TWO TWENTIETH CENTURY FERTILITY TRANSITIONS: IMPLICATIONS FOR HUMAN CAPITAL

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Abstract:

This paper compares U.S. fertility transitions in the early 20th century and post-1960 period. After affirming the similarities between declines in period fertility rates (births in a year per indicated population) and mean completed childbearing (cohort-based measures from the Census), our analysis describes five distinct features of the post-1960 period. Cohorts reaching childbearing age in the post-1960 period were substantially more likely to have exactly two children and significantly *less* likely to be childless (feature 1). The post-1960 period also witnessed a decoupling of sex and marriage, sex and childbearing, and marriage and childbearing. Cohorts reaching childbearing age in the post-1960 period formed their first households (through marriage or cohabitation) at similar ages as cohorts born from 1900 to 1910, but recent cohorts were much more likely to precede first marriage with non-marital cohabitation (feature 2). More recent cohorts delayed motherhood compared to the cohorts born from 1900 to 1910 and, among women marrying before having children, increased the interval between first marriage and motherhood (feature 3). These cohorts had intercourse at earlier ages but gave birth at later ages and more frequently outside of marriage (feature 4). Mothers' education has become an increasingly strong predictor of age-at-first birth and non-marital childbearing in the post-1960 period (feature 5). These five features of the post-1960 period have implications for behavioral models of childbearing and the human capital acquisition of women and children.

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Over the course of the last 100 years, American childbearing has changed dramatically. American women reaching childbearing age around 1890 averaged 4.2 live births during their reproductive years (figure 1). For women reaching childbearing age around 1990, this number had fallen to 2, a level just below replacement levels, and has remained stable ever since.[1] The U.S. baby boom temporarily reversed this trend. Between 1940 and 1960, the general and total fertility rates rose by 60 percent and cohort measures of completed fertility rates rose by 45 percent.

The causes of these dramatic fertility swings have been the subject of large literatures in economics and demography. The economics literature has focused on the demand for children—changes in preferences, income, and the shadow price of children that affects how many children couples choose to have, while the demographic literature has emphasized models of "demographic transition." Such models have some success in generating the decline in childbearing (generally, as a by-product of rising wages or of rising incomes, which induce substitution toward child quality) but they have had difficulty generating the baby boom (for an overview of demographic models of fertility transition, see Kirk 1996; for dynamic economic models, see Galor and Weil 1999, 2000, Becker and Barro 1988, and Barro and Becker 1989). Other models have succeeded in generating the baby boom have struggled to generate the speed of the post-1960 decline in fertility (Greenwood *et al*. 2005, Albanesi and Olivetti 2009, Doepke *et al*. 2008) and the relative stability in fertility rates over the past 35 years (Easterlin 1966, 1971, 1980). That is, existing economic and demographic models capture aspects of U.S. fertility transition but none provides a complete explanation.

The neglect of what economists would call the "supply" of children is a potential reason for this incompleteness. An important component of the socio-demographic literature has emphasized birth planning—both timing and stopping, made easier by the diffusion of "the Pill" beginning in the 1960s.[2]

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[1] These statistics use completed childbearing from the U.S. Census (for 1890) and the June Current Population Survey (for 1990) and are close to calculations of the U.S. total fertility rate (TFR). In 1890, the TFR was approximately 3.9 (Haines 1989) and had fallen in half to 1.9 by 2010—just below replacement levels (Martin *et al*. 2012).

[2] Economists also note the potential importance of the supply side: Easterlin 1975; Michael and Willis 1976; Easterlin, Pollak, and Wachter 1980; Easterlin and Crimmins 1985, and Hotz and Miller 1988; but supply-side factors have largely remained

National survey evidence documenting the rise in Pill use led Ryder and Westoff (1971) to herald the 1960s as the "contraceptive revolution." Pushing economists' focus on demand into background, Westoff's 1975 Presidential Address to the Population Association of America asserted that, "the *entire* [emphasis added] decline in births within marriage across the decade of the 'sixties' can be attributed to the improvement in the control of fertility." Lesthaeghe and van de Kaa (1986) also claim credit for the women's rights revolution but extend Ryder and Westoff's argument to say that post-1960 period is exceptional enough to be called a "*Second* Demographic Transition" (SDT).

In broader historical perspective, the unfolding of the post-1960 period looks to many scholars like mean reversion—after the baby boom's 20-year interruption—rather than a distinct transition. Becker's *Treatise on the Family* (1981) challenges the Ryder and Westoff's claim of post-1960s exceptionalism, noting that the decline in childbearing in the 1920s—before the availability of the Pill—was almost as rapid. In an often cited response to Lesthaeghe and van de Kaa, Cliquet (1991) argues that trends often attributed to the SDT "already existed before the sixties [for Council of Europe member states]; in fact, most of them emerged with the … demographic transition around the turn of the century" (p. 72). In another prominent article, Coleman (2004, p. 14) criticizes the SDT literature as ahistorical: "A graph truncated at [the 1950s and 1960s] gives a false impression of an inexorable downward slide coinciding with the onset of the SDT, while in fact in most countries the real decline was forty years earlier. The 1950s and the 1960s are a deceptive aberration in fertility history" (p. 18).[3]

This paper examines the claim at the heart of the controversy for the U.S.: how similar were changes in childbearing in the early 20th century and post-1960 period? Are there features of the 1960s fertility decline that appear distinct compared to the larger U.S. demographic transition? Rather than comparing the post-1960 period to the baby boom era, we compare the features of the post-1960 U.S. fertility decline (roughly 1960 to 1990) with the features of the 1900-to-1930 fertility decline. Our work

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outside the workhorse models in micro and, more recently, macroeconomics.

[3] Because our focus is on periods of fertility decline, our analysis ignores the reasons for the aberration in fertility rates due to the baby boom.

provides a synthesis of time series compiled from many datasets such as the decennial Censuses, the June Current Population Surveys (CPS), Vital Statistics, and the National Surveys of Family Growth (NSFG), which we use to characterize the outcomes and choices of cohorts reaching childbearing age during the 20th century. We frame our analysis within a model of fertility determination that integrates both the demand-side and the supply-side in order to describe how greater availability of reliable and lower marginal cost contraception could alter both the mean *and* dispersion of children born.

After briefly summarizing the literature in economics and demography on the determinants of fertility decline, our analysis affirms the similarities cited in the literature between the fertility declines in both eras, in terms of period rates (births in a year per indicated population) and completed childbearing (cohort-based measures from the Census). We confirm that these similarities remain after adjusting the distribution of completed childbearing à la DiNardo, Fortin, and Lemieux (1996) for changes in the demographic composition of the U.S. population and mortality bias. Our analysis then extends the literature by unpacking changes in the distribution of completed childbearing—including childlessness—and its associations with related behaviors such as household formation and marriage decisions, the timing of first birth, and the relationship of childbearing and marriage.

Our results point to five distinct features of the post-1960 period. Childbearing outcomes among cohorts reaching childbearing age in the post-1960 period were less diffuse; these cohorts also were more likely to have exactly two children and less likely to be childless (feature 1). The post-1960 period also witnessed the decoupling of sex, marriage, and childbearing. Cohorts reaching childbearing age in the post-1960 period formed their first households (through marriage or cohabitation) at similar ages to cohorts born from 1900 to 1910, but recent cohorts were much more likely to cohabitate before formal marriage (feature 2). Compared to women born from 1900 to 1910, more recent cohorts delayed motherhood and, among women marrying before having children, increased the interval from first marriage to motherhood (feature 3). Recent cohorts also had intercourse at earlier ages but gave birth at later ages and more frequently outside of marriage (feature 4). Recently, childbearing has also varied

along class lines. Mothers' education has become an increasingly strong predictor of age-at-first birth and non-marital childbearing in the post-1960 period (feature 5).

These five features of the post-1960 period have implications for behavioral models of childbearing and the human capital acquisition of women and children. These empirical features relate to Goldin and Katz's influential quantitative study on the "Power of the Pill" (2002) as well as a growing empirical literature on the importance of contraception for women's human capital, labor supply and wages (Bailey 2006; Hock 2008; Bailey, Hershbein and Miller 2012) and fertility and cohabitation (Guldi 2008, Christensen 2011). They also bear on Lesthaeghe and van de Kaa's (1986) controversial claims that the 1960s began the "second demographic transition," in part due to Ryder and Westoff's (1971) "contraceptive revolution." Finally, they inform theoretical formulations of fertility determination, many of which ignore changes in the distribution of children born and other features of post-1960 fertility decline.

I. FERTILITY TRANSITION IN THE U.S.

"Fertility transitions" are generally defined by population scientists as "long-term declines in the number of children from four or more per woman to two or fewer" (Mason 1997). Until recently, U.S. (marital) fertility decline was believed to have begun declining in the late 18th century, almost 75 years before marital fertility rates began declining in other nations (France excepted) (Haines 2000 and Binion 2001). Using new estimates of 19th century mortality and IPUMS data, Hacker (2003) shows it is likely that the longer-term secular decline in U.S. fertility decline began closer to the mid-19th century. And, among white women, his estimates suggest that the decline in marital fertility did not begin until after the Civil War. Although its features varied considerably across places and groups (Guinnane 2011), the longer-term demographic transition in the U.S. was characterized by declines in (infant and child) mortality, the disappearance of the Malthusian pattern of late marriage, and the emergence of birth-order specific fertility control.

The features of the American fertility transition present a fascinating challenge to scholars—particularly among those desiring an integrated model of demographic change. The early fertility

decline took place in the absence of modern contraception and is believed to have been driven by changes in the demand for children. The baby boom took place in the context of increasing income, urbanization, educational attainment, and women's labor force participation—all trends associated with declining fertility in the early 20th century. Adding to the puzzle is that the post-1960 period saw falling fertility rates even as incomes, urbanization, educational attainment, and rising women's labor-force participation continued to rise.

A. Models of Fertility Decline in Economics and Demography

The challenge of explaining U.S. fertility transition has led to the development of two main schools of thought in economics. One cornerstone of the literature has been Richard Easterlin's "relative income hypothesis" (1966, 1971, 1980). Easterlin argues that the importance of a cohort's perceived "earnings potential" relative to its "material aspirations" is critical in forming adult preferences for material goods and children. In this view, children who grew up in the Depression in the 1930s formed modest material aspirations that were surpassed by their actual experience as young adults in the 1940s and 1950s. When these children of the Depression found they could afford more of everything, they consumed more and also had more children. That is, the baby boom was a lagged effect of a large fluctuation in relative income. Problematic for this theory is that fertility rates have not cycled since the baby boom.

Another cornerstone of the literature has been Gary Becker's neoclassical theory (1960, 1965, with Greg Lewis 1973). This school of thought pushes Easterlin's endogenous preference formation into the background and emphasizes the importance of prices and absolute incomes—holding preferences constant. Becker's approach explains the negative association between childbearing and income as reflecting the difference in the opportunity cost of childbearing (higher wage rates for higher income individuals) as well as the greater income elasticity of child quality (compared to the quantity of children). Becker has extended the reach of the neoclassical school to macro economics with two joint articles with Robert Barro (1988, 1989). This article reformulated Becker's initially static theory of

fertility to extend utility across generations. This reformulation models decision-makers as altruistic parents who care about the utility of their children and, therefore, incorporate their children's utility into their own utility function. The Barro-Becker framework has led to the development of a new subfield in economics called "family macro," which has created several alternative theories of the baby boom (see Greenwood et al. 2005, Albanesi and Olivetti 2009, and Doepke, Hazan and Maoz 2008). With slightly different formulations of the problem, each of these models examines a different potential price show (as suggested in Barro and Becker's article) produce the baby boom. In the spirit of Becker (1965), all of these models rely upon the increasing *opportunity* cost of childrearing (primarily due to the growth in women's wages) to generate the longer-term decline in US. childbearing. Problematic for these models is that when calibrated to match the baby boom, they difficulty generating the speed of the U.S. fertility decline after 1960.

Much of the demographic literature has maintained a different focus. Citing newly-collected, national surveys documenting increased use in the Pill, Ryder and Westoff (1971) heralded the 1960s as a period of "contraceptive revolution." Building on this claim, Lesthaeghe and van de Kaa (1986) hypothesize that the arrival of the contraceptive, sexual and women's rights revolutions of the 1960s engendered a *distinct* demographic transition—a period *exceptional* enough to be called the "Second Demographic Transition" (SDT). Their initial work focuses on Europe, but recent work argues that a SDT is underway in the U.S. as well (Lesthaeghe and Neidert 2006). The distinctive characteristics of the SDT, they argue, are persistently low fertility rates, substantially delayed marriage and childbearing, increases in non-marital cohabitation and childbearing, and high divorce rates.[4] Even as demographers have stressed these changes, the demand-side formulations of both the Easterlin and Becker schools of thought have continued to shape the theoretical and empirical literature on childbearing in economics.

[4] In some formulations, the rise in women's labor-force participation is also attributed to the SDT. We omit discussion of women's labor-force participation rates here, because this is covered in Olivetti's chapter.

B. Integrating the Neoclassical Model with a Supply Side

Augmenting demand-based economic models of childbearing with a "supply" side is one way to operationalize the Westoff and Ryder (1971) and Lesthaeghe and van de Kaa (1986) hypotheses. To this end, the pioneering work of Michael and Willis (1976) provides a useful bridge between the neo-classical demand for children (Becker 1960, 1965; Willis 1973; Becker and Lewis 1973) and the "supply side" stressed elsewhere (Coale 1973, Sheps 1964, Sheps and Perrin 1964, Westoff 1975, Easterlin, Pollak, and Wachter 1980). Their framework relaxes two assumptions in neo-classical models: (1) that childbearing is deliberately determined and (2) that regulating fertility is costless. In their model, the number of children is a random variable, and couples choose a contraceptive strategy to reduce the monthly probability of conception. In addition, fertility regulation has a price (rather than being costless as in the neoclassical framework). Each contraceptive strategy—the adoption of behaviors or use of contraceptives—is associated with a fixed and marginal cost and yields an expected number of children. Couples maximize utility by weighing the marginal costs of averting births against the marginal benefit of attaining an *ex ante* distribution of childbearing. That is, couples optimize by choosing a distribution of possible childbearing with mean, μ^*, to maximize utility net of the costs of fertility regulation, or $\max_{\mu} U(\mu)-C(\mu)$.

Within this framework, Ryder and Westoff's "contraceptive revolution" is simply the claim that shifts in C( ) became much more important in determining childbearing in the post-1960 period. Using the same framework, Lesthaeghe and van de Kaa (1986)'s distinction between the first and second demographic transitions is summarized by saying that the first transition was driven by shifts in U( ) whereas the SDT was driven by changes in C( ). This framework also provides a starting point for conceptualizing why standard demand-side models in economics may fail to capture important features of the post-1960 fertility decline.

Effects on the Mean Number of Children Born

The Michael and Willis framework provides testable predictions regarding how the introduction of modern contraceptives like the Pill could have changed the distribution of children ever born. The model's insight about the effect of modern contraception on *mean* children ever born is straightforward.

Michael and Willis consider a simple division of costs of attaining a fertility distribution, μ, using contraceptive strategy *j*, into a fixed cost, α_j, and a marginal cost, β_j. The cost of using strategy *j* to attain an *ex ante* birth distribution, μ, is given by $c_j = \alpha_j + \beta_j (\mu_N - \mu)$, where μ_N indexes the expected distribution of children born in the absence of any contraceptive method. The term $\mu_N - \mu$ is, therefore, the expected number of births averted. The (constant) marginal cost of averting a birth, β_j, might be a behavioral cost (abstinence or withdrawal), the inconvenience or discomfort of birth control use (barrier methods), or the necessity of purchasing supplies (as with condoms or the birth control pill). Fixed costs include the price of searching for a supplier, learning about a method, and perhaps side effects as well. The total cost function includes only the lowest cost option for achieving an expected number of births, or $C(\mu)=\min_j\{\alpha_j + \beta_j (\mu_N - \mu)\}$.

Modern contraceptive methods (such as the Pill or IUD) can be modeled as reducing the marginal costs of preventing births, because no interruption, effort, or discomfort at the time of intimacy is required. Thus, modern methods would reduce β for some range of births averted. Holding the demand for births constant, reducing the marginal costs of preventing births would normally lead to a reduction in the number of children born per woman. But because the effectiveness of the Pill also reduced the uncertainty surrounding childbearing outcomes, there is potential for offsetting theoretical effects. Michael and Willis point out that more reliable contraception may, somewhat counter to intuition, increase the number of children born by eliminating precautionary undershooting. This effect may be small, but it does make the theoretical impact of modern contraception ambiguous.

Effects on the Distribution of Children Born

The Michael and Willis model also provides straightforward predictions about how different contraceptive methods affect the distribution of children ever born. Michael and Willis present figures showing how the expected number of children and the variance change with contraceptive technique (table 2, 1976). Techniques with lower contraceptive efficiency (for example, rhythm), tend to have higher mean and variance (5.11, 2.15) than techniques with higher contraceptive efficiency (for example,

condoms: 2.33 and 1.64, or the Pill: 0.19 and 0.18), but this relationship is not monotonic. In particular, the use of no method at all (or reduced frequency of sex) produces a high number of children in expectation but little variance. The intuition for this is that most women achieve near their natural biological fertility without using any method, and this varies relatively little across women. Less effective methods, while reducing the mean, still fail frequently enough that many women have more children than intended, increasing the variance.[5] Thus, for women in the early 20th century, the methods of fertility control readily available to them would be expected to reduce the mean without reducing the variance; in fact, the variance might rise with the use of such methods. In contrast, as women in the latter half of the 20th century began to use more efficient methods in greater proportion, both the mean number of children as well as the variance should fall.

In summary, the Michael and Willis model of fertility change provides a simple, mathematically tractable bridge between economic and socio-demographic models. It explicitly models the importance of the "supply side" as technologies affecting the marginal costs of averting births in the spirit of Easterlin (1975) and Easterlin, Pollak, and Wachter (1980) by formalizing the concept of a birth production function that separates natural fertility, μ_N, from targeted childbearing, μ^*, in a stochastic framework with costs of fertility control. It also formalizes Coale's (1973) conceptual framework: "ready" is captured by the formal calculus; "willing" is captured by the utility function, prices, and income; and "able" enters as the technology and cost of contraception based upon the mathematical demography of Sheps (1964) and Sheps and Perrin (1964).

For our purposes (and those of other empirical researchers wishing to examine the appropriateness of different theories), another valuable feature of the Michael and Willis (1976) model is that it provides a richer set of testable predictions than theory based on changes in the number of children alone. Although Michael and Willis's insights about changes in the dispersion of outcomes do not cover

[5] The nonmonotonic relationship between the mean and the variance in the Michael-Willis model rests on their assumption that childbirth is a Markov renewal process, or that intervals between childbearing can be assumed to be independent and identically distributed.

other features of Ryder and Westoff's (1971) contraceptive revolution or Lesthaeghe and van de Kaa's (1986) SDT, they provide an additional moment of the distribution on which to test claims of post-1960 exceptionalism.

II. DIFFERENCES IN THE EARLY AND LATER 20TH CENTURY FERTILITY TRANSITIONS

The case for the exceptionalism of the post-1960 fertility decline rests on the claim that there are meaningful differences from the pre-baby boom fertility decline. The implicit hypothesis is that the longer-term forces leading fertility to decline in the early 20th century are the same forces (e.g., the opportunity cost of childbearing or substitution toward child quality) that contributed to fertility decline in the post-1960 period. To examine the similarities of the behavioral model driving fertility decline in both periods, our analysis compares outcomes across birth cohorts. For the early 20th century transition, we focus on women born from 1880 to 1910, who reached age 20 from the early 1900s to 1935. We often refer to the cohorts of 1900 and 1910 as the early 20th century cohorts. For the later 20th century transition, we focus on the 1940 to 1970 cohorts, who reached age 20 from 1960 to 1995. We often refer to these cohorts as the later or mid-20th century cohorts.

A. Period Fertility Rates and Mean Completed Childbearing

Figure 1 presents the general fertility rate (GFR) by year and cohort-based measures of mean "children ever born" (live births excluding miscarriages and still births) to women ages 41 to 70 from the decennial Census and the June Current Population Survey (CPS).[6] For mean children born, we have advanced the series 25 years (approximating the period when the birth cohort was having children) to correspond to the GFR. The pattern of the cohort-based measure corresponds closely to the period measures. Women born in 1875 (linked to 1900 in figure 1) averaged 3.3 births over their lifetimes, whereas women in the early 20th century cohorts averaged 2.3 births over their lifetimes. This number rose sharply to over 3 children for the cohorts reaching childbearing age during the baby boom (born

[6] Because the Census stopped asking about children ever born after 1990, we use the June Current Population Survey (CPS) to extend these figures to 2010 (birth cohort of 1969). Changes in the age restrictions and regression-based age-at-observation adjustments alter these figures trivially.

between 1915 and 1935), and then fell to around 2 births for the 1945 to 1970 cohorts.[7] A second series shows that the addition of never-married women (first asked about their childbearing in 1970) alters the overall pattern very little except to reduce the levels of childbearing. Consistent with the literature, figure 1 shows that the decline in the mean number of live births was almost identical for the early and late 20th century cohorts.[8] By comparison, the average annual rate of decline in the general fertility rate (GFR) in the 1960s was 2.2 births per 1000 women of childbearing age per year, only slightly faster than in the 1920s (approximately 2 births per 1000 women of childbearing age per year).

Two kinds of survival bias may influence these estimates. First, income is negatively associated with lifespan and childbearing, so lower income women—who also tend to have more children—may be less likely to survive to answer Census questions about their childbearing. That is, women having more children may be less likely to survive to be enumerated in the Census, and this differential mortality should be more pronounced for the earlier cohorts. Second, women having more children are more exposed to the risk of dying in childbirth and, therefore, less likely to be enumerated later in the Census. Both of these sources of survival bias should lead live births to be understated for the older cohorts and, therefore, understate the speed of fertility decline in the early 20th century. To gauge the importance of the first, we limit our sample to women ages 41 to 50 only, but this has a negligible effect on our estimates. This implies that the mean children ever born to women surviving to 41 to 50 versus those who survive to 51 to 70 are not appreciably different. Assessing the importance of differential maternal mortality is more difficult, but something we aim to do in the revision of this paper. In general, correcting for these sources of bias should increase the rate of fertility decline among the early cohorts and, thus, tend to make the earlier and later cohorts look more similar.

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[7] Child survival rates to age 10 were much lower historically than today, so—holding constant the demand for surviving children—increases in survival provide one reason for the reduction in children ever born over the last 100 years. Unfortunately, as the Census after 1910 did not ask about children surviving, we cannot use these data to investigate the role of child survival on completed fertility. That said, because infant and child mortality rates were higher for the early fertility cohorts, differences in surviving children would tend to make the early and later cohorts look even more similar.

[8] The decline slightly faster for the late cohorts at 0.04 versus 0.036 births per year for the early 20th century cohorts.

Another concern is that the level and speed of declines in completed fertility rates may reflect important compositional changes in the U.S. population. To take account of changes in the urban share of the population, the share of immigrants from different source countries, race and ethnicity, and age composition, we reweight the individuals within each birth cohort à la Dinardo, Fortin and Lemieux (1996) such that the distribution of each cohort's characteristics resembles the characteristics of the 1920 to 1929 cohorts. Adjusting the early cohorts to look more like the 1920s cohorts increases the importance of the urban population, which had lower fertility rates. This adjustment decreases the speed of the early fertility decline slightly but has a negligible impact on estimates for cohorts born after 1940. After reweighting, mean completed childbearing declined by 2.74 births between cohorts born in 1850 and those born in 1910, versus 2.89 without this reweighting. In both the early 20th century and post-1960 period, fertility decline was driven by *within-group* changes in outcomes rather than changes in population composition.

The Census and CPS allow us to highlight these within-group changes by plotting trends for native born whites, foreign born whites, and nonwhites, as well as urban and rural residence.[9] Figure 2 shows that the patterns by white, native-born women (dotted line) follow the overall patterns in childbearing closely. Consistent with the period fertility rates presented in Easterlin (1961), completed fertility among the early 20th century cohorts of foreign-born white women fell more rapidly than other groups. Throughout the period, the completed fertility rates of urban women remained much lower than in the overall population, but the population converged to these lower rates as America urbanized and completed childbearing among women living in rural areas converged to the overall population.

In summary, our analysis with completed childbearing affirms the findings of earlier studies using period fertility rates. The early and later 20th century cohorts both achieved low mean levels of completed childbearing (2.3 and 1.9, respectively), and the speed of fertility decline was comparable in for period

[9] An important distinction in our study is that residence is measured at ages 41-70 rather than at the time the birth took place as in the Vital Statistics.

and cohort-based measures. These findings caution against claims of recent exceptionalism, as the post-1960 period does not appear especially distinctive. They also provide *prima facie* evidence supporting Becker's argument that "the 'contraceptive revolution' … ushered in by the pill has probably not been a major cause of the sharp drop in fertility in recent decades… [W]omen in the United States born between 1900 and 1910 had quite small families without the pill by using other contraceptives, abstinence, and induced abortions" (1981: 101-2).

B. Changes in the Distribution of Completed Childbearing

Similarities in mean outcomes mask important changes in the underlying distribution of children ever born. Figure 3 shows that the early and later cohorts reduced their fertility declines in strikingly different ways. For instance, the distribution of live births for the 1850 birth cohort looks almost uniform between 0 and 6 live births, as roughly 8 to 10 percent of women each achieved exactly one of those numbers. For this cohort, the share having each of 7 to 11 children falls from 7 to 1.5 percent. This pattern is consistent with birth control methods that delayed marriage (and thus childbearing) and increased the spacing of childbearing.

Becker (1981: p. 100) shows a simple calculation that the number of children one could expect to have, n, can be written as $n=E/(C+S)$, where E is equal to the number of months one is susceptible to be pregnant (the interval from first coitus to when one is no longer fecund), and $C+S$ represents the average spacing between births. He argues that fertility rates could be reduced by almost 25 percent by delaying marriage (and thus reducing E). The reduction in childbearing between the cohorts of 1850 and 1910 is consistent with using these types of strategies to reduce completed childbearing. During the late-19th Century/early-20th Century period of fertility decline, each generation of women substituted toward fewer children, and two thirds of women achieved two or fewer children in the cohort of 1910. It is striking that almost 23 percent of the birth cohort of 1910 was childless at ages 41 to 70. Another 20 percent of women born in 1910 had only one child, and 23 percent had exactly two children.

Only slightly more women born from 1940 to 1970 had two or fewer children. Yet these cohorts are distinctive in two respects. First, a substantially larger share of the later cohorts achieved *exactly* two children. In contrast to the fairly equal division of mass between zero, one, and two children for the cohort of 1910, 17 percent of the 1950 cohort had no children at ages 41 to 70. Another 17 percent had one child, and over *35 percent* had exactly two children. Moreover, significantly more of the later cohort had three children (19 percent versus 14 percent in the cohort of 1910), though fewer had 4 or more children. The distributions for the 1960 and 1969 cohorts from the June CPS are almost identical to the 1950 distribution; they are difficult to make out in figure 3 because they lie almost exactly on top of one another. (The only discernible difference may be a very small rise in the share remaining childless, from 17 percent for the cohort of 1950 to 18 percent for the cohort of 1969.) In contrast to the fairly large changes every twenty years since the 1850s, the distribution of children ever born has been remarkably stable among women completing their childbearing in the last 20 years. This finding suggests a distinctive feature of the recent fertility decline.

> *Feature 1. Cohorts reaching childbearing age in the post-1960 period achieved similar mean numbers of children born as cohorts born from 1900 to 1910, but the more recent cohorts exhibited substantially less within-cohort dispersion in children born. In particular, they were more likely to have exactly two children and less likely to remain childless.*

The post-1960 decline in childbearing witnessed the collapse in the distribution of live births around a two-child mode and the realization of the "two-child norm" (David and Sanderson 1987), which also led to a strong reduction in within-cohort dispersion in outcomes. This is not only true in terms of the declining standard deviation (and range), but also in terms of the coefficient of variation, which normalizes the standard deviation by the falling mean.[10] This suggests that smaller families—especially two-child families—grew far more universal in the post-1960 period than they had been in the past.

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[10] The coefficient of variation provides a succinct, scale-invariant summary of within-cohort differences. Scale invariance is desirable in this context, because the mean number of children born falls so dramatically across cohorts, and this also mechanically reduces the variance and standard deviation. For the birth cohorts of 1880 through 1910, the coefficient of variation suggests that within-cohort dispersion *grew* during the early 20th century fertility decline, as certain groups (such as foreign-born white women) decreased their childbearing to native levels while other groups (such as rural women and non-white native

Moreover, the later cohorts were much *less* likely to remain childless compared to the early cohorts. This finding challenges the conventional wisdom about the recent period as well as assertions of increasing rates of childlessness. It is true that childlessness rates today are 6 to 7 percentage points higher than for cohorts 30 years older (cohorts generating the baby boom), but they are 6 percentage points *lower* (17 versus 23 percent) than the low fertility cohorts. Similarly, a *smaller* share of the mid-20th century cohorts had exactly one child relative to the lower fertility cohorts. Consistent with Michael and Willis's model that better contraception reduces precautionary undershooting, more recent cohorts today are less likely to have fewer than two children. This finding may be surprising given qualitative evidence and media accounts of women having overestimated their ability to get pregnant at older ages.[11] Taking these accounts at face value, however, suggests that childlessness rates may even fall if younger cohorts of women adapt their behavior to minimize the risk of subfecundity. The two child mode, decreasing childlessness, and reduced variance in number of children suggests that women have been increasingly able to reach their desired number of children since 1960.

C. Changes in the Relationship of Marriage Timing and Childbearing

In the early-20th century U.S. fertility transition, marriage decisions—whether to marry and when—seem to play little role. Changes in parity-specific birth control (stopping within marriage) seem much more important. As completed childbearing declined, figure 4 shows that both the share marrying by age 40 and 45 and the age at first marriage remained very stable for cohorts born between 1870 and 1910. As the baby boom began, the share ever marrying increased from a stable 90 percent to 95 percent and the mean age at first marriage fell by almost two years to around age 20.7 for the 1935 cohorts. As

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women) remained much higher (see figure 2). The within-cohort dispersion in live births was highest for women born from 1900 to 1910, the cohorts experiencing the lowest pre-baby boom levels of completed childbearing. During the baby boom, however, dispersion in childbearing fell rapidly, as groups with previously falling fertility rates changed course to have more children. This reversal reduced within-cohort differences in childbearing, and the coefficient of variation reached a 100-year nadir for cohorts born in the mid-1930s—those giving birth to the largest number of children during the baby boom. In contrast, the strong negative relationship between the dispersion in childbearing and fertility decline disappeared in the post-1960 period. As completed childbearing fell to 1.9 for the later cohorts, the coefficient of variation grew only slightly, from 0.66 to 0.73.

[11] See the stories, for example, at http://www.wbur.org/npr/142725547/many-women-underestimate-fertility-clocks-clang and http://www.prweb.com/releases/2012/3/prweb9286601.htm.

the baby boom ended, the first decade of the post-1960 fertility decline was characterized by a *stable* age at first marriage and share ever married by age 40. Only with the cohorts born in the mid-1940s and early 1950s did mean age at first marriage begin to rise and share ever married by age 40 fall.

Figure 5 compares the age-at-first marriage distributions across cohorts. The mean age at first marriage for the cohort of 1910 (conditional upon being married before age 35) was 22 but the distribution was diffuse (variance of 21.5). During the baby boom when completed childbearing was at its 50-year peak and very few women never married, the mean age at first marriage was lower and more concentrated around age 21. During the post-1960 fertility decline, the mean age at first marriage *continued* to remain low at 20.6 (cohort of 1940) and 21.3 (cohort of 1950) as did the dispersion of outcomes (variances of 14.7 and 16.9, respectively). As with the early 20th century fertility decline, the post-1960 reduction in childbearing exhibited a neutral relationship between age at first marriage and completed childbearing.[12]

The transition toward today's comparatively higher age at first marriage (compared to the low fertility cohorts) and rates of non-marital cohabitation appears to have begun with cohorts born in the late 1950s. Among cohorts reaching 20 in 2010 (the 1990 birth cohort), less than 10 percent had married, whereas almost 40 percent of women born from 1900-1910 had married by age 20. By age 25, almost 40 percent of the 1985 birth cohort had married versus 70 percent of the birth cohorts born in the early 1900s. Information from the 1988 to 2010 NSFG allows us to investigate how much of this trend has been due to pre-marital cohabitation—a change in the terms and the "label" of a long-term relationship. Series that include age at first cohabitation or marriage allow us to assess the importance of cohabitation for recent cohorts. The results show that the drop in the fraction of women ever married by age 25 is much more gradual decline once cohabitation is included. Whereas the declines in share ever married continue

[12] The low levels in the age at first marriage for the 1940 and 1950 cohorts could reflect selection: women who previously married relatively late becoming less likely to marry at all (perhaps due to an increased rate of non-marital cohabitation) or increases in first marriages happening after our sample age cutoff of 35. But figure 6 shows the reverse is the case. Relative to cohorts born from 1900 to 1910, cohorts born in the 1940s and 1950s were slightly *more* likely to be married by age 35. This indicates that later marriage among the cohorts born from 1900 to 1910 should tend to work against finding differences between the early and mid-20th century cohorts.

for cohorts born after 1965, the marriage plus cohabitation trends seem to have stabilized, or even risen slightly, for these more recent cohorts. Only 20 percent of women born in 1970 had married by age 20, but 35 percent had cohabited; by age 25, 55 percent of the same cohort had married, but over 70 percent had cohabited.

> *Feature 2. Cohorts reaching childbearing age in the post-1960 period first formed households (through marriage or cohabitation) at similar ages to cohorts born from 1900 to 1910, but considerably more of the recent cohorts precede marriage with non-marital cohabitation.*

Presuming non-marital cohabitation was rare in the early 20th century, combining these non-marital cohabitation and marriage rates suggests a striking similarity in the age at first household formation in the U.S. in the early 20th century and post-1960 period. As in the early 20th century, considerable reductions in childbearing occurred within marriage due to parity-specific fertility control. This delay in marriage does not appear to be a return to the pre-baby boom norm, as women are delaying significantly more than what was common even for the low-fertility cohorts born in the early 1900s. However, these changes do not appear to be a retreat from marriage altogether. The share of women married by age 40 has remained relatively stable around 90 percent for the last 100 years and is only slightly lower for the most recent cohorts reaching that age. The rise in cohabitation may imply substantial changes in matching between men and women as well as in traditional gendered forms of household/labor-force specialization.

D. Changes in the Timing of Childbearing and its Occurrence within Marriage

Lesthaeghe and van de Kaa claim two additional distinctions for the post-1960 fertility decline: the delay of childbearing and the occurrence of childbearing outside of marriage. Figure 7 provides context for our discussion of fertility delay by plotting 90 years of age-specific fertility rates in the U.S. by year (not birth cohort). Ignoring the tremendous increase in earlier childbearing during the baby boom, the early 20th century and post-1960 declines exhibit several interesting features. One is that non-teen birth rates by age group maintained a certain ordering before the 1960s, which has changed today. During the early 20th century, women in their early twenties had the highest birth rates, followed by women in their late twenties, early thirties, late thirties, and then by teens and older women. Consistent

with substantial delays in motherhood, birth rates today are higher among women in their late twenties; further, in 2010 birth rates to women in their early thirties exceeded those among women in their early twenties for the first time in 90 years. On the other hand, the levels of teen birth rates are more similar to rates earlier in the century than they have been since the 1930s. Given frequently cited concerns about high rates of teen childbearing in the U.S., only in the last few years have teen birth rates dipped to 90-year lows (i.e., lower than rates recorded in 1918).

Figure 8 plots changes in the share of women with their own child in the household for the birth cohorts of 1875 to 1990.[13] Although the early 20th century fertility decline corresponded to modest reductions in the share of women with children at home by age 20 (2 percentage points), age 22 (6 percentage points), age 25 (5 percentage points), and age 30 (6 percentage points), completed fertility declined in the 1960s *despite* considerably earlier age at first birth, especially relative to the 1910 cohort. For instance, 42 percent of the 1947 birth cohort had a child by age 22 whereas only 32 percent of the 1907 cohort did. For the early cohorts, motherhood delay was not just at very early ages but reflected a fanning out of the first birth distribution at older ages. By age 30, 72 percent of the 1949 birth cohort had a child whereas only 59 percent of the 1909 birth cohort did. The post-1960 delay in childbearing has only gradually reached and then surpassed the distribution in age at first birth for the low fertility cohorts. After three decades of fairly stable childbearing rates (figure 1), only the cohorts born in the late 1970s were just as likely to be mothers at age 30 as women born 70 years earlier.

Figure 9 provides more detailed examination of changes in the age-at-first birth distribution using the June CPS and NSFG (these distributions are for women ages 36 or older who gave birth by age 35). As the baby boom got underway, the 1930 to 1940 birth cohorts gave birth earlier as childlessness rates fell—a trend that continued for cohorts born into the late 1940s. Consistent with figure 8, considerably more of the birth cohort of 1950 first gave birth at 19, 20, and 21. Beginning with cohorts born after

[13] While we reliably identify that a given child belongs to a particular woman, we cannot identify whether that child was born to the woman, adopted by her, or is a step-child.

1950, mean age at first birth rose rapidly as the baby boom ended—in fact, twice as fast as age-at-first marriage. The average age at motherhood reached 23.2 for the cohort of 1950 and 23.9 for the cohort of 1960, and the variances increased to 19.6 and 23.6, respectively. The delay and growing dispersion continued over the 1960s, with the 1970 cohort having mean age of first birth at 24.4 and a variance of 25.9.

In addition, the distribution of the interval between first marriage and first birth changed for cohorts reaching childbearing age in the more recent period (among those who achieved both outcomes by age 35, but not in a particular order; figure suppressed but available upon request). Whereas 57 percent of the 1910 cohort gave birth within two years after getting married, 45 percent of the 1950 or 1960 cohorts did, and only 35 percent of the 1970 cohort did. The mean interval length from first marriage to first birth fell from 2.2 years for the cohort of 1910 to 1.5 years for the cohort of 1940 before rising back to 2.0 years for the 1950 cohort. But it fell *again* for the next two decades, even as age at first birth was rising. The mean interval length from first marriage to first birth fell to 1.7 years for the 1960 cohort and just 0.9 years for the 1970 cohort. These aggregate declines are driven entirely by women marrying after first childbirth. But among women who married before giving birth, the interval from first marriage to first birth *increased* from 2.8 years for the 1950 cohort to 2.9 and 3.2 for the 1960 and 1970 cohorts. These findings suggest another distinctive feature of the recent fertility decline.

> *Feature 3. Cohorts reaching childbearing age in the post-1960 period delayed motherhood relative to the cohorts born from 1900 to 1910 and exhibited increasing dispersion in age at first birth. Among women marrying before having children, the interval from first marriage to motherhood increased.*

Delays in age at first birth occurred even as significantly younger women had intercourse. Figure 10 depicts what many have referred to as the "sexual revolution." The share of women who first had intercourse in their teens increased sharply for the cohorts born in the late 1940s. Although the distribution of age at first intercourse appears relatively stable from the calendar years 1955 to1965 (calendar year series is suppressed; figure 10 only shows statistics by cohort), the mean age at first intercourse began to fall rapidly starting in the late 1960s. This strong period effect is less evident in our

cohort figure but implies that cohorts were affected at different ages. The birth cohort of 1948 was 18 in 1966, and the share having intercourse by 18 rose for subsequent cohorts. Similarly, the birth cohort of 1950 was 16 in 1966, and the share of subsequent cohorts having intercourse by age 16 rose rapidly for subsequent cohorts. We cannot construct similar statistics for the early cohorts, but all of our analysis thus far suggests that the baby boom period should have led to *earlier* first intercourse (along with earlier first marriage and birth) relative to the low fertility cohorts.[14]

As pre-marital sex increased, so did the proportion of births that were non-marital.[15] As shown in figure 11, the rise was initially for women in their teens. Between the cohorts of 1940 and 1960, the share of non-marital teen births rose from approximately 14 percent to almost 40 percent. There is also a noticeable rise for women in their early 20s from 5 percent (1940 cohort) to 19 percent (1960 cohort). As completed fertility for the youngest cohorts has stabilized, the non-marital share of births to women in their teens and early twenties has risen dramatically. Older women have also seen rising non-marital birth rates, but the increases are more modest. These findings suggest another distinctive feature of the recent fertility decline.

> *Feature 4. The post-1960 fertility decline corresponded to a decoupling of sex, marriage, and childbearing. Cohorts reaching childbearing age in the post-1960 period had intercourse at earlier ages but gave birth at later ages and more frequently outside of marriage.*

We do not mean to imply that pre-marital sex, and thus pre-marital *pregnancies*, were uncommon in the U.S. before 1960. They were not (Smith and Hindus 1975). However, non-marital *births* occurred much less frequently than today, because non-marital conceptions more frequently resulted in marriage.[16] An important distinction today is that Americans have more sex—at younger ages and within and outside of marriage, yet realize aggregate and mean completed fertility rates similar to cohorts that delayed marriage

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[14] We expect that data on age at first intercourse for these earlier cohorts of women would show that even fewer had sex as teens rather than more. Using the baby boom cohorts as our starting point, therefore, should lead us to understate the increase in sexual activity among younger teens.

[15] We do not intend to convey a causal direction with the ordering of this statement. Nonmarital sex may have increased because more women desire children but not husbands.

[16] Akerlof, Yellen, and Katz (1996) provide an economic bargaining model that relates availability of abortion and modern contraception to the decline in shotgun marriages.

and childbearing (and likely sex) until much older ages. In the post-1960 period, increasingly earlier intercourse was *not* associated with falling age at first birth or greater numbers of children born—relative to women reaching childbearing age during the baby boom or the low fertility cohorts.

III. CHANGES IN THE SOCIO-ECONOMIC GRADIENT OF CHILDBEARING

This final section of our analysis considers the link between the features of the post-1960 fertility decline and mother's education. This focus is not intended to describe the link between women's own opportunity costs of childbearing and their outcomes but to characterize the implications of changes in childbearing for the affected children. The weakening linkages between sex, marriage, and childbearing mean that childbearing outcomes have become much more strongly linked to socio-economic characteristics in the post-1960 period.

Mother's education is a useful proxy for her own socio-economic status in adulthood, but it is also a strong predictor of children's outcomes. For instance, mother's education is closely related to a mother's marital status, husband's education, and family earnings (own and spouse's). As a practical matter, each woman's education is observed in the Census even when we do not observe her earnings, occupation, or her spouse's earnings (e.g., he is deceased). Because the share of women with any given absolute level of education has changed dramatically over the century of birth cohorts we examine, our analysis uses a *relative* measure of education computed for each birth cohort. Women whose educational attainment is below the 25th percentile are grouped with the "low group" and those above the 75th percentile are grouped with the "high group."[17]

Our focus is on six outcomes by birth cohort associated with the distinctive features of the post-1960 period featured elsewhere: (1) mean children ever born, (2) childlessness (the share of women who have not given birth), (3) age at first marriage, (4) the share of women ever married or cohabiting by age

[17] Specifically, we employ a quantile regression of an individual woman's years of schooling on birth year dummies and a quartic in age interacted with dummies for 20-year birth cohort intervals (1880-1899, 1900-1919, etc.). Predicted values from the quantile regression (either at the 25th or 75th percentiles) are then compared with actual values for each woman. Because there is significant heaping in the education distribution (particularly at 12 and 16 years), we first "smooth" actual education values by adding a stochastic noise term drawn from a uniform distribution of width 1, centered at 0. This procedure preserves the cohort quantiles but alleviates composition changes across cohorts due to heaping in the education distribution.

35, (5) age at first birth, and (6) the share of women whose first birth was non-marital. In the first two cases, we restrict the sample to women at least 41 years of age for comparison with the trends in figures 1 and 2. For the latter cases, which rely on the smaller sample sizes of the NSFG for the more recent cohorts, we use women at least 36 years of age in order to balance the need to allow the lifecycle event to have occurred with preserving sample size.[18] Although our data do not permit a direct analysis of parental investments in children, they are informative in light of other studies on differences in parental time use and investments in children by mother's education.

Figure 12 documents changes in childbearing for women in the upper and lower quantiles of the education distribution. As is well known, women with less education have always had more children than women with more education. Less well-known is that the most educated women in the early 20th century were having fewer than two children over their life-times. This educational difference in completed childbearing narrowed from 2.0 children for the 1880 cohort to 1.2 in the early 20th century. After narrowing even further during the baby boom, as more educated women increased the number of children they had, the post-1960 period saw the gap fall to around 0.9 for the 1950 cohorts and to 0.5 for the 1970 cohorts. Today, inequality in completed childbearing is at a 90-year low. The overall narrowing in the education gap has been driven by falling completed fertility among the less educated, but the more recent convergence is also due to rising childbearing among more educated women. Counter to common intuition, the mean number of children ever born to more educated women is higher today at 1.7 children than earlier in the 20th century.

Similar to the relationships for children ever born, figure 13 shows that childlessness rates have tended to be higher among more educated women (a relationship that almost disappeared during the baby boom). The more educated women in cohorts reaching childbearing age in the 1970s had roughly the same rates of childlessness as the early 20th century cohorts (around 29 percent) but this is less the case

[18] We have calculated the trends for outcomes (3) through (6) using women at least 41 years of age. Although noisy, they are qualitatively similar to the figures we present.

for more recent cohorts. Only 21 percent of more educated women born in 1969 were childless by age 41. Similarly, childlessness rates among the less educated are lower for recent cohorts compared to the early 20th century cohorts.

Marital decisions have changed differentially by education quantile as well. Accounting for age at first cohabitation, figure 14 shows that age at first household formation (either through marriage or cohabitation) occurs earlier today than historically for less educated women. The education gap is also larger today. Age at first marriage shows a wide educational gap of around three years for the pre-1910 cohorts, which narrowed considerably during the baby boom as marriage age fell faster for the more educated group. The average marriage age among the less educated remained similar for the 1935 and 1950 cohorts at around 20, but the average marriage age for the more educated rose two full years, from 22.1 to 24.1, over the same period. Both groups saw rising ages for post-1950 cohorts, with the top quartile rising particularly rapidly for the early 1960s cohorts. The series for cohabitation shows that cohabitation was rare for cohorts born before 1960. Accounting for changes in cohabitation reduces the gap in age at first marriage to around four years for the cohorts born in 1970.

Figure 15 shows that selection into marriage has changed. For the early 20th century cohorts, less educated women were 10 to 15 percentage points more likely to have married by age 35. This gap disappeared during the baby boom (the 1920 to 1940 cohorts) and more recently appears to have reversed. Today, more educated women appear slightly more likely to marry than less educated women, although the NSFG data are too noisy to conclude this definitively..[19]

Age at first birth (figure 16) and non-marital childbearing (figure 17) have shown the most dramatic changes by education since 1960. In the early 20th century, the gap in age at first birth between more educated and less educated women was around 3.5 years. After falling by about 0.5 years during the baby boom, as mean age at first marriage fell faster for more educated women, the gap has expanded to almost 7 years, roughly *twice* the size of the education gap for the 1910 cohort. More educated women

[19] This conclusion is unaltered if we restrict the sample to women at least age 41.

born in the 1970s waited 2.5 years longer than they had 55 years earlier, whereas the less educated gave birth 1 to 1.5 years *earlier* than they had historically.

As the age at first birth for less educated mothers remained at 90-year lows, their rate of non-marital childbearing grew rapidly. Following a period of stability during the baby boom, at around 11 percent for less educated mothers and 4 to 6 percent for the more educated mothers, the gap in non-marital births exploded for cohorts born after 1950. Non-marital childbearing grew across the education distribution, but more slowly for the top quartile. Among women born in the late 1960s, the share of non-marital childbearing reached three times the historic average for more educated women and over four times the historically higher average among less educated women. For the most recent cohorts, 54 percent of first births among the less educated are non-marital. These observations suggest a final distinctive feature of the post-1960 period.

> *Feature 5. Mothers' relative education has become an increasingly strong predictor of age-at-first birth and non-marital childbearing among women reaching childbearing age in the post-1960 period.*

In fact, important features of the post-1960 fertility decline have taken place along more clearly designated educational lines. Whereas trends in children ever born, childlessness, marriage rates, non-marital childbearing, and age at first birth moved in tandem across the educational distribution during the early 20th century fertility decline, the childbearing outcomes of the more and less educated evolved very differently after 1960. Over the last three decades, diverging patterns in age at first birth and non-marital childbearing have not stabilized—a pattern suggesting that the current socio-economic transition, perhaps part of a larger gender revolution (Goldscheider 2012), is still incomplete.

IV. TWO TWENTIETH CENTURY TRANSITIONS: IMPLICATIONS FOR HUMAN CAPITAL

Viewed in isolation, many of the individual features of the post-1960 U.S. fertility decline are not significant departures from the early 20th century fertility transition. In the context of the U.S., we find evidence of Coleman's assertion (for Europe) that "the contraceptive revolution that began in the later 19th century had at least partly uncoupled marriage from birth rates…" The evolution of the distribution

of children born in the late 19th and early 20th century U.S. is consistent with increased spacing and stopping—especially given the relatively stable age at first marriage during the early 20th century fertility decline. We also agree with Coleman's claim that the 1940s and 1950s are an aberration in the broader U.S. fertility history. In every series presented, the 1940 to 1960 period (or the 1915 to 1935 cohorts) represents a substantial deviation from earlier trends. Finally, our analysis supports Coleman's argument that many trends in reproductive and relational behavior "already existed before the sixties; in fact, most of them emerged with the … demographic transition around the turn of the century" (p. 72).

We describe five aspects of the post-1960 period that might give pause to scholars wishing to equate this period with the early 20th century fertility decline. Cohorts reaching childbearing age in the post-1960 period were substantially more likely to have exactly two children and significantly less likely to be childless (feature 1). The post-1960 fertility decline realized the emergence of a 2-children mode. Most economic models simplify childbearing decisions to the number of children born and proxy for this theoretical concept in empirical work using the mean number of children born (or a measure of period fertility), but this simplification misses important changes in *how* couples achieved their targets and how many couples missed these targets.

Other distinctive aspects of the post-1960 period are the decoupling of sex and marriage, sex and childbearing, and marriage and childbearing. Cohorts reaching childbearing age in the post-1960 period formed their first households (through marriage or cohabitation) at similar ages as cohorts born from 1900 to 1910, but recent cohorts were much more likely to substitute non-marital cohabitation for formal marriage (feature 2). More recent cohorts delayed motherhood relative to the cohorts born from 1900 to 1910 and, among women marrying before having children, increased the interval from first marriage to motherhood (feature 3). These cohorts also had intercourse at earlier ages but gave birth at later ages and more frequently outside of marriage (feature 4). The weakening link between sex, marriage, and childbearing in the post-1960 period has also occurred along class lines. Mothers' education has become an increasingly strong predictor of age-at-first birth and non-marital childbearing in the post-1960 period (feature 5).

These five features of the post-1960 U.S. fertility decline are challenging to explain with standard economic models of fertility decline and suggest that modest extensions to existing models. A particularly fruitful avenue for economic models may be an explicit incorporation of a supply side—an acknowledgement that changes in the cost of averting births has changed dramatically over the 20th century. Changes in the costs and technology of contraception are consistent with changes in the distribution of childbearing, even if the mean number of live births is similar for women coming of age in the early and later twentieth century. They are also consistent with the decoupling of sex, marriage, and childbearing.

The growing educational gradient in the timing of motherhood and its occurrence outside of marriage presents another challenge for more standard economic models of childbearing. Differences in childbearing and marriage by mothers' education are consistent with Akerlof *et al.*'s (1996) story that not all women benefited from improvements in contraceptive technology and also with recent theoretical work by Sah and Birchenall (2012) formally linking the opportunity cost of childbearing to the demand for contraception.

On balance, how should changes in the relationship of mother's education and childbearing influence human capital? Recent studies suggest that the availability of modern contraception relaxed important constraints on women's human capital investment decisions. Modern contraception increased women's educational attainment and allowed them to pursue careers (Goldin and Katz 2002; Hock 2008). It also increased their subsequent labor-force attachment and wages (Bailey 2006; Bailey, Hershbein and Miller 2012). Christensen (2011) suggests that early access to the Pill affected decisions to cohabit before, which in turn may directly and indirectly have altered women's incentives to specialize in household production. Greater cohabitation rates imply important changes in matching between men and women as well as changes in women's bargaining power within marriage. The greater rise in age at first marriage among more educated women means that they have more time to search for a mate, increasing both the quality of their match and, potentially, household earnings.

These changes may have increased some women's human capital, their wages (an important component of the opportunity cost of childbearing) and also their incomes, all of which should induce some to have fewer children while increasing their investments in each. Modern contraception may also have the direct effect of reducing the relative price of child "quality," which should lead to an increase in the "quality" of the average child—even holding income constant (Becker and Lewis 1973). For all of these reasons, one might expect the distribution of human capital among children born after 1960 to change. Changes in childbearing by mothers' education imply a growing divergence in the resources available to children born into lower and higher socio-economic status households.

Consistent with these predictions, recent studies provide evidence that the distribution of children's resources is becoming increasingly polarized—the destinies of higher and lower socio-economic status children are diverging. McLanahan (2004), for instance, summarizes the empirical support for the idea that the type of environment in which a child is raised has become more closely determined by socio-economic factors. Mothers with higher relative education are less likely to be unmarried, more likely to work, give birth at older ages, and live in higher income households. Children who have a college-educated father spend more time with him than children who do not. Similarly, studies using data from the American Time Use Surveys have found that more educated mothers not only spend more time on all forms of child care than less-educated mothers (Guryan, Hurst, and Kearney 2008), but they are also more likely to change the type of child care based on children's developmental needs (Kalil, Ryan, and Corey 2012). This divergence in family resources invested in children is closely related to decisions about when to become a parent and how many children to have. It may be closely linked to these children's educational achievement and widening inequality in their earnings potential as adults.

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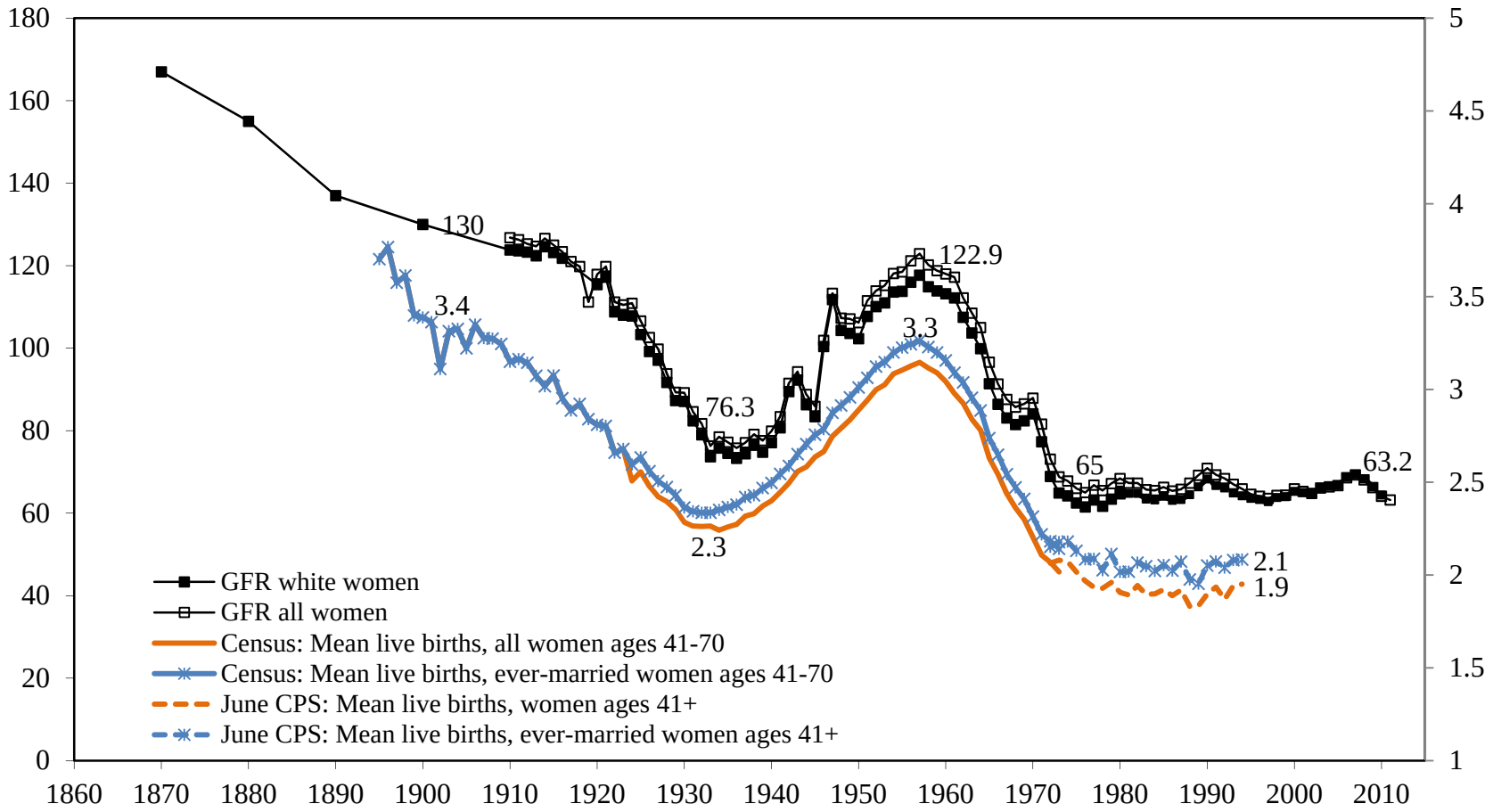
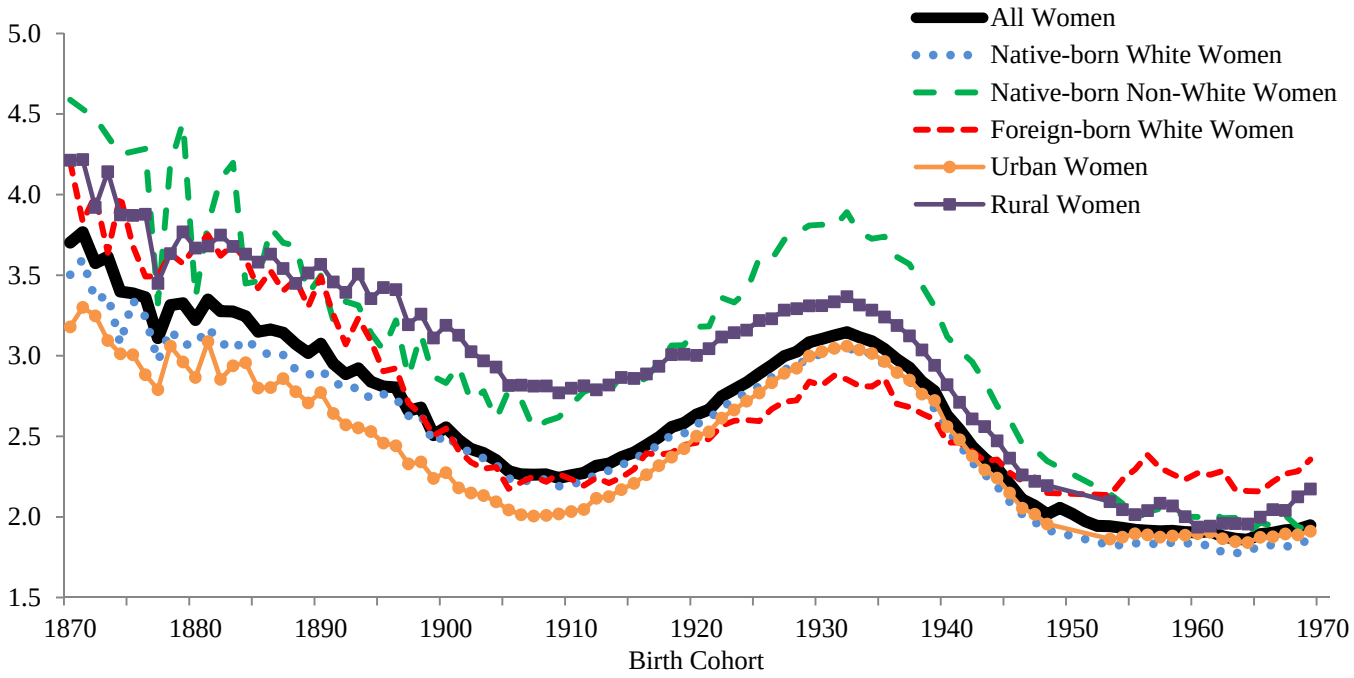
Figure 1. U.S. General Fertility Rate and Completed Childbearing, 1895-1985



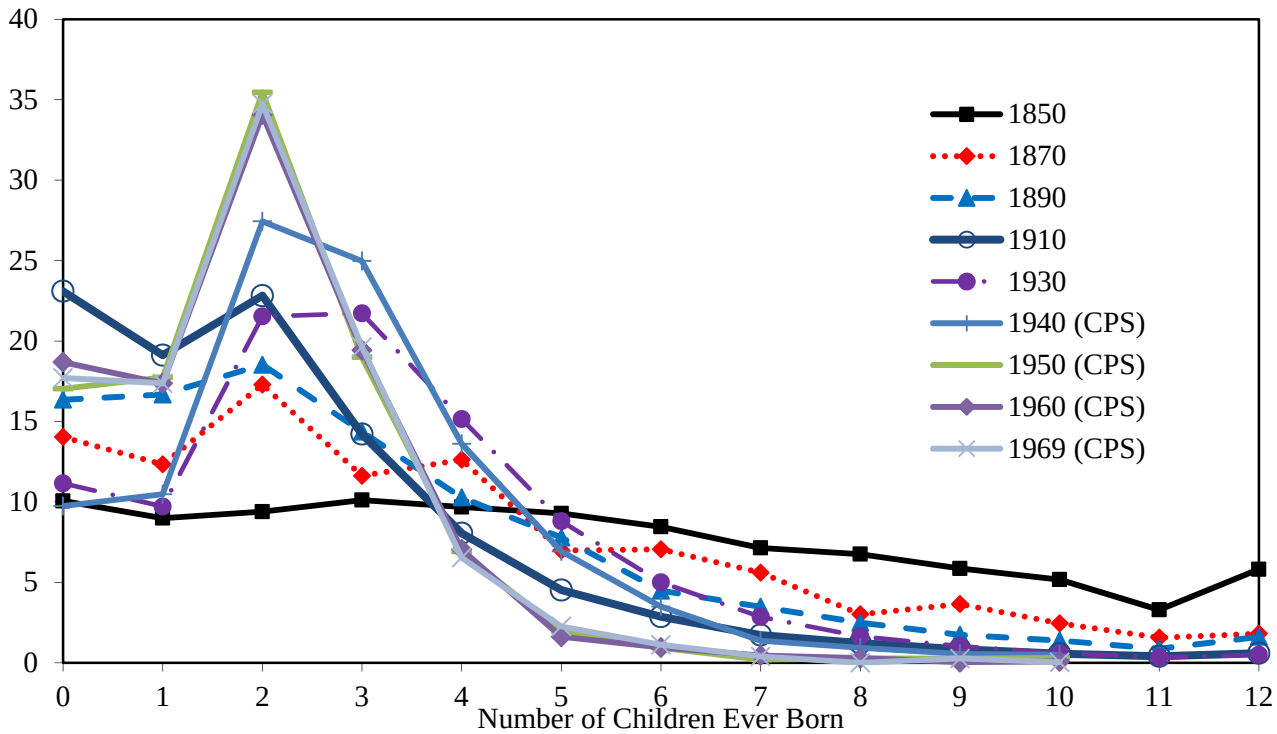
Notes: The general fertility rate (GFR) is the number of births per 1000 women (all or white women only) ages 15 to 44 in the population from Vital Statistics. Mean live births is the mean self-reported number of children ever born for each birth cohort as measured between the ages of 41 and 70 (indexed to year by adding 25 years to mother's year of birth; e.g. mean children ever born to the birth cohort of 1870 corresponds to the year 1895 on the graph's horizontal axis). We additionally include rates for never married women as this was measured in the 1970-1990 Censuses. Computations use population weights.
Sources: Fertility rates are from Historical Statistics, http://www.cdc.gov/nchs/data/statab/t001x01.pdf. Mean live births are computed using the 1940-1990 IPUMS of the Decennial Censuses (Ruggles *et al*. 2012) and the 1995-2010 June CPS.

Figure 2. Completed Childbearing by Group and Birth Cohort, 1870-1970



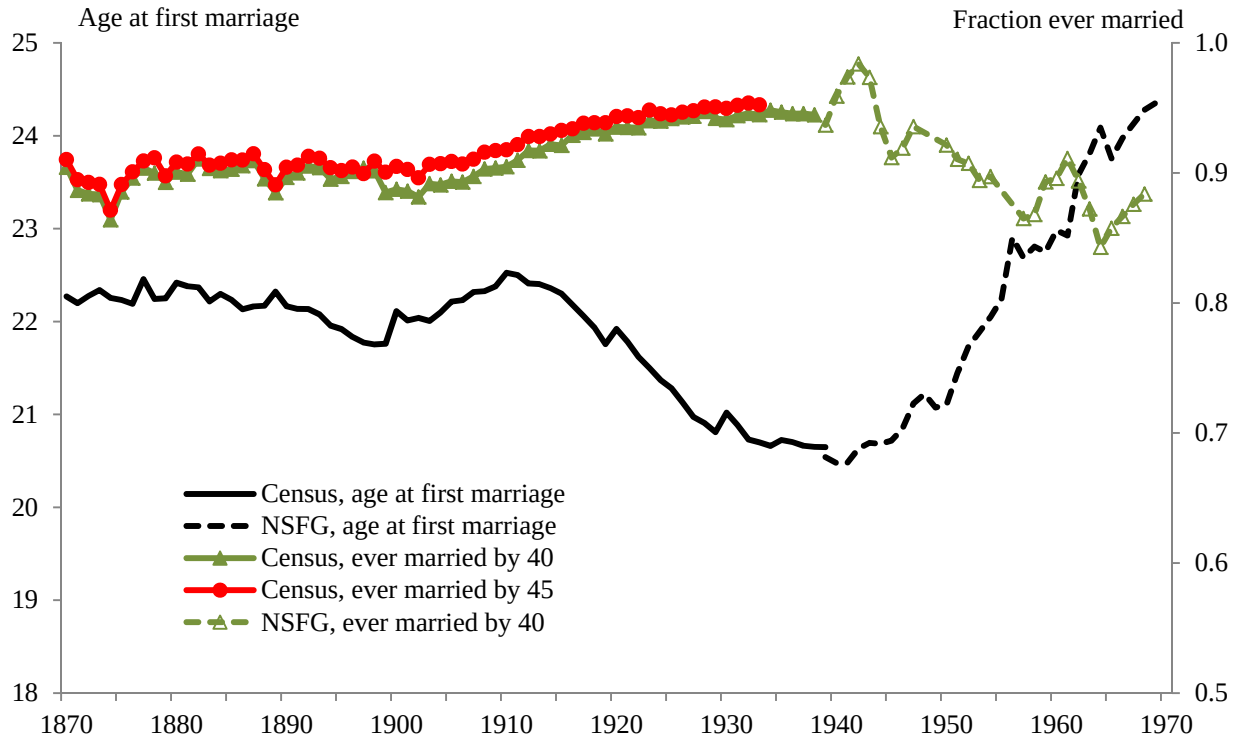
The figure plots the mean number of live births among women aged 41 to 70, by birth cohort, for the Census (1870 through 1948 cohorts) and the same statistic for women aged 41 to 44 in the June CPS (1949 through 1969 cohorts). The native born include women who were born in the 50 U.S. states (including the time they were territories) or the District of Columbia. Non-Whites include all races other than White. Urban/rural is based on the "urban" variable for 1960, 1970, and 1990 Censuses and on the "metro" variable for the 1940, 1950, and 1980 Censuses, and the June CPS (urban if in a metro area, rural if outside a metro area). All computations use the recommended population weights, and the CPS series are 3-cohort moving averages. Sources: See figure 1.

Figure 3. Distribution of Completed Childbearing by Birth Cohort, 1850-1969



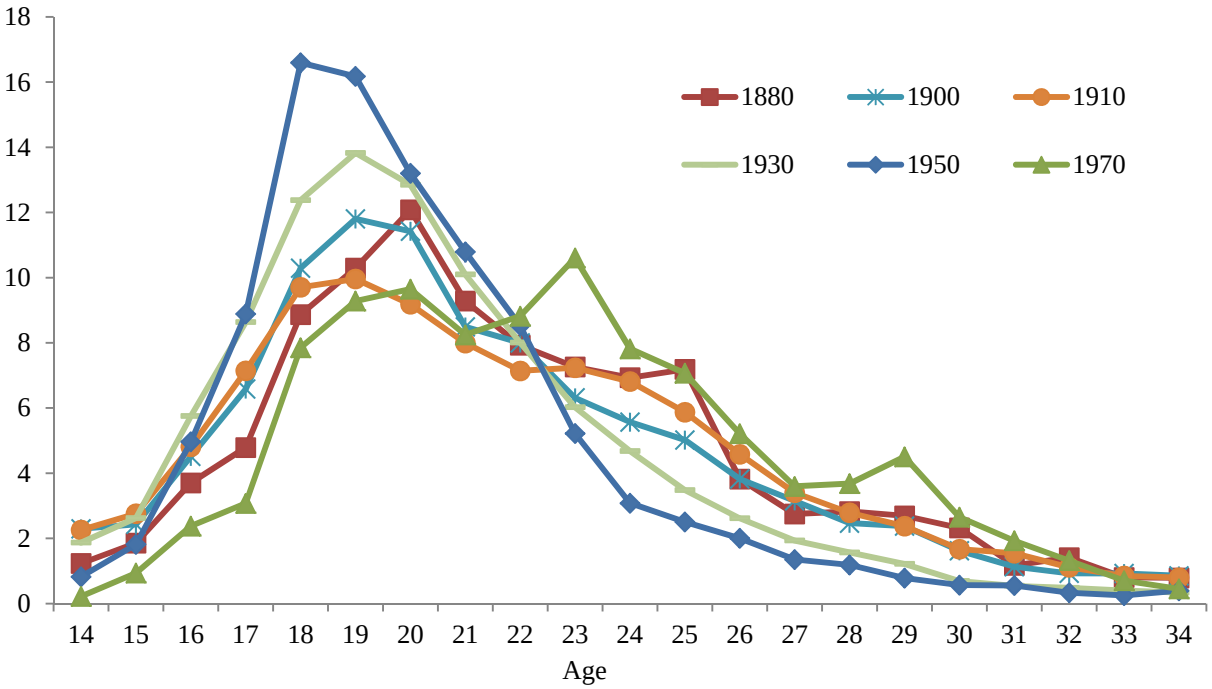
We plot the percent of women ages 41 to 70 who report having each number of children. We include information on childbearing to never-married women in the 1970 to 1990 Censuses and June CPS when available so that these figures include the rising share of non-marital childbearing among the younger cohorts. We top-code children ever born at 12 for consistency across years. Differences between the CPS and Census in overlapping cohorts were trivial, so seaming issues between surveys should be minimal. Source: 1850 to 1930 cohorts are computed using the 1900, 1910, 1940-1990 Decennial Censuses (Ruggles *et al*. 2012); 1940 to 1969 cohorts are computed using the 1981 through 2010 June CPS.

Figure 4. Share Ever Married and Mean Age at First Marriage, by Birth Cohort



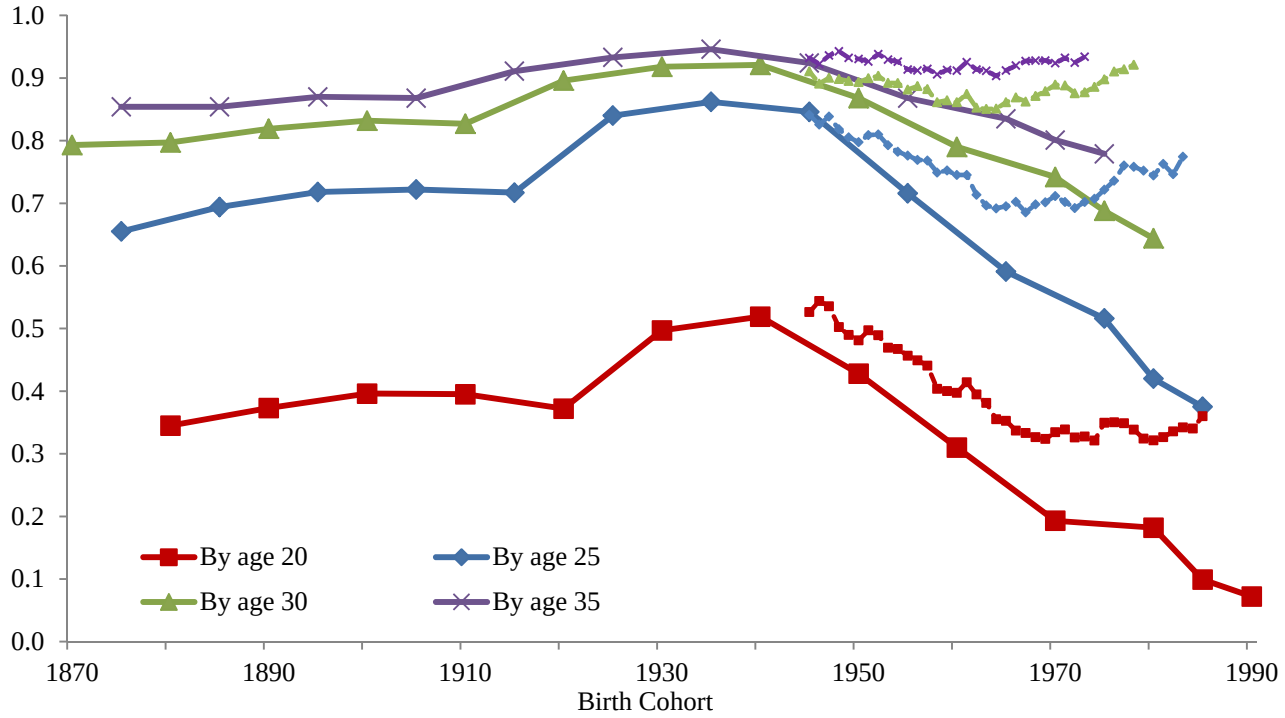
The series plot mean age at first marriage (conditional on ever married by age 39) on the left axis and fraction ever married on the right axis. Birth cohort is on the x-axis. NSFG trends are based on 3-cohort moving averages. Sources: 1940-1980 Census (Ruggles *et al*. 2012); 1982-2010 NSFG.

Figure 5. Percent of Women First Marrying at Each Age, by Birth Cohort



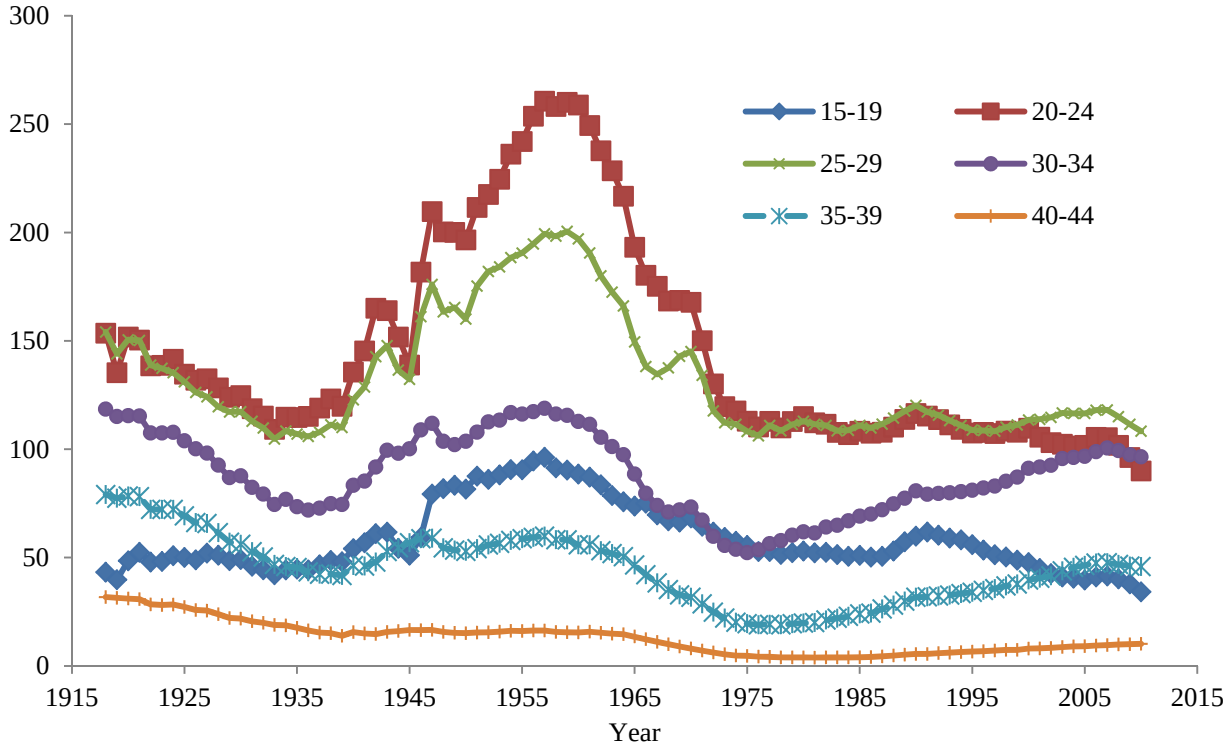
The series represent the percent of women in the indicated single-year-of-birth cohort married by age on the horizontal axis among those married by age 34. Distributions from the NSFG are based on 3-cohort moving averages; thus the 1950 birth cohort is an average of the 1949, 1950, and 1951 cohorts. Sources: 1940-1980 Census (Ruggles *et al*. 2012) for 1900 through 1940 and 1988-2010 NSFG for 1950 through 1970.

Figure 6. Share of Women Ever Married or Cohabiting by Age, 1870 to 1990 Birth Cohorts



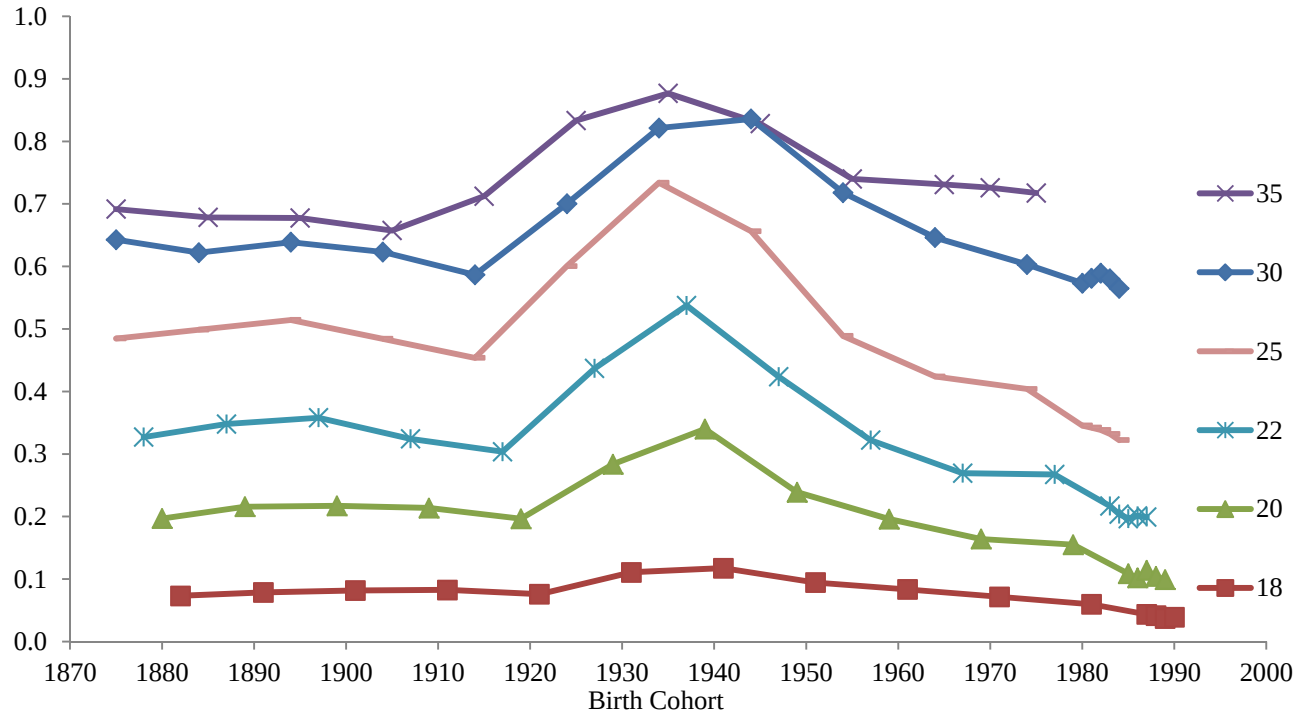
The solid series represent the share of women ever married by the indicated age and is based on current marital status being any category other than never married in the Census. The lighter, dashed lines represent the share of women ever married or cohabiting by the indicated age from the NSFG, and are smoothed using 3-cohort moving averages. Sources: 1900-2000 Decennial Census IPUMS Samples and 2006-2010 ACS (Ruggles *et al*. 2012); 1988-2010 NSFG.

Figure 7. Age-Specific Birth Rates, by Year



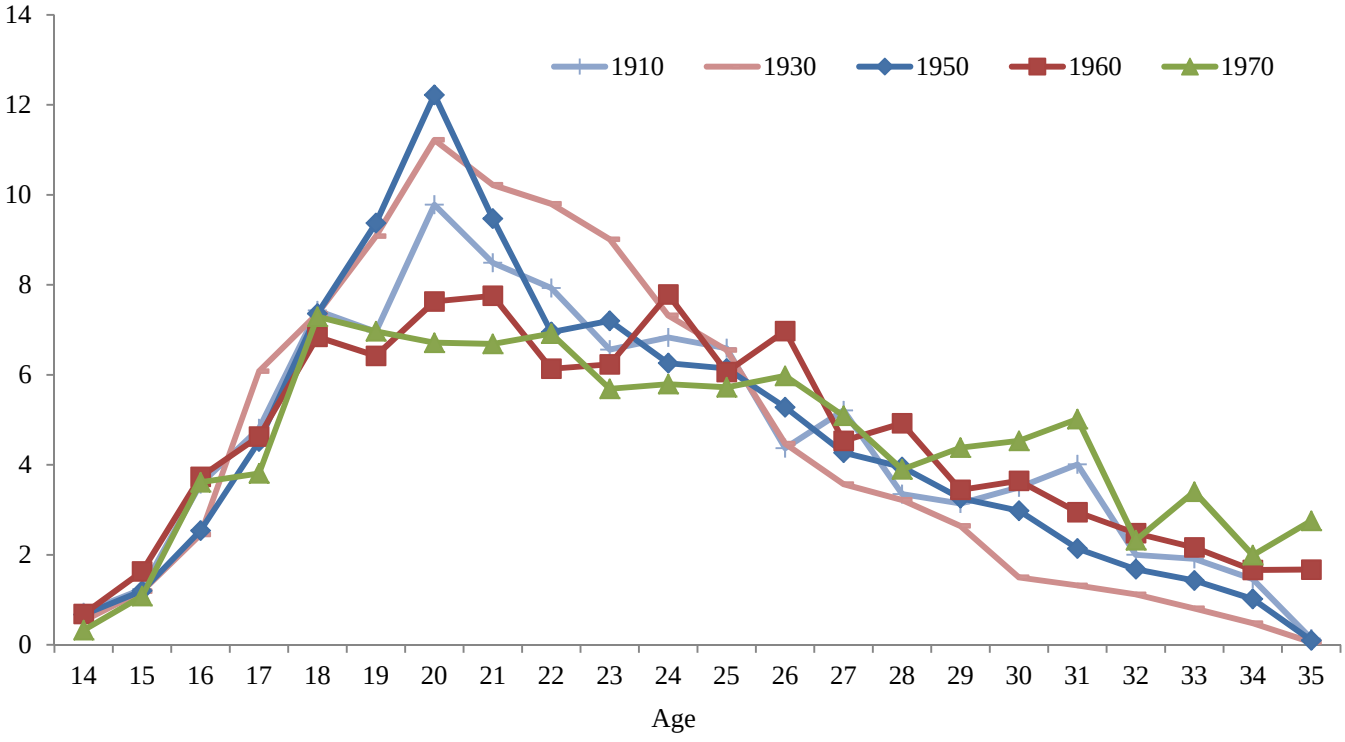
The series plot the number of births per 1,000 women in a given age group by the year that the births occurred (not birth cohort). Sources: National Vital Statistics Reports (Linder and Grove, 1947; Grove and Hetzel, 1968; Martin et al, 2012).

Figure 8. Share of Women with Own Child in their Household, by Age and Cohort



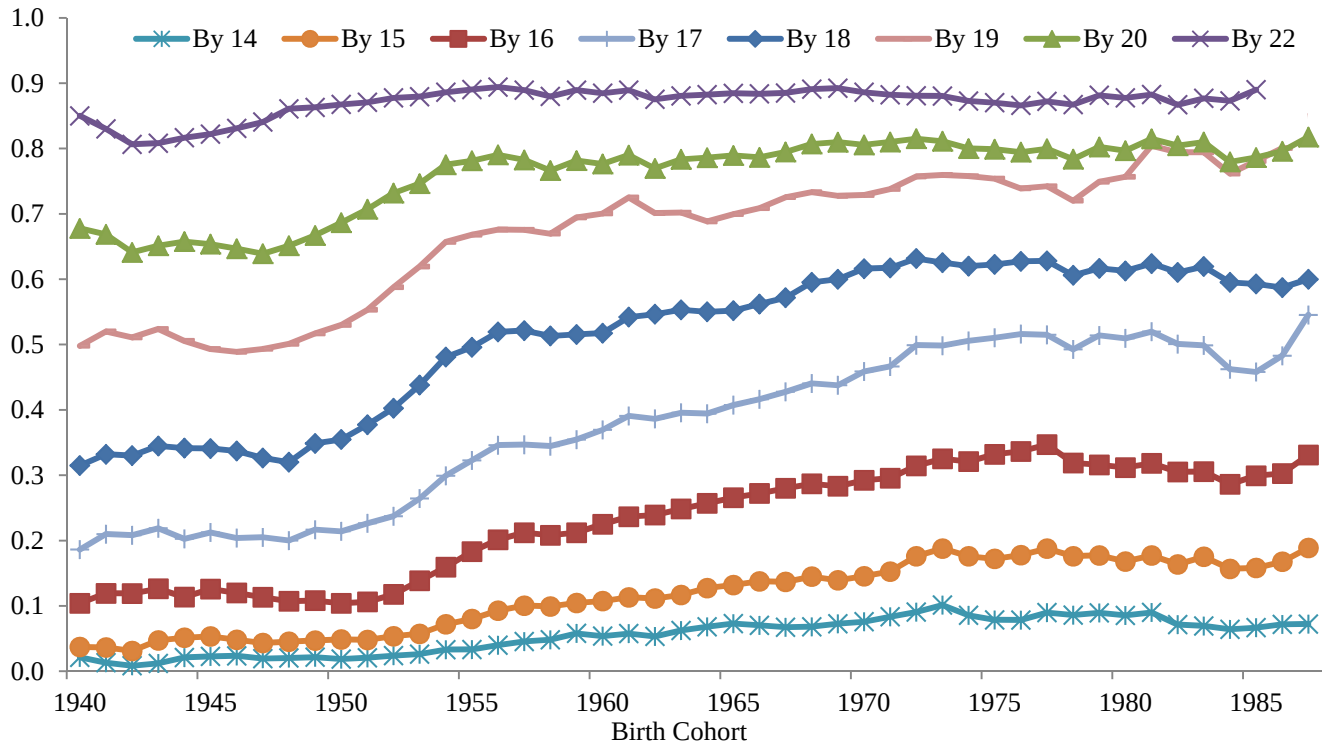
The series show the share of all women with at least one own (but not necessarily biological) child in their household at the indicated age. Sources: 1900-2000 Decennial Census IPUMS Samples and 2006-2010 ACS (Ruggles *et al*. 2012).

Figure 9. Percent of Women First Giving Birth at Each Age, by Birth Cohort



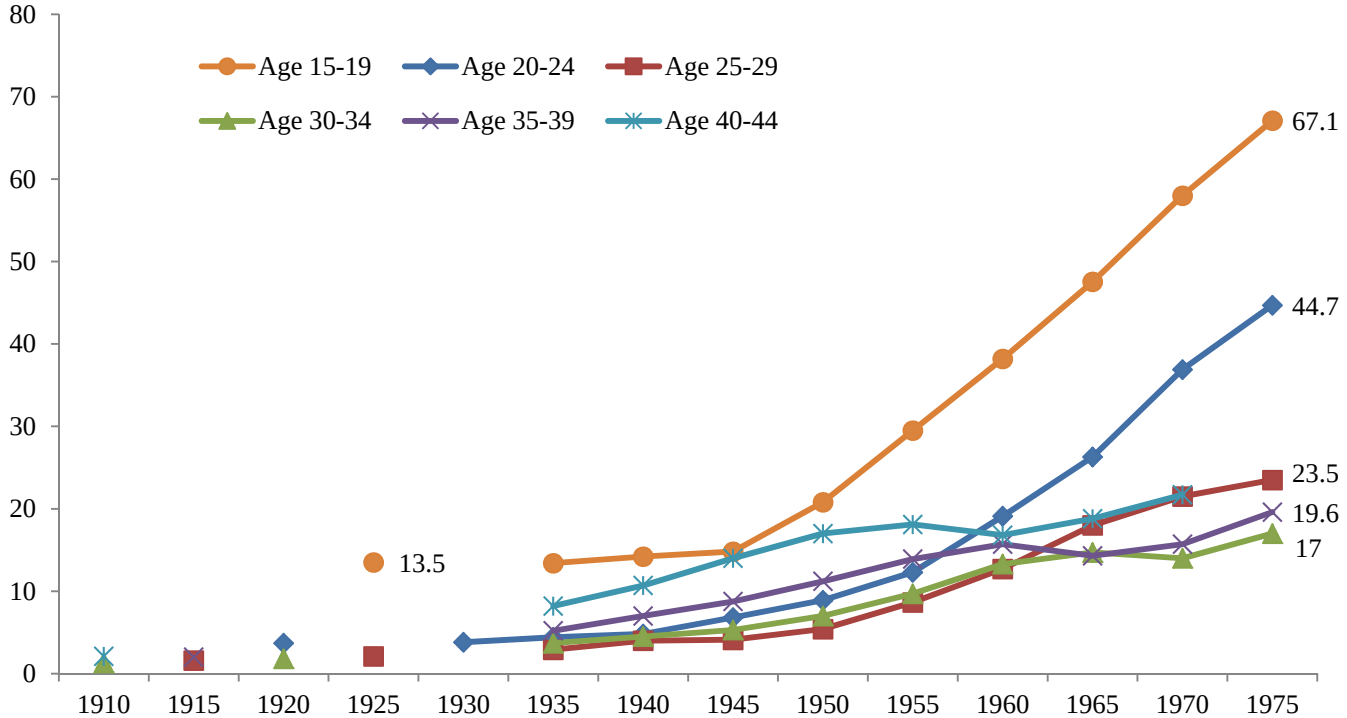
The series show the percentage of women having their first birth at the indicated age (x-axis) conditional upon giving birth by age 35 and being at least age 36 at time of observation. Distributions from the NSFG are based on 3-cohort moving averages; thus the 1960 birth cohort is an average of the 1959, 1960, and 1961 cohorts. Sources: 1979 to 1995 June CPS (1910 through 1950 cohorts); 1995 through 2010 NSFG (1960 and 1970 cohorts).

Figure 10. Fraction of Women Having First Sex, by Age and Birth Cohort



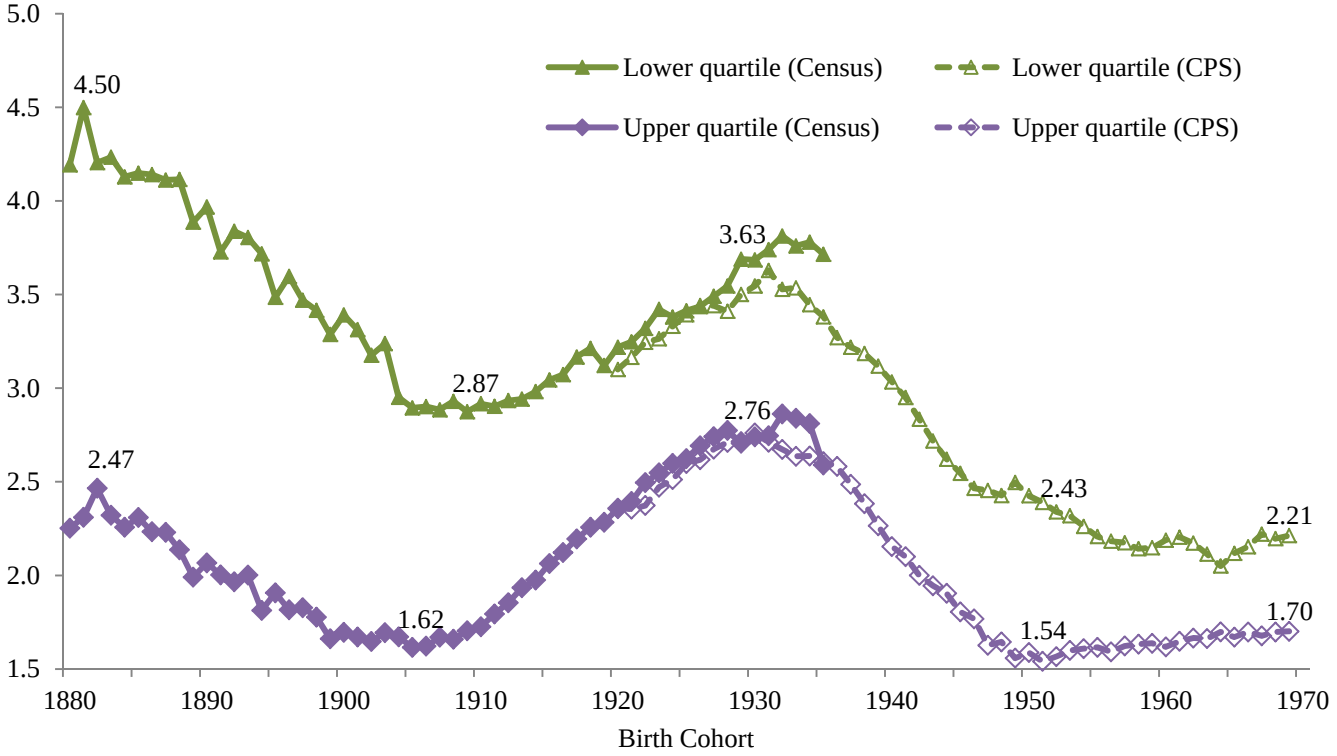
The series show the fraction of women having had vaginal intercourse with a man by the specified ages across birth cohorts. Trends are smoothed using 3-cohort moving averages. Source: 1982-2010 NSFG.

Figure 11. Percent of Births to Unmarried Women, by Birth Cohort



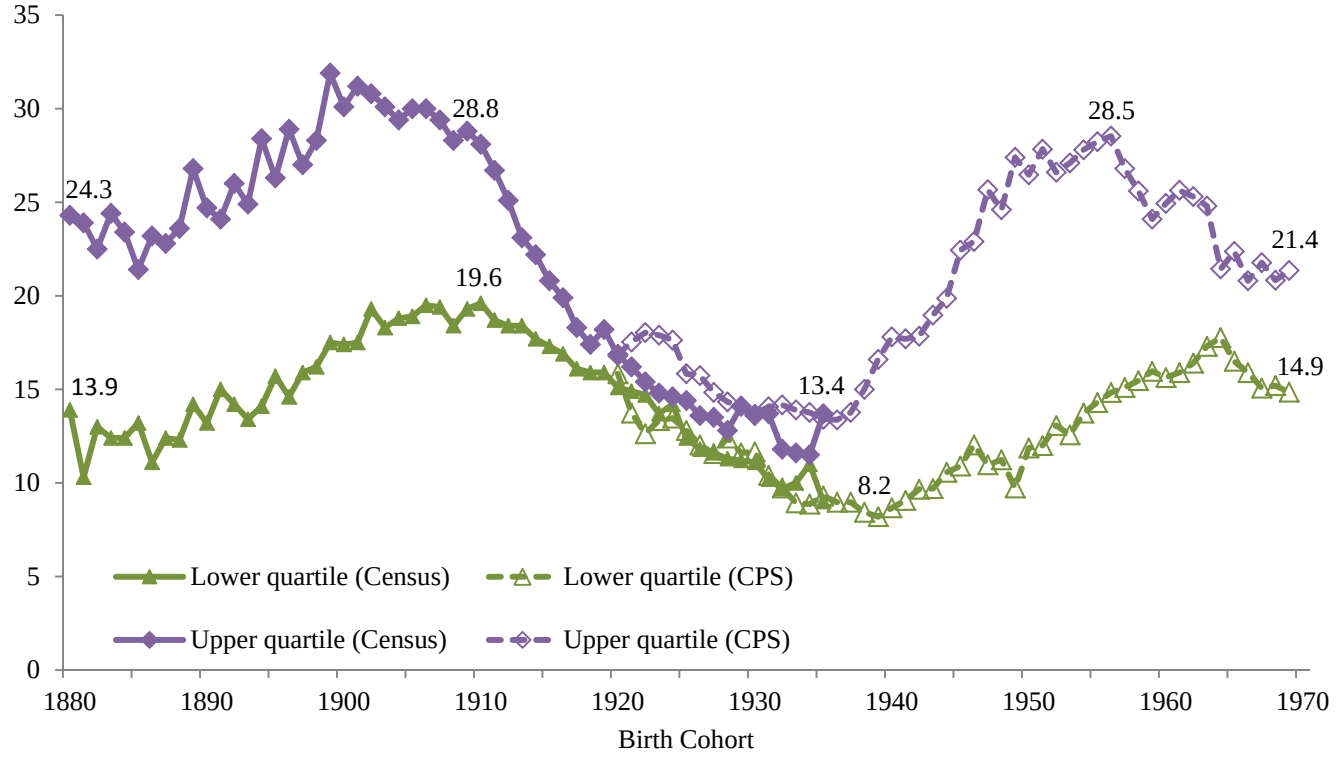
The series are the percent of births to unmarried women for the indicated age groups for each cohort (x-axis). The births are reported for five-year age groups, and we assume the start of the age group for the five year band. For example, 13.5 percent of births to women born between 1921 and 1925 between the ages of 15 and 19 were born to unmarried women. Source: National Vital Statistics Reports (Ventura and Bachrach 2000; Martin et al. 2007, 2012).

Figure 12. Children Ever Born, by Education Quantile and Birth Cohort



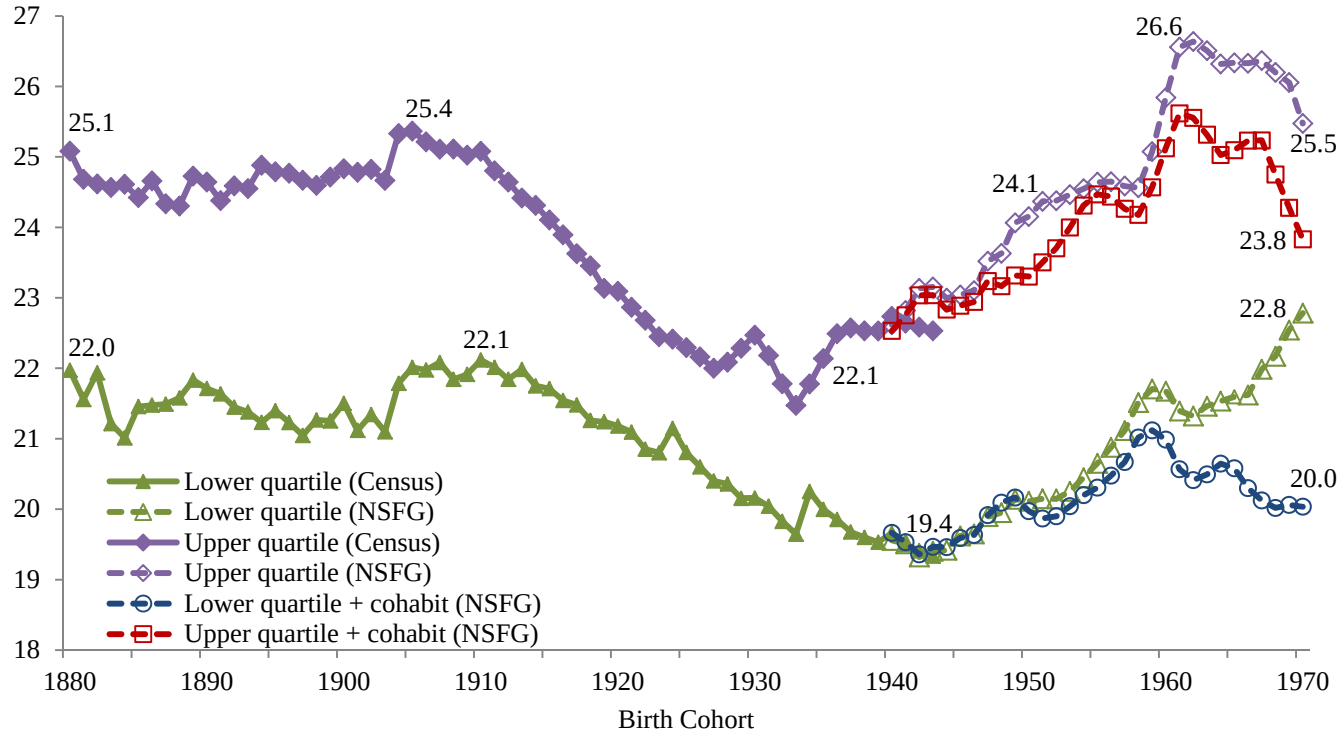
The figure plots the mean number of live births among women ages 41+, by birth cohort, for the Census (1880 through 1935 cohorts) and the same statistic for women in the June CPS (1920 through 1969 cohorts). See text for education group definitions. All computations use the recommended population weights, and the CPS series are 3-cohort moving averages. Sources: 1940-1990 IPUMS (Ruggles *et al*. 2012) and 1979-2010 June CPS.

Figure 13. Childlessness, by Education Quantile and Birth Cohort



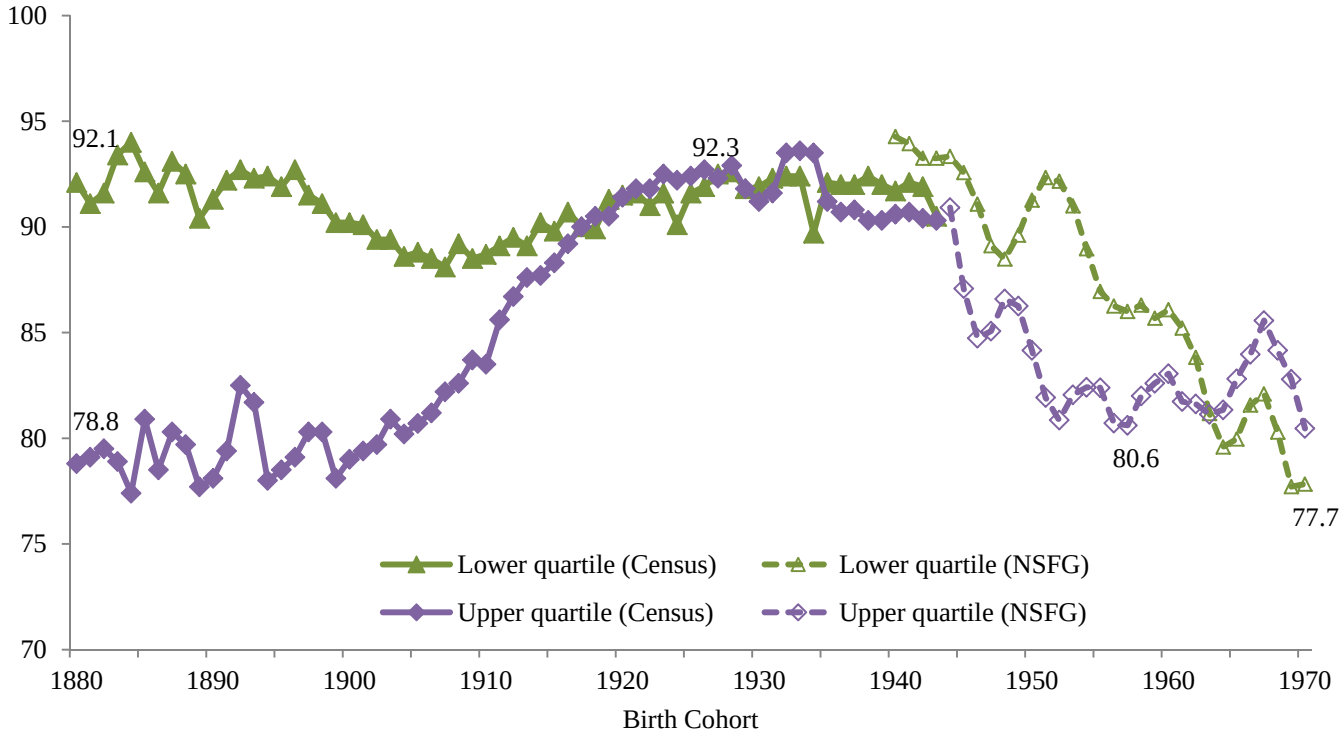
The figure plots the percentage of women ages 41+ who have not had a live birth, by birth cohort, for the Census (1880 through 1935 cohorts) and the same statistic for women in the June CPS (1920 through 1969 cohorts). See notes and sources for figure 12.

Figure 14. Age at First Marriage and Cohabitation, by Education Quantile and Birth Cohort



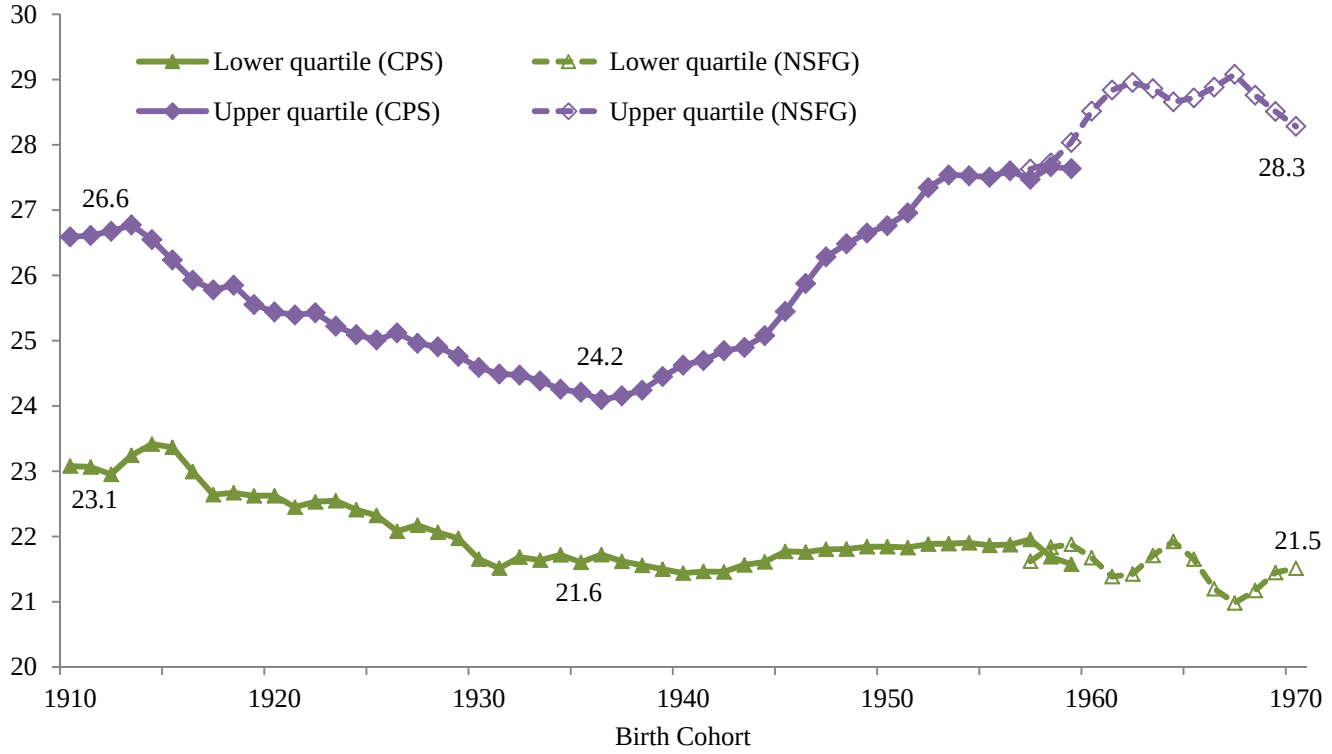
The figure plots age at first marriage among ever-married women ages 36+ by birth cohort using the Census (1880 through 1943 cohorts) and the NSFG (1940 through 1970 cohorts). For the NSFG cohorts, there are also series plotted for the younger of age at first marriage or age at first cohabitation (conditional on one of these events occurring by age 35). See text for education group definitions. All computations use the recommended population weights, and the NSFG series are 5-cohort moving averages. Sources: 1940-1980 IPUMS (Ruggles *et al*. 2012) and 1982-2010 NSFG

Figure 15. Ever Married by age 35, by Education Quantile and Birth Cohort



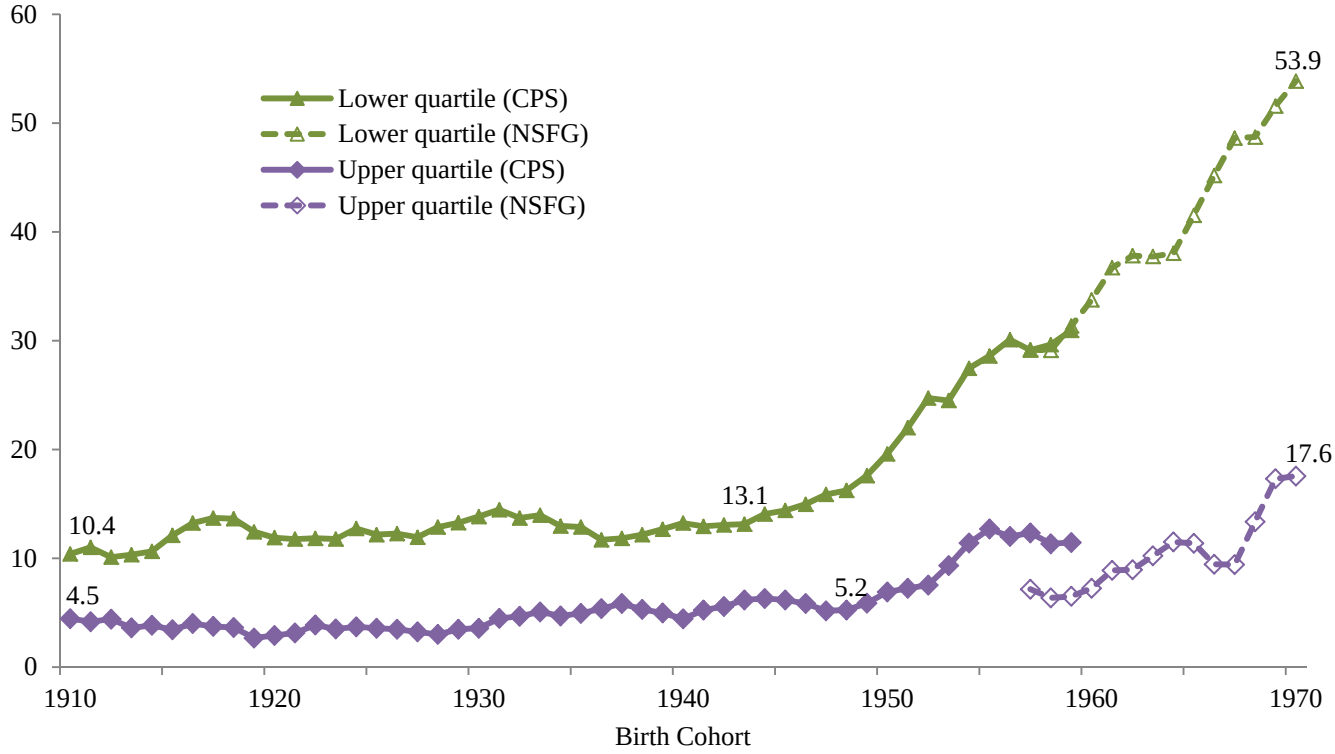
The figure plots the percentage of women ever married by age 35 among women ages 36+, by birth cohort, for the Census (1880 through 1943 cohorts) and the same statistic for women in the NSFG (1940 through 1970 cohorts). See text for education group definitions. All computations use the recommended population weights, and the NSFG series are 5-cohort moving averages. Sources: 1940-1980 IPUMS (Ruggles *et al*. 2012) and 1982-2010 NSFG.

Figure 16. Age at First Birth, by Education Quantile and Birth Cohort



The figure plots age at first birth among women ages 36+, by birth cohort, for the June CPS (1910 through 1959 cohorts) and the same statistic for women in the NSFG (1957 through 1970 cohorts). See text for education group definitions. All computations use the recommended population weights; the June CPS series use 3-cohort moving averages and NSFG series are 5-cohort moving averages. Sources: 1979-1995 June CPS and 1995-2010 NSFG.

Figure 17. Non-Marital First Childbirth, by Education Quantile and Birth Cohort



The figure plots the percentage of first births that are non-marital among women ages 36+, by birth cohort, for the June CPS (1910 through 1959 cohorts) and the same statistic for women in the NSFG (1957 through 1970 cohorts). See text for education group definitions. All computations use the recommended population weights; the June CPS series use 3-cohort moving averages and NSFG series are 5-cohort moving averages. Sources: 1979-1995 June CPS and 1995-2010 NSFG.