sale of contraceptives in the early 1960s: Illinois in 1961 and New Jersey in 1963.[21] In a 1965 decision (*Griswold v. Connecticut* [381 US 479 (1965)]), the U.S. Supreme Court struck down the ban on the *use* of contraceptives in Connecticut – the only state with such a law in place. While this did not necessarily apply to the sale of contraceptives, the remaining states with prohibitions on contraceptive sales took the cue from *Griswold* and revised or repealed their laws by the end of the decade: Nebraska in 1965 and Mississippi in 1970. Nonetheless, since the *Griswold* decision was based on a doctrine of marital privacy, two states (Massachusetts and Wisconsin) continued to maintain prohibitions

[21] This discussion does not include a small number of additional states that had substantially weaker laws limiting the sale of contraceptives to physicians.

on the sale of contraceptives to non-married individuals. The Massachusetts laws was invalidated in 1972 when the U.S. Supreme Court decision ruled in *Eisenstadt v. Baird* [405 US 438 (1972)], and the Wisconsin law soon followed based on a Federal district court ruling (*Baird v. Lynch* [390 F. Supp. 740 (1974)]).

A.3 Late-Adolescent Contraceptive Access

The primary indicator of interest in this paper is contraceptive access among late-adolescent women. As mentioned in the main text, changes in late-adolescent contraceptive access were primarily driven by changes in the age of majority. Table A1 summarizes the historical age of majority and the year in which unmarried late adolescents obtained the right to consent for contraception.[22] It also lists the nature in which consent was obtained for the instances where this was not based age-of-majority-based.

The legal summary presented in Table A1 differs slightly from what might be gleaned from Goldin and Katz (2002, Table 2) and from Bailey (2006, Table 1). In particular, Goldin and Katz count certain unrestrictive contraceptive consent laws specific to state health and welfare (H-W) departments as amounting to access to the pill. However, the group of women that these types of legal changes affected was small and potentially non-representative, as compared to the total population. Additionally, more detailed information on H-W law is available in the sources listed above for certain large, "over-researched" states (e.g. New York and California), while information is sparse for many other states. Because of these limitations, H-W laws are not included in my measure of access to contraception. Further, Bailey (2006) includes in a number of instances comprehensive family planning (CFP) laws not explicitly requiring minors' consent among the mechanisms by which adolescents could obtain contraceptives. However, as these CFP laws also did not explicitly grant unconditional access, it is unlikely that they abrogated existing common-law or legislative medical consent jurisprudence. Finally, the broader set of primary sources that I utilize has allowed to determine the timing certain legal changes more precisely. Thus, the in-

[22] In a number of states, pregnancy also legally emancipated the minor. However, this is precisely the condition that the woman wishes to avoid by seeking contraception. Hence, I omit pregnancy as an emancipator from my discussion, although it plays a role in determining the abortion consent laws utilized as controls in my estimation.

formation I present in Table 1 can be considered as a substantive update to the existing published accounts of late-adolescent contraceptive access.

A.4 Contraceptive Access Among Early Adolescents

By 1980, the following 17 states changed their laws to allow contraception by women younger than age 18 through family planning legislation: Illinois in 1969; Colorado, Maryland, Tennessee, and Virginia in 1971; Florida, Georgia, and Kentucky in 1972; Maine in 1973; Alaska, the District of Columbia, Delaware, Idaho, and Montana in 1974; California in 1975; North Carolina in 1977; and Hawaii in 1979. Access to contraception was allowed under a legislative or judicial mature minor doctrine in the following 7 states: Kansas and Mississippi in 1970; Alabama, New Hampshire and Oregon in 1971; South Carolina in 1972; and Arkansas in 1973.[23] A Minnesota court ruled in January 1976 that a pregnancy consent clause for minors applied also to contraception. Finally, the Arizona attorney general ruled in 1977 that physicians and family planning agencies would not be held liable for providing contraception to minors without parental consent.

A.1.4 Legalized Abortion

The legislatures of Alaska, New York, and Hawaii repealed their restrictive abortion laws in 1970. Additionally, a referendum in late 1970 legalized abortion on demand in Washington. While California's abortion law was not completely rewritten until 1972, it is generally agreed that abortion on demand became legal after the Supreme Court of California held the state's restrictive abortion law unconstitutional in late 1969. Further, courts overturned restrictive statutes in Vermont and New Jersey in 1972. In 1973, the U.S. Supreme Court's decision in *Roe v. Wade* [93 S. Ct. 1409 (1973)] and *Doe v. Bolton* [93 S. Ct. 739 (1973)] resulted in the legalization of abortion on demand in the remaining states.

A.1.5 Abortion Consent

At the time at which abortion on demand became legal, late adolescents could consent in most states for abortions based on the age of majority, a mature minor law (as described above), or a pregnancy-specific medical consent law. By 1977 this was the case in every state.

[23] The mature minor doctrine in Mississippi actually came at an earlier date. However, it became effective in terms of contraceptive access only after the 1970 repeal of Mississippi's Comstock law.

However, in the years following *Roe* quite a few states passed abortion-specific laws with the explicit intent of preventing minors under the age of 18 from obtaining abortion without the involvement of their parents. These often served to reinforce the lack of statutory (or common-law) capacity to consent for medical treatment, but in a number of instances nullified the ability of otherwise-emancipated early adolescent to consent for abortion. The status of such laws became unclear after a 1976 Supreme Court decision (*Planned Parenthood of Central Missouri v. Danforth* [96 S. Ct. 2831 (1976)]), which found Missouri's abortion-specific parental consent requirement unconstitutional. However, in its decision the court emphasized that this ruling was not intended to imply that "every minor, regardless of age or maturity may give effective consent for the termination of her pregnancy" (p. 73). The Court gradually clarified its position in a series of rulings in the years following the *Danforth* decision. In the meantime states introduced various forms of abortion-specific involvement laws, some of which withstood legal challenges and others which did not. Thus, starting in 1976 it becomes somewhat difficult to determine the ability of a minor under the age of 18 to consent for abortions. This results in the sample restrictions employed in the empirical analysis.

For the sake of brevity, a full detailing of the evolution of abortion consent laws is not presented here, as it was a somewhat convoluted process in certain states. However, the coding of the abortion access variables used in this paper reflects my best understanding of the law as gleaned from the sources indicated above. Full documentation of the coding of all legal variables is available upon request.

References

Akerloff, George A., Janet L. Yellen, and Michael L. Katz. "An Analysis of Out-of-Wedlock Childbearing in the United States." *Quarterly Journal of Economics* Vol. 111, No. 2 (May, 1996): pp. 277-317.

Ananat, Elizabeth Oltmans, and Daniel M. Hungerman. 2007. "The Power of the Pill for the Next Generation." National Bureau of Economics Working Paper No. 13402. Cambridge, MA: NBER.

Bailey, Martha J. 2006. "More Power to the Pill: The Impact of Contraceptive Freedom on Women's Lifecycle Labor Supply." *Quarterly Journal of Economics* 121(1): pp. 289-320.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics* 119(1): pp. 249-275.

Bitler, Marianne, and Madeline Zavodny. 2002. "Did Abortion Legalization Reduce the Number Of Unwanted Children? Evidence from Adoptions." *Perspectives on Sexual and Reproductive Health* 34(1): pp. 25-33.

Bollinger, Chistopher R., and Barry T. Hirsch. 2006. "Match Bias from Earnings Imputation in the Current Population Survey: The Case of Imperfect Matching" *Journal of Labor Economics* 24(3): pp. 483-520.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. 2007. "Bootstrap-Based Improvements for Inference with Clustered Standard Errors." National Bureau of Research Technical Working Paper No. 344. Cambridge, MA: NBER.

Card, David E. and Thomas Lemieux. 2001. "Going to College to Avoid the Draft: The Unintended Legacy of the Vietnam War." *American Economic Review* 91(2): pp. 97-102.

Dawson, Deborah Anne. 1990. "Trends in the Use of Oral Contraceptives – Data from the 1987 National Health Interview Survey." *Family Planning Perspectives* 22(4): pp. 169-172.

Dienes, C. Thomas. 1972. *Law, Politics and Birth Control*. Urbana, IL: University of Illinois Press.

Gartner, Scott Sigmund, Gary M. Segura, and Michael Wilkening. 1997. "All Politics are Local: Local Losses and Individual Attitudes toward the Vietnam War." *Journal of Conflict Resolution* 41(5): pp. 669-694.

Goldscheider, Frances K., and Gayle Kaufman. "Fertility and Commitment: Bringing Men Back In." *Population and Development Review* Vol. 22, Supplement: Fertility in the United States: New Patterns, New Theories (1996): pp. 87-99.

Goldin, Claudia, and Lawrence F. Katz. 2002. "The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions." *Journal of Political Economy* 110(4): pp. 730-770.

Hotz, V. Joseph, and Robert A. Miller. 1988. "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply." *Econometrica* 56(1): pp. 91-118.

Inter-university Consortium for Political and Social Research. 1997. *Vital Statistics: Marriage Detail (United States), 1970* [Computer file]. Hyattsville, MD: U.S. Department of Health and Human Services, National Center for Health Statistics [producer]. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor].

Klepinger, Daniel, Shelly Lundberg, and Robert Plotnick. 1995. "Adolescent Fertility and the Educational Attainment of Young Women." *Family Planning Perspectives* 27(1) pp. 23-28.

_____. 1999. "How Does Adolescent Fertility Affect the Human Capital and Wages of Young Women?" *Journal of Human Resources* 34(3): pp. 421-448.

Merz, Jon F., Catherine A. Jackson, and Jacob A. Klerman. 1995. "A Review of Abortion Policy, Medicaid Funding, and Parental Involvement, 1967-1994." *Women's Rights Law Reporter* 17(1): pp. 1-61.

Merz, Jon F., Jacob A. Klerman, and Catherine A. Jackson. 1996. "A Chronicle of Abortion Legality, Medicaid Funding, and Parental Involvement Laws, 1967-1994." RAND Labor and Population Working Paper No. 96-08. Santa Monica, CA: RAND Corporation.

Mullin, Charles H., and Ping Wang. 2002. "The Timing of Childbearing Among Heterogeneous Women in Dynamic General Equilibrium." National Bureau of Economics Working Paper No. 9231. Cambridge, MA: NBER.

Paul, Eve W., and Harriet F. Pilpel. 1979. "Teenagers and Pregnancy: The Law in 1979." *Family Planning Perspectives* 11(5): pp. 297-302.

Paul, Eve W., Harriet F. Pilpel, and Nancy W. Wechsler. 1974. "Pregnancy, Teenagers and the Law, 1974." *Family Planning Perspectives* 6(3): pp. 142-147.

_____. 1976. "Pregnancy, Teenagers and the Law, 1976." *Family Planning Perspectives* 8(1): pp. 16-21.

Pilpel, Harriet, and Nancy F. Wechsler. 1969. "Birth Control, Teenagers and the Law." *Family Planning Perspectives* 1(1):: pp. 29-36.

_____. "Birth Control, Teenagers and the Law: A New Look, 1971" *Family Planning Perspectives* Vol. 3, No. 3 (Jul., 1971): pp. 37-45.

Ruggles, Steven, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King, and Chad Ronnander. 2004. *Integrated Public Use Microdata Series: Version 3.0* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor].

Unicon Research Corporation. 2005. *Current Population Surveys.* October 1968–1981 [machine readable data files]/conducted by the Bureau of the Census for the Bureau of Labor Statistics (Washington, DC: Bureau of the Census [producer and distributor]; Santa Monica, CA: Unicon Research Corporation [producer and distributor sof CPS Utilities]).

U.S. Department of Health, Education and Welfare. 1974. *Family Planning, Contraception and Voluntary Sterilization: An Analysis of Laws and Policies in the United States, Each State and Jurisdiction (As of September 1971)*. Washington, DC: Government Printing Office.

_____. 1978. *Family Planning, Contraception, Voluntary Sterilization and Abortion: An Analysis of Laws and Policies in the United States, Each State and Jurisdiction (As of October 1, 1976 with 1978 Addenda)*. Washington: Government Printing Office.

U.S. Food and Drug and Drug Administration. 2003. "Birth Control Guide." *FDA Consumer Magazine* Vol. 31, No. 3 (Apr., 1997). [Updated December 2003 and available on-line at http://www.fda.gov/fdac/features/1997/babyguide2.pdf .]

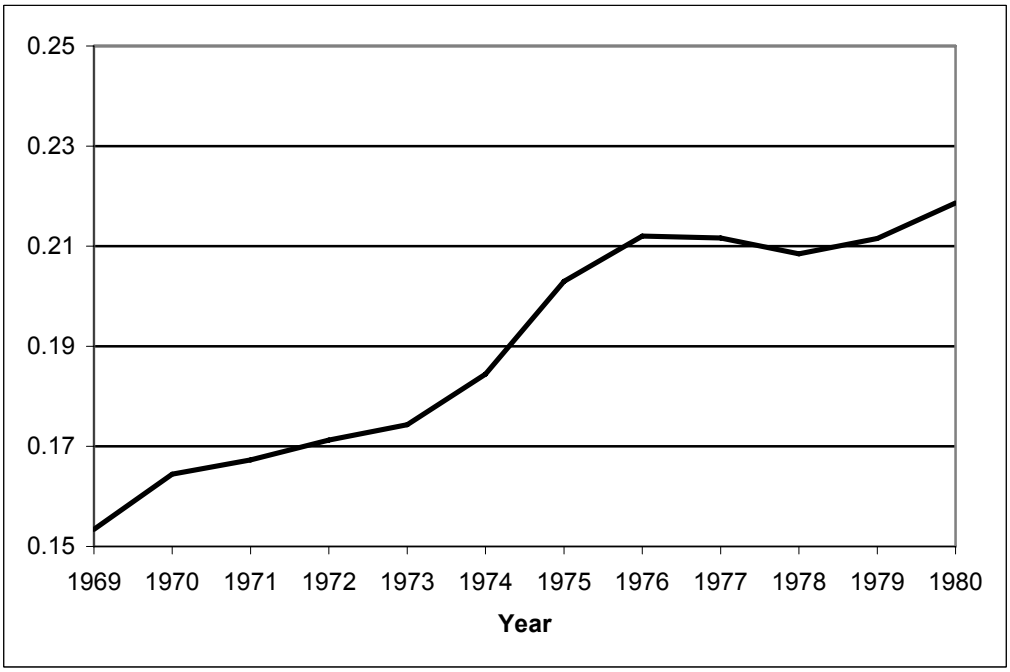
Watkins, Elizabeth Siegel. 1998. *On the Pill: A Social History of Contraceptives 1950-1970.* Baltimore, MD: The Johns Hopkins University Press.

Weinberg, Bruce A. 2004. "Experience and Technology Adoption." IZA Discussion Paper No. 1051. Bonn, Germany: Institute for the Study of Labor.

Westoff, Charles F., and Norman B. Ryder. 1977. *The Contraceptive Revolution.* Princeton, NJ: Princeton University Press.

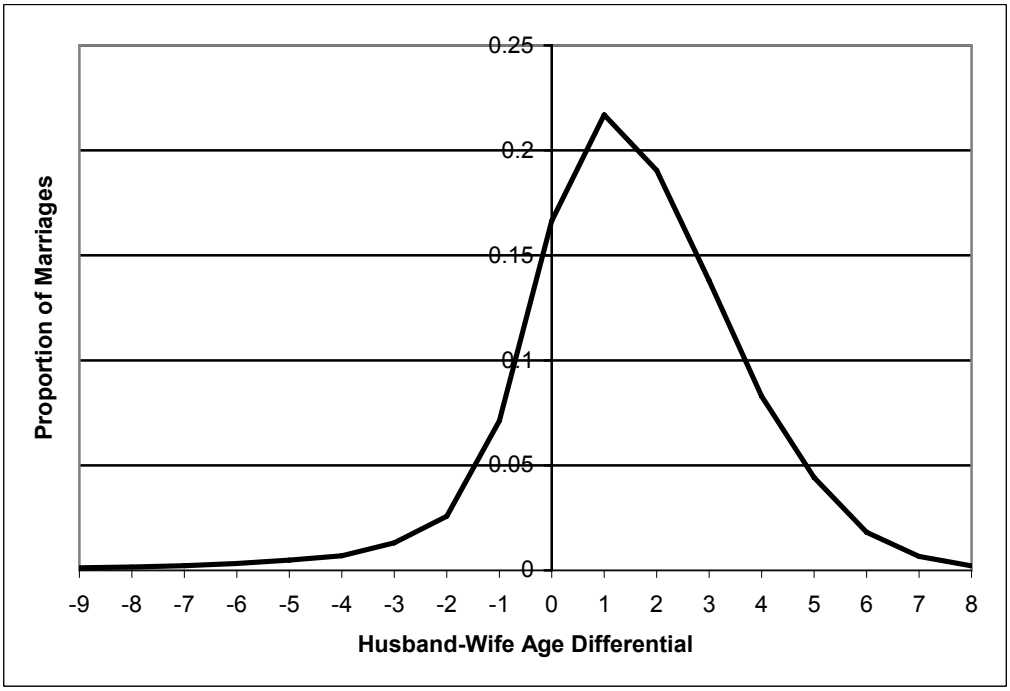
Zelnik, Melvin, and John F. Kantner. 1982. *1971 U.S. National Survey of Young Women* [machine readable data file] conducted by the Institute for Survey Research at Temple University (Bellingham, WA: George Cvetkovich and Barbara Grote [producer]; Los Altos, CA: Sociometrics Corporation [distributor]).

Figure 1: College Enrollment Among 21-22 year-old women, 1969-1980



Notes: The figure plots the proportion of women enrolled in grades higher than 12, but excludes those attending CPS-defined "special schools". The series is smoothed using a 3-year moving average centered on the given year.
Data Source: October CPS schooling supplements (Unicon 2005)

Figure 2: The 1970 Distribution of the Age Gap at Marriage for College-Age Males



Data Source: Vital Statistics Marriage Detail File (ICPSR 1997)

Table 1: Late-Adolescent Pill Access and Female College Enrollment

Dependent Variable:	Currently Enrolled		Currently Enrolled in College			Ever Attended College	Dropped Out of College
Late-Adolescent Contraceptive Consent	0.0892 (0.0455)	0.0885 (0.0418)	0.0792 (0.0399)	0.0041 (0.0796)	0.1471 (0.0395)	0.0005 (0.0408)	-0.2321 (0.0940)
Implied Marginal Effect	0.0251	0.0248	0.0206	0.0005	0.0521	0.0002	-0.0518
Controls for Effects of Vietnam	no	yes	yes	yes	yes	yes	yes
Log-Likelihood	-14381	-14369	-133369	-3939	-7505	-19100	-4774
Mean of Dependent Variable	0.2124		0.1873	0.0661	0.3540	0.4143	0.1441
Population	Full Sample		Full Sample	Married	Never Married	Full Sample	Ever Attended
Number of Observations	28689		28689	16608	12081	28689	11887

Notes: The base data comprises a sample of 21 to 22 year-old women drawn from the Current Population Survey October supplements, 1968-1979 (Unicon, 2005). All specifications are based on probit estimation and include year fixed effects, age-specific state fixed effects and trends, racial indicator variables, and the controls for access to other fertility control mechanisms described in Section 3.1. Controls for Vietnam are as described in Section 3.1.1. Cluster-robust standard errors clustered are given in parentheses. Finally the estimated marginal effects associated with late-adolescent pill access are computed as the average of the individual marginal over the sample distribution.

Table 2: Late-Adolescent Contraceptive Access and Female College Completion

Dependent Variable:	Rate of BA Completion	
Late-Adolescent Contraceptive Consent	0.0078	0.0076
	(0.0030)	(0.0035)
(Late-Adolescent Contraceptive Consent) x (Age - Minimum Age)	-0.0002	-0.0002
	(0.0002)	(0.0003)
R-squared	0.9563	0.9619
Mean College Completion	0.2366	0.2512
Birth Cohorts	1940-1959	1947-1959
Minimum Age	31	31
Number of Observations	1938	1224

Notes: The base data are derived from 1990 and 2000 Census microdata (Ruggles et al. 2004). Estimates are based on OLS using state-of-birth/year-of-birth/age cell means as the unit of observation. Both specifications include the controls described in equation (5). The standard errors reported in parentheses have been weighted by the number of observations in each cell to account for heteroskedasticity and are clustered on the state of birth.

Table 3: Direct Effects of Legal Changes on Male College Completion

Dependent Variable:	Rate of BA Completion	
Type of Law	Contraception	Contracting
Unrestrictive Late-Adolescent Law	0.0015	-0.0034
	(0.0030)	(0.0034)
(Unrestrictive Late-Adolescent Law) x (Age - Minimum Age)	0.0000	0.0004
	(0.0003)	(0.0003)
R-squared	0.9657	0.9657
Mean College Completion	0.2798	
Birth Cohorts	1940-1959	
Minimum Age	31	
Number of Observations	1938	

Notes: The base data are derived from 1990 and 2000 Census microdata (Ruggles et al. 2004). Estimates are based on OLS using state-of-birth/year-of-birth/age cell means as the unit of observation. Both specifications include the controls described in equation (5). The standard errors reported in parentheses have been weighted by the number of observations in each cell to account for heteroskedasticity and are clustered on the state of birth.

Table 4: Indirect Effects of Female Contraceptive Access on Male College Completion

Dependent Variable:	Rate of BA Completion		
Length of Lead	1 year	2 years	3 years
Late-Adolescent Contraceptive Consent	0.0074	0.0069	0.0066
	(0.0039)	(0.0041)	(0.0035)
(Late-Adolescent Contraceptive Consent) x (Age - Minimum Age)	-0.0002	-0.0001	-0.0004
	(0.0003)	(0.0003)	(0.0003)
R-squared	0.9654	0.9651	0.9642
Mean College Completion	0.2803	0.2803	0.2797
Birth Cohorts	1939-1958	1938-1957	1937-1956
Minimum Age	32	33	34
Number of Observations	1938	1938	1938

Notes: The base data are derived from 1990 and 2000 Census microdata (Ruggles et al. 2004). Estimates are based on OLS using state-of-birth/year-of-birth/age cell means as the unit of observation. All specifications include the controls described in equation (5), with the time-series leads applying to late-adolescent contraceptive consent laws and the reproductive controls. The standard errors reported in parentheses have been weighted by the number of observations in each cell to account for heteroskedasticity and are clustered on the state of birth.

Table A1: Access to Contraception Among Single Late-Adolescent Women, 1960-79

State	Age of Majority for Females, 1960	Access Among Single Women Aged 18-19: Year First Obtained	Access Among Single Women Aged 18-19: Type of Access (If Not Age of Majority)	State	Age of Majority for Females, 1960	Access Among Single Women Aged 18-19: Year First Obtained	Access Among Single Women Aged 18-19: Type of Access (If Not Age of Majority)
Alabama	21	1971	Mature Minor Legislation	Montana	18	1960	
Alaska	19	1960		Nebraska	21	1972	
Arizona	21	1972		Nevada	18	1960	
Arkansas	18	1960		New Hampshire	21	1971	Mature Minor Legislation
California	21	1972		New Jersey	21	1973[b]	
Colorado	21	1971	Mature Minor Legislation	New Mexico	21	1971	
Connecticut	21	1971	Mature Minor Legislation	New York	21	1972	
Delaware	21	1972		North Carolina	21	1971	
DC	21	1974	Family Planning Legislation	North Dakota	18	1960	
Florida	21	1972	Family Planning Legislation	Ohio	21	1974[b]	
Georgia	21	1971	Mature Minor Legislation	Oklahoma	18	1960	
Hawaii	20	1975		Oregon	21	1971	Mature Minor Legislation
Idaho	18	1960		Pennsylvania	21	1970	Mature Minor Legislation
Illinois	18	1961[a]		Rhode Island	21	1972	
Indiana	21	1973		South Carolina	21	1972	Mature Minor Legislation
Iowa	21	1972		South Dakota	21	1972	
Kansas	21	1970	Judicial Mature Minor Ruling	Tennessee	21	1971	
Kentucky	21	1965[b]		Texas	21	1973	
Louisiana	21	1972		Utah	18	1960	
Maine	21	1972		Vermont	21	1972	
Maryland	21	1971	Mature Minor Legislation	Virginia	21	1971	Family Planning Legislation
Massachusetts	21	1974[b]		Washington	21	1971	
Michigan	21	1972b		West Virginia	21	1972	
Minnesota	21	1973		Wisconsin	21	1974[a]	
Mississippi	21	1970[a]	Mature Minor Legislation	Wyoming	21	1973[b]	
Missouri	21	1977					

Notes: [a]: Indicates that a Comstock law was in place until the given year. [b]: Indicates that the law had a January effective date, but was enacted the previous year.