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The Impact of Unintended Childbearing on Future Generations

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Summary

Out of wedlock births are increasingly becoming the norm for much of America, particularly for less advantaged young Americans. Many of the women who have children out of wedlock report that they did not plan to have the child and that the child is in fact either mistimed (i.e., came earlier than they would have preferred) or wholly unwanted. Nonmarital childbearing and unintended pregnancy are associated with many adverse outcomes for both the mother and the child, but it has been difficult for researchers to tease out any causal relationship between a mother's fertility intentions and her child's later life outcomes. In this paper, we try to trace the effects of reducing unintended childbearing on children's success in later stages of life by using the Social Genome Model to simulate two "what-if" scenarios:

1) What if we could prevent all unwanted births?

2) What if we could prevent all unwanted births and delay all mistimed births to match the mother's fertility intentions?

Though the impacts of improving women's control over their fertility are small for the population as a whole, there are significant and important improvements in the lives of mistimed children if they are instead born when their mothers are older and more prepared to be a parent. These findings suggest that increasing access to and awareness of high-quality, easy to use contraception (such as long-acting reversible contraception) combined with policy interventions during subsequent stages of a child's life could begin to close the growing gaps in opportunity.

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I. Introduction

Unplanned children, particularly those born out of wedlock, have contributed to high rates of child poverty in the U.S. (Sawhill and Venator, 2014; Sawhill, forthcoming). In the past, many of the efforts aimed at preventing unintended births outside of marriage have been focused on teenage mothers, with considerable success. The teen birth rate has reached the lowest level reported in over six decades (Hamilton, Martin, and Ventura, 2013). However, in the last twenty years, the problem has moved up the age scale. It is now primarily women and men in their twenties who are having children outside of marriage, many of them unplanned. The growth in unplanned, out-of-wedlock childbearing among young Americans over the last fifty years has resulted in more and more children growing up in single-parent families. Many children are also born to cohabiting couples, but even when the parents are living together at birth, unmarried parents typically break up before the child reaches school age (McLanahan, 2012).

Many unwed mothers report that their children are either mistimed or altogether unwanted. These unintended births are concentrated among low-income, low-education parents. It used to be that most children, whether rich or poor, grew up in an intact family. That is no longer true. Today, the family environments of children and the kind of parenting they receive are more likely than in the past to be split along class lines. Furthermore, the relationship between family formation and class goes both ways: Those who are more disadvantaged are more likely to have an unintended pregnancy, but non-marital and unintended childbearing are also associated with a variety of adverse outcomes for both mothers and their children.[1] The divide in family formation patterns between the most advantaged and everyone else reflects and reinforces differences in education and income and is destined to perpetuate the class divide if nothing is done.[2]

This prompts the question: how would children's life trajectories improve if women were better able to match their fertility behavior with their intentions? Children's circumstances at birth – for example, their mother's age, education, and marital status; the child's birth weight; and their family's income – all have impacts on later outcomes for the children. To better understand the impact of unintended childbearing on the child, this paper uses the Social Genome Model (SGM79) to estimate the effect of aligning mothers' fertility behavior with their intentions on the child's success in later life stages. The SGM is a life-cycle model that combines real-world data with sophisticated simulation techniques in order to track the academic, social, and economic experiences of individuals from birth through middle age (Sawhill and Karpilow, 2014; Winship and Owen, 2013).[3]

Results from these simulations show that preventing unwanted births and delaying mistimed births have modest but important impacts on child success rates. Though the effects on success rates for the entire population are small (about 1 to 2 percentage point improvements in most life stages), there are sizeable, positive impacts on the life trajectories of the children who would have been born too soon according to their mothers. For example, if we simulate a delay in births to match the mother's preferred timing, children's predicted high school graduation rates would increase from 76 to 82 percent and

1 See, for example, Thomas (2012b) and Logan et al. (2007) on the relationship between pregnancy intentions and maternal, child, and societal outcomes. See also Haskins and Sawhill (2009).

2 This theme is explored more in Sawhill's forthcoming book *Generation Unbound: Drifting into Sex and Parenthood Without Marriage* (2014).

3 The Social Genome Model, originally developed at the Brookings Institution and based at the Urban Institute, is a collaborative effort of the Brookings Institution, Child Trends, and the Urban Institute.

college graduation rates from 22 to 30 percent.

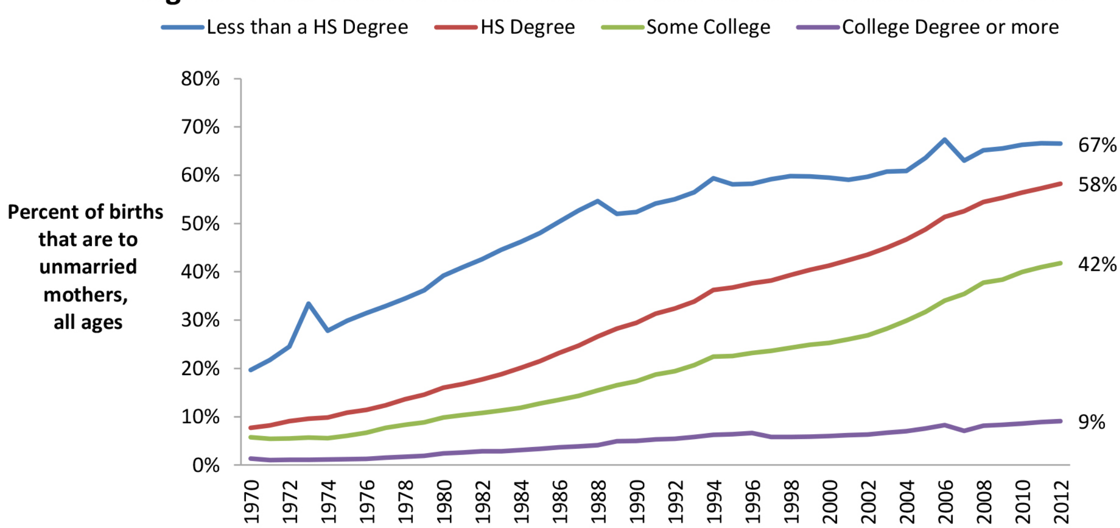
The rest of this paper is organized as follows. Section II provides an up-to-date portrait of unintended pregnancy in the United States and discusses the immediate cause of unintended pregnancy, namely: non-use or poor use of contraceptives. Section III follows with a review of the literature on the impacts of delaying childbearing on the circumstances into which a child is born. In section IV, we describe the simulation model and the underlying data used to parameterize it, and in section V, we report results from our simulations. We then conclude by discussing the broader implications of our findings.

II. The Class Divide and Unintended Pregnanies[4]

The growing class divide

There is a growing class divide in the formation of American families and in the type of family environment in which children are being raised (Sawhill, forthcoming). Take the growth of single parent families: In 1950, 7 percent of all families with children under 18 were headed by a single parent; by 2013, this had increased to 31 percent (US Census Bureau, 2013). There are large differences by class and by race, with the proportion of families headed by a single parent varying from 27 percent for whites to 34 percent for Hispanics to 62 percent for African-Americans. Though divorce was the main route into single parenthood in the 1960s and 1970s, the growth of single parent families since 1980 has been driven almost entirely by an increase in childbearing outside of marriage. This growth has been concentrated among less-educated women (see Figure 1).

Figure 1. The Class Divide in Births to Unmarried Mothers: 1970-2012



The role of unintended pregnancy in creating the class divide

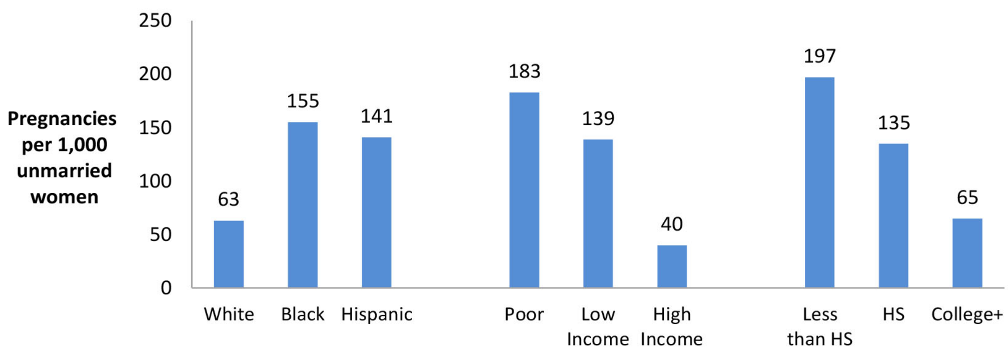
One of the reasons for the high number of non-marital births is that many young adults are sliding into relationships and having children they did not intend to have. Among unmarried women, most pregnancies and births are unintended. The term "unintended" comes from the National Survey of Family Growth (NSFG) which asks women to characterize retrospectively the intentionality of all of their previous pregnancies at the time they learned they were pregnant (Lepkowski et al., 2010). If they say the pregnancy was unintended, they are also asked whether it was "unwanted" or "mistimed." An unwanted pregnancy is a pregnancy that the woman says she never wanted to happen, whereas a

4 The material in this section is drawn from Sawhill, *Generation Unbound: Drifting into Sex and Parenthood Without Marriage* (2014).

mistimed pregnancy is a pregnancy that came earlier than the woman desired – in some cases by a short period of time but in other cases by many years.[5]

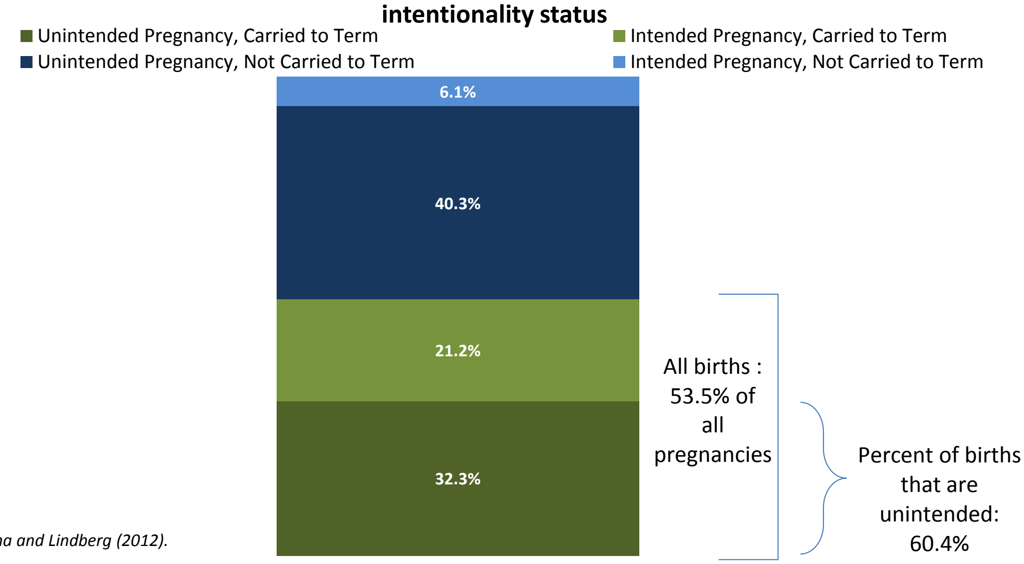
Approximately half of all pregnancies in the United States are unintended. Among single women under 30, the proportion of pregnancies that are unintended is even higher, around 70 percent (Zolna and Lindberg, 2012). Unintended pregnancy rates are highest for the least advantaged women (see Figure 2). In particular, unintended pregnancy rates for lower income women are more than triple the rate for women with incomes above 200 percent of the poverty line.

Figure 2. Unintended Pregnancy Rates among Unmarried Women in their Twenties



Many of these pregnancies are aborted, but about half are carried to term, with the result that about 60 percent of the births to single women under 30 are unintended (see Figure 3).[6]

Figure 3. Percent of pregnancies carried to term for unmarried women under 30, by intentionality status

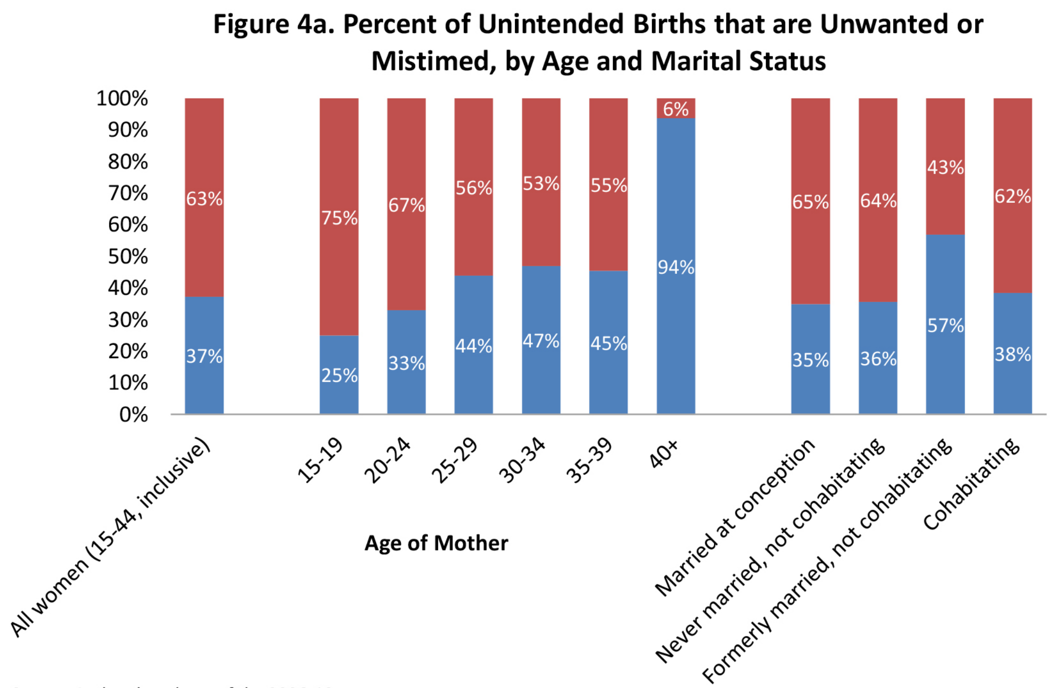


Source: Zolna and Lindberg (2012).

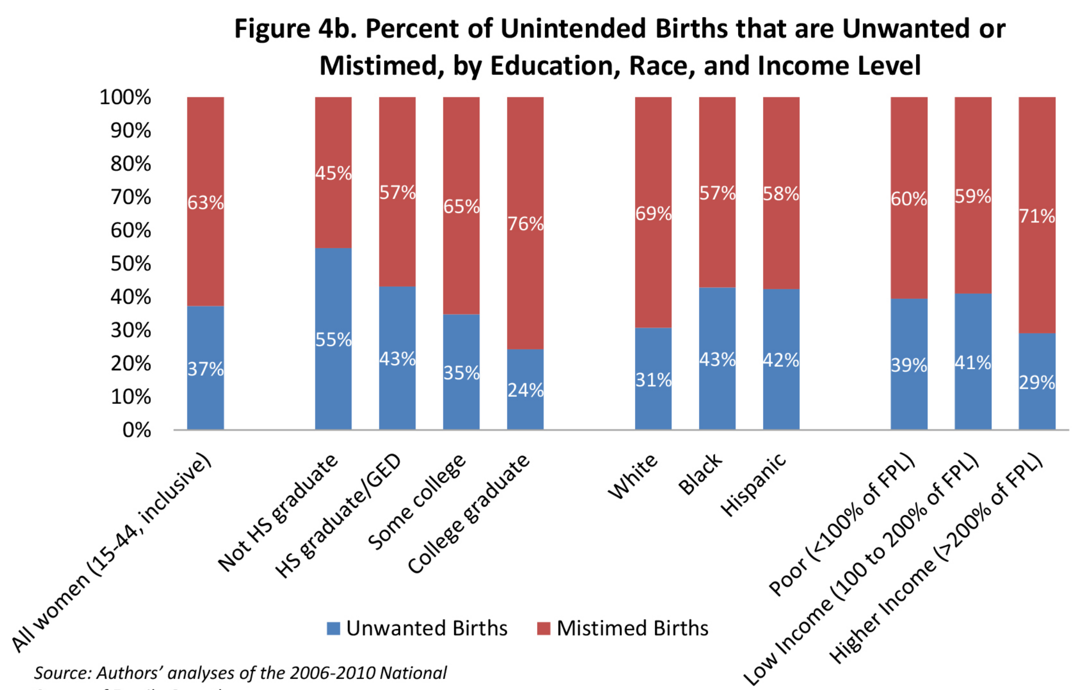
5 Admittedly, research shows that asking women about the "wanted-ness" or timing of their pregnancies has many methodological difficulties (Thomas, 2012c). Given the sensitive nature of the question and possible stigmas against not "wanting" one's child, it is difficult to assess whether women give completely honest answers. However, these women are asked about the intentionality of their births after the birth of their child, suggesting that if they are biased, it is likely to be towards claiming that they intended to have the child.

6 To solve for this, divide the number of unintended births to single women ages 15 to 29 by the total number of births to single women ages 15 to 29. About 29 percent of intended pregnancies to single women ages 15 to 29 are not carried to term, meaning that the calculation is approximately (0.73*0.44)/(0.73*0.44+ 0.27*0.71) or 60.4%.

About one-third of unintended births are described by the mother as unwanted as opposed to merely mistimed (see Figures 4a and 4b). Less-educated women are more likely to indicate that an unintended birth was unwanted rather than mistimed.



Source: Authors' analyses of the 2006-10 National Survey of Family Growth.



Source: Authors' analyses of the 2006-2010 National Survey of Family Growth.

Among unmarried women in their twenties who experience an unplanned pregnancy, less-educated women are also more likely to carry the pregnancy to term. As a result of disadvantaged women being both more likely to have an unintended pregnancy and less likely to abort the pregnancy, two-thirds of all unintended births among unmarried women aged 20–29 occur to women with no college experience, while only 7 percent occur among women with bachelor's degrees (Karpilow et al., 2013).

Contraceptive use and unintended pregnancy

Why, then, do so many unmarried women who say they do not want to get pregnant or have a baby fail to match their behavior to their own intentions? Birth control, particularly common methods such as the condom, is widely available. Unfortunately, many couples who claim they do not want to have a child do not use birth control consistently or correctly. There are many reasons for this – misinformation and myths about contraception and its side effects, the cost of effective contraceptive methods, and human error when faced with a non-user-friendly contraceptive method.

Moreover, many people at risk of an unintended pregnancy do not use contraception at all. Twenty-eight percent of women aged 20-24, excluding those who are pregnant or trying to become pregnant, report that they are currently using no contraception (Jones, Mosher, and Daniels, 2012). The most commonly cited reason for nonuse given by women with unintended pregnancies in a government survey was "I didn't think I could get pregnant" (Mosher and Jones, 2010).

In a nationally representative survey of unmarried young adults aged 18-29, 44 percent of young women agreed or strongly agreed with the statement, "It doesn't matter whether you use birth control or not; when it is your time to get pregnant it will happen" (Sawhill, Thomas, and Monea, 2010). Sex education in the U.S. is not doing a good enough job of explaining to young Americans the risks associated with having sex. To some young Americans, the simple fact that they have had unprotected sex and not gotten pregnant leads them to believe (incorrectly) that they are infertile and will not get pregnant from subsequent sexual encounters (Frohwirth, Moore, and Maniaci, 2013).

Moreover, when they are using contraception, many people do not use the most effective methods. Among sexually active women aged 20-24, about 3 percent use intrauterine devices (IUDs) as their primary form of contraception, 27 percent use the Pill, 7 percent use another hormonal method (e.g., patch, injectable, or contraceptive ring), and 15 percent rely on condoms (Jones, Mosher, and Daniels, 2012). Long-acting reversible contraception (LARCs), which include implants and IUDs, have very low failure rates (<1 percent), lower by far than the two most commonly used forms of contraception, condoms (18 percent) and the Pill (9 percent) (Trussell, 2011).

The reason for these high failure rates is not the efficacy of these methods when used as intended; instead, it reflects the ability of the users to use them consistently and correctly. Condoms and the Pill require some upfront planning and consistency of use. The Pill must be taken every day; prescriptions must be refilled; and condoms must be used, and used properly, every time one has sex. In a qualitative study of couples who were part of the Fragile Families survey, sociologists Kathryn Edin, Paula England, and colleagues (2007) found that a large fraction of couples who had unintended pregnancies simply had difficulty matching their behavior to their intentions. Very few listed money or access as their reason for not using contraception. Instead they said, "I simply wasn't thinking." The combination of ambivalence about having children and a lack of self-efficacy leads to very low rates of contraceptive use among a large segment of the population.

Although many young Americans do not cite cost as their reason for not using contraception, it may affect the type of contraception they use. The most effective contraceptive methods, such as IUDs and the implant, have very high upfront costs (though they are cheaper over the course of a lifetime than, say, the Pill). With limited government funding for contraceptive services, clinics do not always offer these more expensive but more effective methods of birth control.

Research suggests that increases in LARC use could help to combat the problems encountered with other methods of contraception. For example, the CHOICE Project in the St. Louis area gave women free contraception and counseling on the efficacy of different contraceptive methods. A study of CHOICE Project participants found that the risk of contraceptive failure (i.e., the probability of becoming pregnant while using a given method) is twenty times higher among users of the pill, transdermal ring, and hormonal patch than among LARC users (Winner et al., 2012).[7] Additionally, the study reported an 80 percent reduction in teen births and a 75 percent reduction in abortions among women in the cohort compared to national statistics (Secura, 2013).

LARCs change the default from requiring a person to act to prevent a pregnancy to not getting pregnant until you take deliberate steps to do so.

III. Consequences of delaying births for mothers and children

Nonmarital childbearing and unintended pregnancy are associated with a variety of adverse outcomes for mothers and their children. Children born out of wedlock are more likely to fare worse in many ways, including their school achievement, their social and emotional development, their health, and their success in the labor market. These children are also at greater risk of parental abuse and neglect (especially from their mothers' live-in boyfriends who are not their biological fathers), more likely to become teen parents, and less likely to graduate from high school or college (McLanahan and Sandefur, 1994; Waldfogel, Craigie, and Brooks-Gunn, 2010). Children whose conception was unintended are more likely to have poor physical or mental health and are more likely to engage in delinquent behavior during adolescence, even controlling for family characteristics (Logan et al., 2007).

While much of the research has been correlational in nature, some studies have investigated the causal relationship between unmarried or unintended births and maternal outcomes. For example, women have benefited significantly from legal and technological advances that have given them more control over the timing of their families. Studies of the historical expansion of oral contraception have used exogenous variation in state laws governing the sale of birth control to make the causal claim that increased access to the Pill raised college attendance and graduation rates (Hock, 2007), boosted the number of women pursuing graduate degrees (Goldin and Katz, 2002), and led to higher female earnings (Bailey et al., 2012). Expanded access to family planning has primarily benefited mid- and high-skilled women (as measured by aptitude tests and educational attainment). This suggests

7 In this study, participants were read a standardized script about birth control which stated that IUDs and the subdermal implant were the most effective methods of contraception. Women also received contraceptive counseling regarding all reversible contraceptive methods. They were then allowed to choose which birth control method they wanted to use and were provided with the method of their choice at no cost for 2 to 3 years. It should be noted that since this study was not a randomized controlled trial, there were some demographic differences across contraceptive type. Women who chose the Pill, patch, or ring were more likely not to have previously had a child; were more likely to have private health insurance; and were less likely to have had a previous unintended pregnancy, abortion, or sexually transmitted disease. These demographic differences only strengthen the authors' findings: those who chose IUDs or DMPA injections were more likely to be part of demographic groups that are generally at higher risk of unintended pregnancy, making the lower pregnancy rates under IUDs and injections all the more noteworthy.

that family planning is particularly beneficial for women who have more to lose – those with the background and motivation to take advantage of contraceptives to plan their fertility. That said, this earlier generation of women is now being replaced with a younger generation whose education and attachment to the labor force, whatever their socioeconomic background, is even greater than it was for the baby boom generation and whose need and ability to benefit from birth control is correspondingly greater as well.

Still, as noted above, unintended pregnancy is now highly concentrated among less advantaged women. Because of this fact, it is unclear whether the effect sizes reported in the historical Pill studies are applicable to today's group of high-risk women. Similarly, it is unclear if the adverse effects of non-marital pregnancy are the same now as they were in the past. More specifically, because women who have unintended pregnancies in the modern era disproportionately come from disadvantaged backgrounds, there is widespread debate over whether unintended childbearing contributes to, or is a product of, the disadvantages of these women. Given their backgrounds and limited opportunities, these women might be poor regardless of whether they postponed childbearing or not. Kearney and Levine (2009; 2011) argue that many young mothers live in a "culture of despair" in which a pregnancy is not what limits a woman's future prospects. Rather, these women have limited prospects with or without a baby.

Additional research on the causal effects of delaying births has been focused on a specific demographic group: teenage mothers. Having a child as a teenager is associated with lower educational attainment, lower income as an adult, and a lower likelihood of marriage (Ng and Kaye, 2012). But the question of whether this association is causal remains a point of disagreement due to the difficulty of disentangling the factors that co-determine fertility and these later outcomes. For example, unplanned pregnancies are one reason that women drop out of high school or community college (Ibid). But they might have dropped out of high school even without a pregnancy. Controlling for family background through sibling or twin fixed-effects models has been found to weaken (and sometimes eliminate) the observed correlations between teenage childbearing and negative maternal and child outcomes.[8] Other studies have used quasi-random fertility shocks, such as miscarriages, as instruments for fertility and found the effects of teen births to be negative, but small (Hotz et al., 2005, 2008; Levine, Emery, and Pollack, 2007; Ermisch and Pevalin, 2003; Hoffman and Maynard, 2008).[9]

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8 See, for example, Geronimus and Korenman (1993), Levine & Painter (2003), Webbink et al. (2011), Fletcher (2012), and Holmlund (2005) for studies related to maternal outcomes.

9 Later studies have called into question the use of miscarriages as instruments, arguing that miscarriages aren't random fertility events. Those who choose abortion over carrying their pregnancy to term are more likely to come from advantaged backgrounds and also more likely to induce an abortion prior to a miscarriage taking place, making the population of mothers who miscarry less advantaged than a random sample of teens who become pregnant (Ashcraft and Lang 2013). Therefore, estimates that use miscarriages to identify the causal effects of teen childbearing are likely to underestimate the true consequences of teen childbearing. As such, Ashcraft, Fernandez-Val, and Lang (2013) and Fletcher and Wolfe (2008) instead use such estimates as a lower bound and find that teenage childbearing has small but significant negative effects on educational attainment, annual income, employment, and the likelihood of being on welfare. Similarly, a meta-analysis by Kane, Morgan, Harris, and Guilkey (2013) finds that miscarriage studies underestimate the true effects of teen childbearing and finds, in addition, that teenage mothers complete 0.7 to 1.9 fewer years of education than women who do not give birth as a teenager.

Another failure of the literature on teenage mothers is that these studies only look at the effect of delaying a birth until the woman is no longer a teenager. By definition, a woman stops being a teenager at 20, meaning that these studies only look at short delays in childbearing (typically 2 to 3 year delays). In such a short span of time, a woman's financial or educational situation may not have changed substantially and she may, in fact, still not consider herself ready for a child, despite no longer being a teenager.

A smaller body of literature on slightly older women suggests that delaying a birth can have positive effects for non-teen mothers. For instance, Miller (2011) finds that delaying motherhood for women in their twenties leads to a substantial increase in career earnings of 10 percent per year of delay, a small increase in wage rates of 3 percent, and an increase in career hours worked of 5 percent. Another paper (Herr, 2008) uses naturally occurring fertility shocks (i.e., miscarriages and contraceptive failure) as instruments to estimate the effect of the timing of a woman's first birth on wages, hours worked, and educational attainment. The author finds that a one-year delay in age at birth results in a 6 percent increase in years of full-time education. Additionally, a one-year delay is estimated to increase women's wage growth over the first 15 years after labor market entry by 3 percent on average with higher increases for more highly educated women.[10]

Finally, having a child early and out of wedlock is also associated with poorer marital prospects for the mother. Women who have an out of wedlock birth have a 20 percent lower chance of being married by age 40 (Lichter and Graefe, 2001). This makes intuitive sense – many men shy away from making a commitment that involves raising and caring for a child that isn't their own.[11] To summarize, although there is continuing uncertainty, and thus controversy, about what explains the strong association between too-early pregnancy and a host of negative outcomes for women, in the end we should keep in mind that these pregnancies are overwhelmingly unplanned and thus not what the mother wanted. That should be reason enough to help them control their fertility. The issue, beyond this fact, is the extent to which their children are likely to have a different life course as the result of being born before their mothers say they are ready to be a parent.

IV. Simulating the lifetime effects of reducing unintended childbearing

Missing from the above literature are estimates of how reducing unintended childbearing would impact the lifetime trajectories of the next generation. Studies tend to focus on specific demographic subgroups (e.g., teen mothers) or the short-term effects of delaying childbearing (e.g., early childhood achievement). The narrowness of this research agenda is partly due to data limitations: very few nationally representative datasets follow children from birth to adulthood, and even fewer provide reliable measures of birth intentionality. As such, the important question of whether contraceptive interventions can significantly alter the long-run opportunities of the next generation has remained largely unanswered.

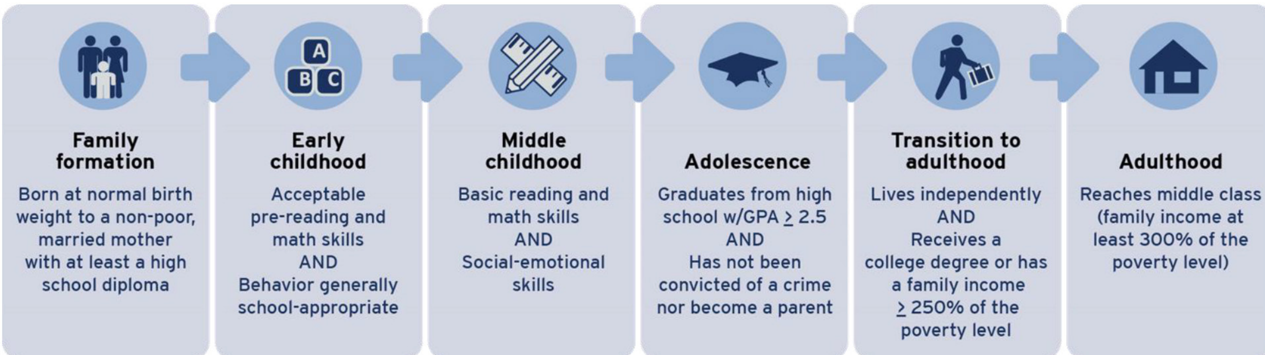
We take a first step towards addressing this research gap by using the Social Genome Model (SGM) to simulate how reducing unintended births would impact children's paths to adulthood. Built using real-

10 As noted previously, studies that use miscarriages as instruments for fertility typically underestimate the effects of delaying a birth, suggesting that if Herr's estimates are biased, they are likely to be conservative estimates of the effects.

11 These correlations may be partially due to selection effects; women who have an out of wedlock birth may be more likely to have other traits that make them less marriageable. However, the authors of the above-cited study also looked at the cumulative marriage rates of unmarried women with pregnancies that were terminated by miscarriage or abortion and found that they are more similar to women without nonmarital births than to women who have a child out of wedlock. This suggests that the lower chance of marriage may be specifically related to having and raising a child out of wedlock, though women with terminated pregnancies may not be an ideal comparison group as discussed in the earlier footnote on flaws in miscarriage studies. In a similar vein, studies that correct for selection using random fertility shocks (Qian, Lichter, and Mellott, 2005; Ermisch and Pevalin, 2005) have found that out of wedlock births are associated with mothers marrying a "poorer quality" man – that is, less educated or more likely to be unemployed.

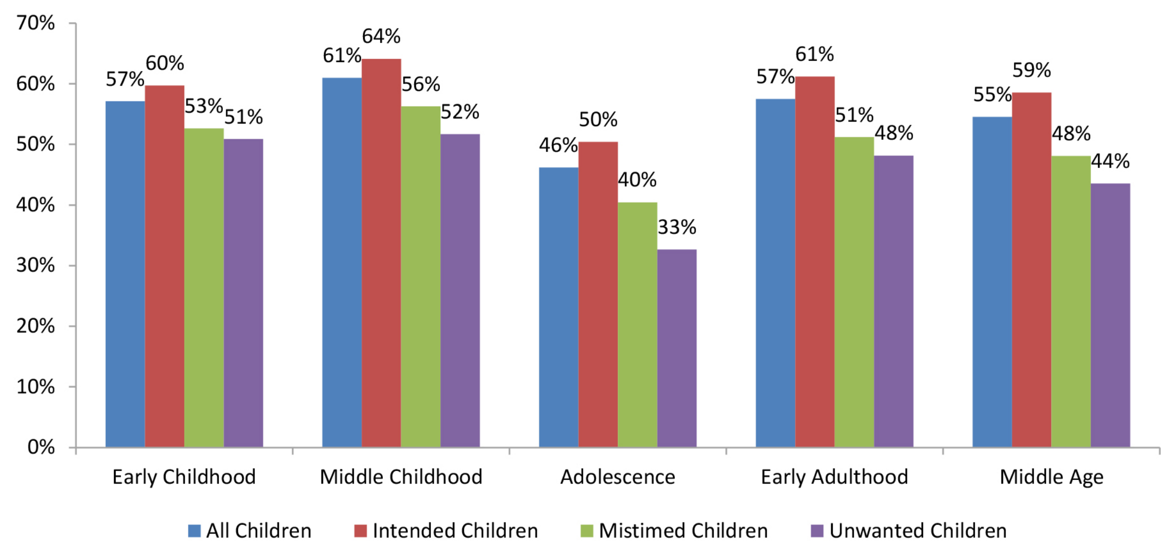
world data and a variety of sophisticated simulation techniques, the SGM is uniquely suited to address this question because it tracks the academic, social, and economic experiences of individuals from birth through middle age. Specifically, the model divides the life cycle into six stages and specifies a set of outcomes for each life stage that, according to extant research, is predictive of later outcomes and eventual economic success. Importantly, these outcomes are not only correlated with later success, but also reflect widely-held norms of success for each life stage (Figure 5).

Figure 5. Definitions of Success at Each Life Stage of the Social Genome Model



As a result, the SGM can be used to trace the effects of reducing unintended childbearing across multiple stages of the lifecycle and along different dimensions of the opportunity structure. For example, descriptive tabulations from the SGM show that children whose mothers characterized them as unintended are less likely to be successful at every life stage (Figure 6). These success gaps widen slightly in adolescence and early adulthood, and, by the time unintended children are middle age, they are between 18 and 25 percent less likely to reach the middle class than their intended peers.

Figure 6. Success Rates by Intentionality Status



Source: Simulated data from the SGM.

These figures are, of course, descriptive – they do not demonstrate that there is a causal relationship between a child's intentionality status and their success later in life. But the persistence of such disparities across the life course suggests that better family planning could have important long-run effects on child success. In this paper, we explore the extent to which reducing unplanned births could improve children's life chances using the best causal evidence from the external literature together with the Social Genome Model to simulate two what-if scenarios:

1. What if we could prevent all unwanted births?
2. What if we could prevent all unintended (unwanted or mistimed) births?

Because unwanted children tend to come from more disadvantaged backgrounds, removing these children (who were ostensibly never wanted by their mothers in the first place) from the population will cause a cohort of children to look more advantaged. There is, however, an upper limit on the effects of these compositional changes, as less than one in five births are reported as unwanted by their mothers.[12] In contrast, the benefits from postponing mistimed births have no firm ceiling since they depend entirely on the extent to which a child's circumstances at birth are "upgraded" due to the delay in childbearing.

While undoubtedly utopian, these thought experiments can nonetheless offer important insights into the size of the effects that we might expect from improving family planning in the United States.

Methods

In order to simulate these two what-if scenarios, we augmented the model's original framework so as to be able to identify and prevent unwanted and mistimed births in the SGM.[13]

Identifying unwanted and mistimed SGM children

The original SGM does not contain variables for identifying intended, mistimed, and unwanted SGM children. To circumvent this limitation, we used birth data from the 2006-2010 cycle of the NSFG to estimate the likelihood that a birth was intended, mistimed, or unwanted according to the demographic characteristics of the mother.[14] These estimated parameters were then imported into the SGM and used to impute intentionality-status probabilities (e.g., the likelihood of being unwanted) to SGM newborns. The predicted probabilities were subsequently used to label SGM children as intended, mistimed, or unwanted.[15]

Because we are interested in the effects of aligning family planning outcomes with family planning intentions, we required an additional piece of information for mistimed SGM children, namely the number of years by which these children were mistimed.[16] Fortunately, the NSFG survey asks mothers of mistimed births this exact question. We were therefore able to use regression analysis to estimate the relationship between the degree by which a birth is mistimed and the demographic characteristics of the mother (i.e., age, education, race/ethnicity, and poverty status).[17] As in the case of birth

12 Authors' tabulations of the 2006-2010 NSFG.

13 For more technical details on the SGM and SGM simulations, see Winship and Owen (2013). For a more descriptive discussion of the SGM, see Sawhill and Karpilow (2014).

14 The results from these analyses are presented in the technical appendix of this paper.

15 Specifically, at the start of each policy simulation, predicted intentionality probabilities are compared to random draws from a uniform (0,1) distribution in order assign SGM children to the three intentionality categories. As a result of this standard simulation procedure, children with the highest imputed probability of being unwanted are also the most likely to be identified as unwanted in the SGM; children with the highest predicted probability of being mistimed are the most likely to be assigned to the mistimed category; and so forth.

16 Since a mother reports a child as "unwanted" if she was never planning on having the child, this is not an issue for unwanted SGM children.

17 The results from these analyses can also be found in the technical appendix.

intentionality, we then imported the parameters from these "mistimed-ness" analyses into the SGM and used them to impute the numbers of years by which mistimed SGM children are mistimed.

Preventing unwanted and mistimed SGM children

Although we used distinct approaches to model the prevention of unwanted and mistimed births in the SGM, both strategies relied on the accuracy of the mother's self-reported data. In particular, because an NSFG mother is supposed to report a birth as "unwanted" if and only if she did not want to have that child now or anytime in the future, we aligned fertility outcomes with fertility expectations by assuming that unwanted SGM children are never born. Mechanically, this assumption amounts to removing unwanted SGM newborns from the simulation population.[18]

Similarly, we relied on the mother's self-reported preferences when modeling the prevention of mistimed births in the SGM. More specifically, we assumed that a mistimed birth is avoided if that birth is delayed by the number of years that it was reported to be mistimed by the mother. Consequently, we began the SGM simulation by increasing the ages of the mothers of mistimed SGM children according to their predicted fertility misalignment – i.e., the number years by which their children were mistimed.

Of course, boosting maternal age at birth is just one of the channels through which delaying childbearing can potentially affect child outcomes. Drawing upon extant literature, we used the effect sizes reported in Table 1 to model the impact of postponing a birth on maternal education, marital status of parents, and family income at birth.[19] These effect sizes are intended to capture the causal relationship between delaying child birth and the circumstances in which the child is born. A more thorough discussion of how we chose and developed these effect sizes can be found in the technical appendix of this paper.

18 As discussed in Winship and Owen (2013), the parameters used to govern the progression of SGM children through the various lifecycle stages are estimated using the full cohort of SGM children. Thus, even though unwanted SGM children are removed from the simulation population, they nonetheless contribute to the estimation of the SGM equations. The implicit assumption that we make here is that the model's baseline parameters (which have been estimated on the full population) approximate to the extent possible causal relationships and should therefore not vary depending on the composition of the cohort. Importantly, our benchmarking of the SGM against external datasets suggests that the model does quite well in replicating real-world relationships across the life stages (Winship and Owen, 2013), although it tends to underestimate the documented effects of real-world interventions.

19 It should be noted that we do not allow delays in childbearing to affect birth weight. This is because most studies find that delaying births has an insignificant effect on birth weight, once researchers control for sociodemographic traits.

Table 1. Summary of the Effects of Delaying Childbearing on Maternal Characteristics[20]

	Age range of analysis sample	Estimated effect	Source	Methodology
Maternal Educational Attainment	Teens	A teen birth reduces total education by 0.7 years	Kane et al. (2013)	Meta-analysis
	Non-teens	A one year delay in age at birth increases years of full-time education by 6.1%	Herr (2008)	Instrumental variable analysis
Marital Status at Birth	Ages 15-29	A one year delay in age at birth increases marriage probabilities by 4.5%	Authors' analyses of 2006-2010 NSFG	Multivariate regression, controlling for observed maternal characteristics (race/ethnicity, educational attainment, poverty status)
	Ages 30 and up	A one year delay in age at birth increases marriage probabilities by <1%		
Family Income at Birth	All ages	A one year delay in age at birth increases family income at birth by 3.9%	Authors' analyses of 2009 CPS	Multivariate regression, controlling for observed maternal characteristics (age, race/ethnicity, educational attainment, marital status)

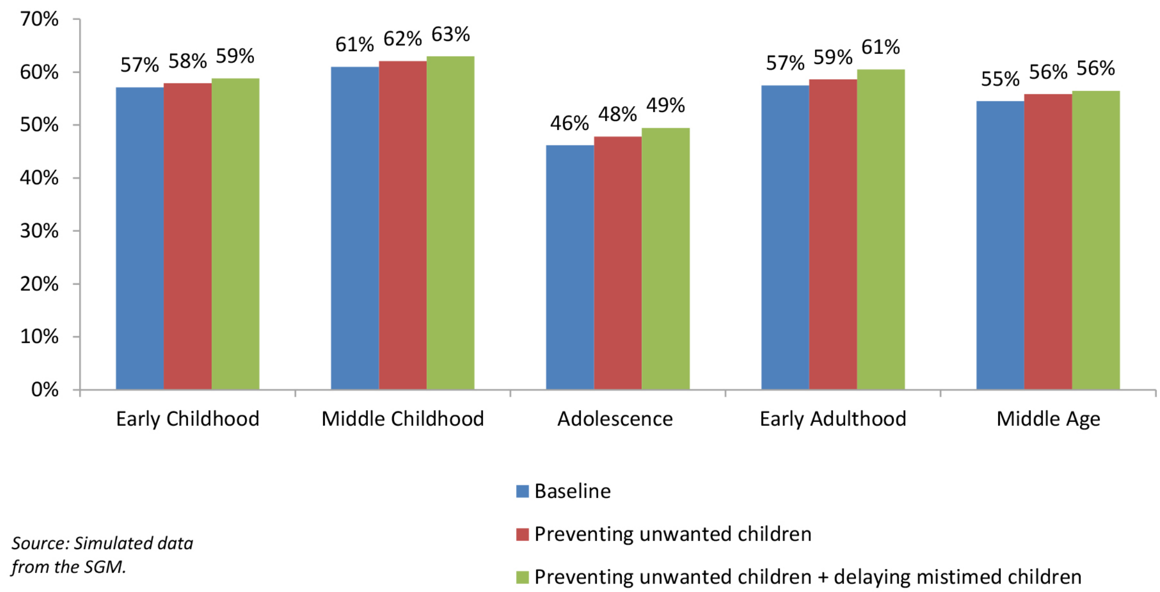
20 While there is substantial literature on the effects of childbearing on maternal education, the research on the links between unintended childbearing, marital status, and family income at birth is less developed. As such, we conduct our own analyses of the effects of delaying childbearing on maternal marital status and family income at birth. We decided to disaggregate our marital-status regressions by age groups because (1) sample sizes permitted such disaggregation, and (2) we found that the effects of a one year delay in childbearing varied significantly between younger and older mothers. We relied on the Current Population Survey (CPS) for estimates of the family income effects. Because the income effects of delaying childbearing did not appear to vary greatly by age, we used the average effect for mothers of all ages. For more details on these supplementary analyses, see the technical appendix.

Furthermore, because parenting quality in the SGM is a function of maternal age at birth and the three maternal attributes listed in table 1, delays in childbearing are also allowed to improve parenting skills in the model.[21] Ultimately then, modeling reductions in mistimed births in the SGM consisted of four steps: (1) boosting maternal age at birth in accordance with the years by which a mother reports her child is mistimed; (2) combining these changes in maternal age at birth with the effect sizes detailed in Table 1 in order to approximate the overall effects of delaying childbearing on maternal education, marital status, and family income at birth;[22] (3) allowing these changes in maternal attributes to affect parenting skills; and (4) filtering the effects of these adjustments through the existing SGM framework, thereby allowing alterations in the circumstances of birth of mistimed children to affect child outcomes at later stages in the life cycle.

V. Results

Figure 7 shows that preventing all unwanted and mistimed births would have modest, but important, impacts on child success rates. In particular, helping all women attain their desired family size (i.e., reducing unwanted births) and meet their fertility-timing goals (i.e., preventing mistimed births) each raise life-stage success rates by about 1-2 percentage points.

Figure 7. Success Rates at Each Life Stage for All Children



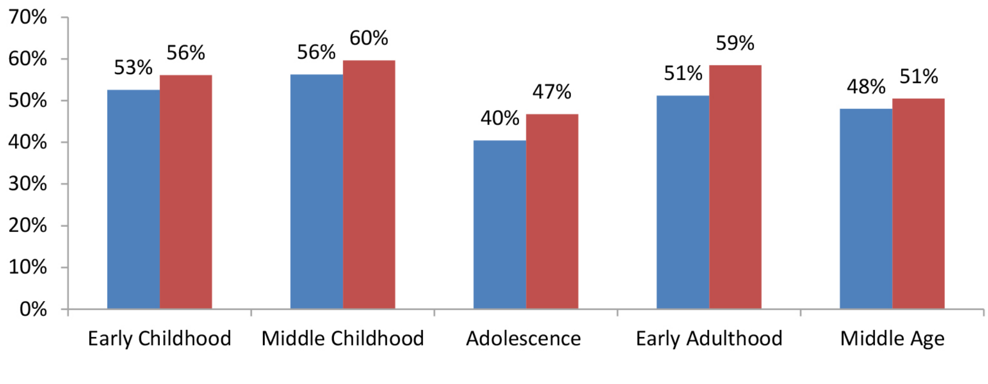
Source: Simulated data from the SGM.

21 More specifically, we specify parenting quality as a function of race, maternal education, the gender and low birth weight status of the child, maternal age, marital status at birth, mother's AFQT scores, and family income at birth. More details on the modeling of parenting quality in the SGM are contained in the technical appendix of this paper. The SGM measures parenting quality using the HOME-SF scale (Home Observation for Measurement of the Environment-Short Form), which consists of mother self-reports and interviewer observations on the emotional and learning environment of the home (Reeves and Howard, 2013).

22 For example, if a 22-year-old mother of a mistimed SGM child reported that her birth was mistimed by three years, we would: (1) increase maternal age at birth to 25; (2) increase the mother's probability of marrying by about 14 percent (1.0453); (3) boost her years of schooling by roughly 19 percent (1.0613); and (4) increase family income at birth by about 12 percent (1.0393).

While it is important to understand how reducing unintended births might impact overall child well-being (i.e., the weighted average across intended and unintended children), Figure 7 understates the benefits that mistimed children, as a group, accrue from having their births delayed. For this reason, we also examined the effect of delaying births on the portion of the sample that was originally mistimed. Figure 8 shows the benefits accruing to the mistimed children specifically. The overall success rates are lower for the mistimed population than for the whole population, because mistimed children tend to be in more disadvantaged circumstances than the rest of the sample, but their gains from the simulation are large. As illustrated in Figure 8, these gains are non-trivial and are particularly striking in adolescence and early adulthood, where success rates for mistimed children jump by between 7 and 8 percentage points as a result of postponed childbearing.

Figure 8. Success Rates at Each Life Stage for Mistimed Children



Source: Simulated data from the SGM.

If we unpack these aggregate success rates for mistimed children into their individual components, we find consistent improvements across a variety of cognitive, non-cognitive, and social dimensions. The increases in early and middle childhood development are small by themselves, but the effects build such that, by adolescence, delaying childbearing boosts high school graduation rates among previously mistimed children by about 7 percentage points and reduces their chances of becoming a teen parent by about 3 percentage points. Perhaps even more striking is the 8 percentage point increase in college graduation rates from 22 percent to about 30 percent (an increase of 36 percent). In total, we estimate that preventing all mistimed births would increase lifetime income for mistimed children by roughly $52,000.

Table 2. Simulated Effects of Preventing All Mistimed Births on Mistimed Children

	Pre-intervention	Post-intervention	Change
Early Childhood			
Standardized Math Score	-0.22	-0.14	0.08
Standardized Reading Score	-0.22	-0.11	0.11
Standardized Antisocial Behavior Score	-0.13	0.00	0.13
Standardized Hyperactivity Score	-0.17	-0.03	0.14
Middle Childhood			
Standardized Math Score	-0.18	-0.07	0.11
Standardized Reading Score	-0.14	-0.03	0.11
Standardized Antisocial Behavior Score	-0.15	-0.02	0.14
Standardized Hyperactivity Score	-0.08	0.01	0.09
Adolescence			
Percent Graduating from High School	78%	84%	7%
Percent Becoming Teen Parents	17%	13%	-3%
High School GPA	2.84	2.96	0.12
Percent Convicted of a Crime	21%	19%	-2%
Early Adulthood			
Percent Living Independently by Age 28	88%	88%	0%
Percent Graduating from College	22%	30%	8%
Family Income	$55,688	$59,987	$4,299
Middle Age			
Family Income	$63,432	$67,260	$3,828
Lifetime Income	$731,200	$783,461	$52,261

Source: Estimates from SGM simulations.

VI. Discussion

This paper examines the impact of reducing unintended childbearing on the children's life trajectories. Due to a variety of data limitations, previous studies have primarily focused on the costs of early childbirth to the mother and have largely ignored the long-run effects of family planning on the next generation. In this study, however, we are able to take advantage of the unique capabilities of the Social Genome Model in order to simulate the effects of reducing unintended childbearing on children's pathways into adulthood.

Evaluating pre-birth interventions

It is well-established that the circumstances into which children are born have a lasting impact on their later life trajectories (Chetty, Hendren, Kline, Saez, and Turner, 2014). We extend this research by examining whether having a child who is mistimed or unwanted would have long-run negative ramifications for that child. Our descriptive data show that children whose mothers report that their birth was unwanted or mistimed typically fare worse than their intended counterparts at all stages of the life cycle.

We thus hypothesized that helping women to align their fertility behavior with their intentions would improve the children's circumstances at birth and have positive impacts on their success in later stages of life as well. Our estimates from SGM simulations show that the prevention of all unintended births would modestly, but meaningfully, improve children's success rates. We found, for example, that delaying the births of mistimed children would increase their average lifetime income by about $50,000, which, even if appropriately discounted, is substantially more than the cost of an IUD or other forms of highly effective contraception.

These estimates likely understate the overall social benefits from reducing unintended childbearing. For instance, the SGM does not allow the life trajectories of children to interact, meaning that the model ignores any positive spill-over effects that might arise from improving the life chances of one segment of the population. To take a concrete example: while we know that reductions in crime have benefits that extend beyond the individuals at risk of committing criminal acts, these externalities are omitted from the SGM's calculus. On a measure more specific to our question, there may be positive effects for other children within the family. An unwanted fourth child might have diverted family resources away from the first three children that now can be used to improve the life trajectories of these earlier children. Delaying a first birth may lead to subsequent children also being born later than they would have been if the mother had an early, mistimed birth, meaning that these later children also get the benefits of a mother who is older and more prepared to parent. Moreover, the model fails to include estimates of the costs of unintended childbearing on the U.S. taxpayer. Monea and Thomas (2011), for example, estimate that preventing all unintended births would reduce expenditures on publicly financed medical care by about $6 billion.

These analyses, however, also indicate that there is an upper limit to the gains that can be expected from improving family planning in the United States. There are two main limiting factors. First, the impact of eliminating all unwanted births is small because only a small proportion of births (11 percent in our sample) are described as unwanted by their mothers. Even if we reached the utopian goal of all women perfectly achieving their fertility goals, this intervention only marginally changes the composition of the whole population. Secondly, the effects of delaying a mistimed birth on the child's later life outcomes, though noteworthy, are small. Most mothers with mistimed births only delay their births by a few years which will, realistically, only result in small improvements to their material circumstances. Pre-birth interventions can play a role in improving children's life trajectories, but a child's circumstances at birth are only one part of what holds back a disadvantaged child. Just like any other one-time intervention into a child's life, changing the age at which a mother gives birth can only go so far in improving child opportunity.

Limitations

There is, admittedly, room for uncertainty in our findings. First, we do not directly measure the intentionality of a birth and instead use propensity scores to categorize a child as mistimed or unwanted which adds uncertainty to our estimates. Though our sample's imputed levels of mistimed children and unwanted children mirror that of the NSFG sample, our imputations of the amount of time a child is delayed have a slightly different distribution than that of the NSFG sample (see Appendix Figure A2). Also, our imputations from NSFG of how long a child would be delayed may either over- or underestimate the true delay because they rely on women's self-report of their fertility intentions. On one hand, it is possible that a woman who delays a birth would end up on a different life path that leads to a longer delay in childbearing than she anticipated. On the other hand, the woman may be overly optimistic in thinking that she wants to wait until she is, say, 30 to have children and therefore reports a longer preferred delay than she later wants.

Additionally, our analyses assume that the effects of delaying a child are the same regardless of the birth order of the child. Though we did a robustness check in which we restricted the sample to first-born children (see technical appendix for more discussion), we did not allow the effect sizes to vary by birth order. Unfortunately, there is a dearth of literature on the subject of varying impacts of delaying childbirth by birth order, meaning that specifying alternative effect sizes for first births was not feasible within the scope of this paper.

Lastly, because maternal education at birth is such an influential factor in the life path of a child, a great deal of the effects of delaying births relies on our estimate of how much delaying a birth improves a woman's educational attainment. Running the simulation without including the changes in education (that is, allowing a delay in timing of birth to change maternal age, family income, marital status at birth, and parenting, but keeping maternal education at the original levels) results in significantly smaller effect sizes. That said, as demonstrated in our literature review, it is plausible that delaying fertility would allow a woman to pursue further education. As such, we ran sensitivity analyses (see the technical appendix) before settling on an effect size for educational attainment and chose an effect size pulled from the literature, rather than relying on our own regressional analysis, to ensure that an inaccurate effect size did not overly bias the simulation.

Looking forward: The impacts of intervening in multiple life stages

While it seems clear that reducing unintended childbearing will improve the life trajectories of the next generation, our analyses also indicate that more will be needed to move the meter on mobility. If we want to see larger, longer lasting effects on adult outcomes, we will have to combine pre-birth interventions with interventions in early childhood, elementary school, adolescence, and beyond.

In a recent paper (Sawhill and Karpilow, 2014), we simulated the effects of implementing five well-targeted, evidence-based interventions throughout a child's life. We found that well-evaluated targeted interventions can close over 70 percent of the gap between more and less advantaged children in the proportion who end up middle class by middle age. All of these interventions, however, were post-birth. Many of the factors that have the largest impact on the child's very early years – family income, parental education, parenting skills – are formed by the choices that parents make before the child is even conceived. This current paper suggests what might be achieved if, in addition, children were born to adults who are ready to be parents[23] and how such interventions can be combined with post-birth interventions to provide more economic opportunity for disadvantaged children. In preliminary work in which we combined the what-if scenario described in this paper with the five evidence-based interventions described in Sawhill and Karpilow (2014), we found that the addition of the pre-birth intervention resulted in lower income children achieving similar success rates in middle age as their middle-class peers. Though no existing intervention can perfectly align fertility behavior with

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23 For one set of ideas, see Sawhill and Venator (2014) or the St. Louis Choice Project.

intentions, our estimates suggest the addition of more effective family planning to a series of post-birth interventions may make it possible to nearly close the class gaps in adult outcomes.

However, more work needs to be done to link existing programs that influence women's fertility decisions to the life trajectories of the women's children. Typically, evaluations of initiatives that help women control their own fertility measure metrics such as contraceptive use or pregnancy rates. These metrics tell us something important about how these initiatives are helping women prevent unwanted pregnancies, but do not tell us the amount by which childbearing is delayed, how much better prepared they are for parenthood after this delay, or how much the circumstances into which their children are born change. As a result of this gap in the data, we were forced to use a hypothetical pre-birth intervention in which all women perfectly achieve their fertility intentions, rather than a simulated intervention modeled on a real-world program. Even effective teen pregnancy reduction programs only result in the woman delaying her first birth by at most 1.4 years (Goesling et al., 2013). Given that 60 percent of our sample had births that were mistimed by more than two years, real world policy interventions would likely not achieve perfect alignment of women's fertility behavior with their intentions. Future research should examine how expanding programs that increase the use of contraception (particularly LARCs) would impact women's final realized fertility and how these programs improve the circumstances at birth for the children eventually born to the participating women.

Conclusions

While early childhood initiatives have garnered increasing attention over the years, it seems unlikely that a single life-stage intervention can close the class gap in opportunity. This paper highlights the importance of acknowledging that the world into which a child is born is shaped by his or her parents' decisions pre-birth. Improving opportunity via pre-birth interventions, such as enabling women to more easily control their fertility, along with the post-birth interventions we have simulated in our previous paper (Sawhill and Karpilow, 2014) would have a two-generation effect. Better opportunities growing up improve adult outcomes, meaning that the next generation would be better prepared to be good parents and provide solid opportunities to their own children. If we want to make a difference in the life trajectories of disadvantaged children, we cannot only intervene when the child is 12 years old, or five years old, or even two years old. Rather, real progress on the social mobility problem will require a multi-stage intervention strategy that begins before conception.

Technical Appendix

This appendix provides additional details on the changes made to the SGM in order to simulate reductions in unintended births. More specifically, it contains the regression analyses used to (1) impute intentionality statuses to SGM children; (2) predict the years by which mistimed SGM children were mistimed; (3) model changes in parenting quality that result from delaying childbearing; and (4) estimate the effects of delaying childbearing on marital status and family income at birth. For a technical overview of the original SGM, see Winship and Owen (2013).

Predicting intentionality status

As discussed in the main text of this paper, we used birth data from the 2006-2010 cycle of the NSFG to estimate the probability that a birth was intended, mistimed, or unwanted, according to the mother's demographic characteristics. More specifically, we employed OLS regression techniques to predict (1) the likelihood that a birth was intended, and (2) the probability that a birth was unwanted, conditional on it being unintended. The results from these analyses are presented below in Table A1.

Table A1. OLS Regressions for Predicting Intentionality Status

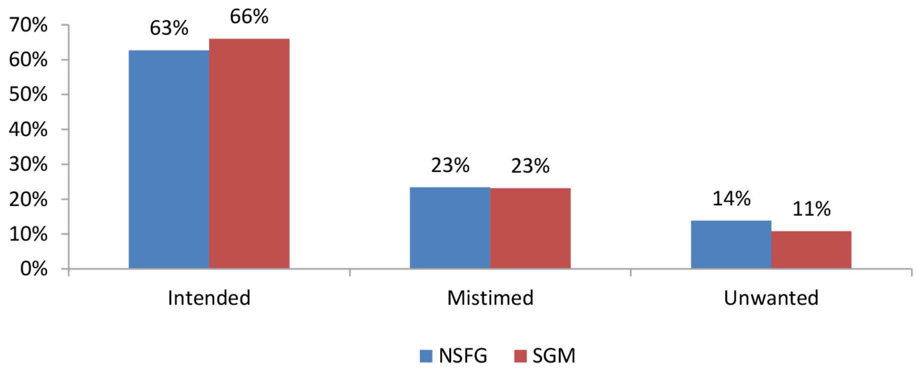
	Probability that a birth is intended	Probability that an unintended birth is unwanted
Maternal characteristics		
Age	0.0130***	0.0254***
Black	-0.0679**	0.102***
Hispanic	-0.0155	0.0405
Less than high school	-0.0551	0.269***
High school	-0.0555*	0.230***
Some college	-0.0557**	0.134**
Married	0.217***	-0.0933**
Living below 200% FPL	-0.0864***	0.0649
Constant	0.248***	-0.510***
R-squared	0.177	0.105
Sample size	4567	1969

Notes: All parameters were estimated using 2006-2010 NSFG data. The excluded race and education categories are as follows: white and other race categories, and bachelor's degree or more. One asterisk (*) indicates that the parameter estimate is significant at or beyond the .1 level, two asterisks (**) indicate that the parameter estimate is significant at or beyond the .05 level, and three asterisks (***) indicate that the parameter estimate is significant at or beyond the .01 level.

These predicted probabilities were then used to sequentially assign SGM children to intended, unwanted, or mistimed categories. More specifically, at the start of each simulation, random draws from a uniform (0,1) distribution were compared to predicted probabilities of being intended in order to identify intended SGM births. Then, from among those children who have not been assigned to the intended birth category, unwanted children were identified by comparing a new set of random draws from a uniform (0,1) distribution to these children's conditional probabilities of being unwanted given that they are unintended. The remaining children who had not been identified as either intended or unwanted were considered to be mistimed.

Figure A1 compares SGM predictions to real-world data on intended-ness.

Figure A1. Proportion of Births that are Intended, Mistimed, and Unwanted



Source: Simulated data from the SGM and authors' tabulations of the 2006-2010 NSFG.

Imputing years by which mistimed children are mistimed

We modeled the years by which mistimed children are mistimed using a negative binomial regression, the results of which are presented below in Table A2.[24]

Table A2. Negative Binomial Model of Mistimed-ness

	Number of years by which a mistimed birth is mistimed
Maternal characteristics	
Age	-0.0689***
Black	0.148
Hispanic	0.0178
Less than high school	0.602***
High school	0.533***
Some college	0.551***
Married	-0.379***
Living below 200% FPL	0.0688
Constant	2.0465***
Over dispersion parameter (alpha)	0.220**
Sample size	1154

Notes: All parameters were estimated using 2006-2010 NSFG data. The excluded race and education categories are as follows: white and other race categories, and bachelor's degree or more. One asterisk (*) indicates that the parameter estimate is significant at or beyond the .1 level, two asterisks (**) indicate that the parameter estimate is significant at or beyond the .05 level, and three asterisks (***) indicate that the parameter estimate is significant at or beyond the .01 level.

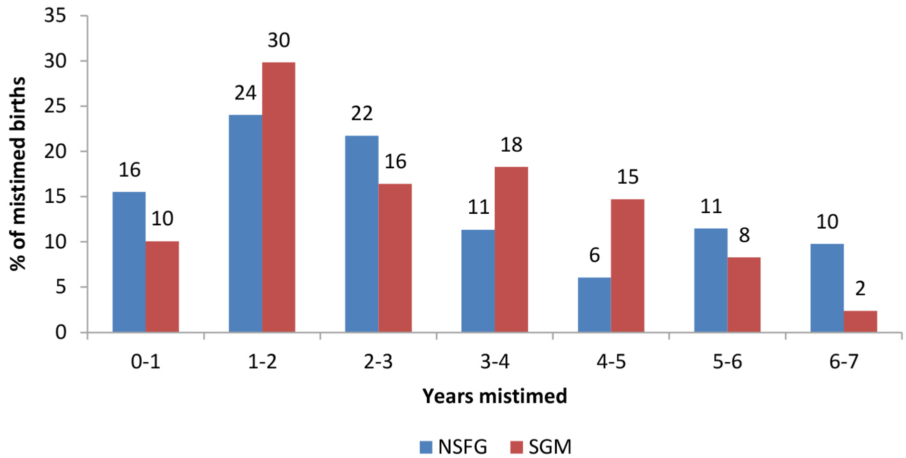
The estimated parameters in Table A2 were then imported into the SGM and used to impute number of years by which mistimed SGM children were mistimed. To simplify the simulation process, we rounded

24 Exploratory analyses showed that mistimed-ness, which is a nonnegative count variable, was characterized by over-dispersion, suggesting that a negative binomial model was more appropriate than a Poisson model. Likelihood-ratio tests confirmed this finding. It should also be noted that we considered using OLS regressions to predict mistimed-ness; however, OLS predictions deviated substantially from real-world data benchmarks.

mistimed-ness predictions to the nearest year.

Figure A2 compares real-world and simulated distributions of mistimed-ness.[25]

Figure A2. Years by which a Mistimed Birth is Mistimed



Source: Simulated data from the SGM and authors' tabulations of the 2006-2010 NSFG.

Because birth order can affect whether a woman describes her birth as intended, mistimed, or unwanted, we also ran sensitivity checks in which we restricted the sample to only first-born children and then imputed intendedness. These analyses did not result in different outcomes in the simulation than for the non-restricted sample, so all findings reported in this paper used the full sample of children.

Modeling the effects of delaying childbearing on parenting skills

In the original SGM, parenting quality is assigned to the circumstances-at-birth (CAB) life stage, meaning that other CAB variables – including maternal education, maternal age, family income, and marital status at birth – are not allowed to influence parenting skills. In simulating the effects of delaying mistimed births, however, this assumption seems implausible in light of research showing that income, age, education, and marital status are all strongly predictive of parenting quality (Reeves and Howard, 2013).

We therefore modified the SGM framework so as to allow delays in childbearing to affect parenting skills. More specifically, we created an intermediate stage between circumstances at birth and early childhood (EC) that we call pre-early childhood (pre-EC). This pre-EC stage contains measures of parenting quality and early child verbal ability – two sets of variables that, in the original SGM, were

25 While we rounded mistimed-ness predictions to the nearest year for our policy simulations, we used a slightly different rounding technique to produce Figure A2. In particular, NSFG respondents were given the option of reporting the degree to which their birth was mistimed in either months or years. For the respondents who opted to report mistimed-ness in terms of months, births were mistimed by two years or less. For all births that were mistimed by two years or more, mistimed-ness was reported as integer years. Consequently, in Figure A2, NSFG births that were mistimed by between 1 and 11 months (inclusive) were coded as “0-1”; births that were mistimed by between 12 and 23 months (inclusive) were coded as “1-2”; births that were reported to be mistimed by 2 years were coded as “2-3”; births that were reported to be mistimed by 3 years were coded as “3-4”; and so forth. To generate comparable results, we used a similar coding strategy to identify SGM births that were mistimed by less than 2 years; for SGM births that were mistimed by two or more years, we rounded predicted years to the nearest integer.

housed in the CAB life stage, but that are likely influenced by delays in childbearing.[26] We then used OLS regressions to predict these pre-EC variables using the remaining variables in CAB, the results of which are presented below in Table A3.

Table A3. OLS Regressions for Pre-EC Outcomes

	Early Child Verbal Ability	Parenting Quality (Emotional Support)	Parenting Quality (Cognitive Stimulus)
Child characteristics			
Female	0.139***	0.115***	0.0710***
Born low birth weight	-0.0457	-0.0451	-0.0244
Maternal characteristics			
Black	-0.745***	-0.273***	-0.260***
Hispanic	-0.517***	-0.123***	-0.327***
Other race	-0.250***	-0.178***	-0.158**
High school degree	0.180***	0.162***	0.240***
Some college	0.235***	0.242***	0.311***
Bachelor's degree or more	0.405***	0.263***	0.288***
Age at birth	-0.00640***	0.0225***	0.0186***
Married	0.0370	0.222***	0.0556
Family income at birth	0.0561***	0.0264**	0.0448***
AFQT scores	0.00802***	0.00262***	0.00429***
Constant	-0.375***	-1.173***	-1.0429***
Sample Size	5783	5783	5783
R-squared	0.295	0.134	0.137

Notes: All parameters were estimated using SGM data. The excluded race and education categories are as follows: white and other race categories, and less than high school. In these regressions, family income at birth has been logged. One asterisk (*) indicates that the parameter estimate is significant at or beyond the .1 level, two asterisks (**) indicate that the parameter estimate is significant at or beyond the .05 level, and three asterisks (***) indicate that the parameter estimate is significant at or beyond the .01 level.

Note then that parenting skills and child verbal ability are functions of the four CAB variables that we manually adjust in order to simulate the effects of delaying a mistimed birth. As a result, our simulations assume that delaying childbearing will only impact parenting quality and child verbal ability through its effects on maternal education, maternal age, family income at birth, and marital status at birth.

Estimating the effects of delaying childbearing on marital status and family income at birth

As mentioned earlier, estimates of the causal impacts of delaying childbearing on marital status and family income are scarce. We therefore conducted original analyses to generate our own estimates of these effect sizes. More specifically, we used 2006-2010 NSFG data to estimate the relationship between maternal age and marital status at birth, controlling for a variety of observed maternal and household characteristics. Because the correlation between maternal age and marital status at birth was found to vary significantly between mothers who were under and over the age of 30, separate OLS regressions were estimated for these two age groups. Table A4 reports the results from these analyses.

We then interpreted the estimated age coefficients in Table A4 as the approximate effects of delaying a birth by one year on the probability that children's parents are married at the time of their birth.
We relied on data from the March 2009 Census Population Survey (CPS) to estimate the effects of delaying childbearing on family income at birth. More specifically, we limited our analysis sample to children who were under the age of one when their family was interviewed, and then modeled (logged)

26 The SGM measure of early reading ability is derived from child Ppvt scores (Winship and Owen, 2013).

family income as a function of maternal characteristics, including age, educational attainment, and race/ethnicity. Results from the OLS regressions are presented below in Table A5.

Table A4. OLS Estimates of the Effects of Delaying Childbearing on Marital Status at Birth

	Probability that mother is married at time of birth (mothers younger than 30)	Probability that mother is married at time of birth (mothers older than 30)
Maternal characteristics		
Age	0.0439***	0.00341
Black	-0.244***	-0.187***
Hispanic	-0.0157	-0.0634
Less than high school	-0.216***	-0.268***
High school	-0.212***	-0.215***
Some college	-0.171***	-0.135***
Living below 200% FPL	-0.139***	-0.127***
Constant	-0.315***	0.832***
R-squared	0.284	0.173
Sample size	3199	1388

Notes: All parameters were estimated using 2006-2010 NSFG data. The excluded race and education categories are as follows: white and other race categories, and bachelor's degree or more. One asterisk (*) indicates that the parameter estimate is significant at or beyond the .1 level, two asterisks (**) indicate that the parameter estimate is significant at or beyond the .05 level, and three asterisks (***) indicate that the parameter estimate is significant at or beyond the .01 level.

Table A5. OLS Estimates of the Effects of Delaying Childbearing on Family Income at Birth

	Logged household income at birth
Maternal characteristics	
Age	0.0389***
Black	-0.1988**
Hispanic	-0.0660
Less than high school	-1.085***
High school	-0.863***
Some college	-0.477***
Married	1.296***
Constant	7.865***
R-squared	0.522
Sample size	2470

Notes: All parameters were estimated using data on children who were under the age of one at the time their families were interviewed for the March 2009 Current Population Survey (CPS). While the unit of analysis is the newborn, the demographic information used here reflects the characteristics of the mother. The excluded race and education categories are as follows: white and other race categories, and bachelor's degree or more. One asterisk (*) indicates that the parameter estimate is significant at or beyond the .1 level, two asterisks (**) indicate that the parameter estimate is significant at or beyond the .05 level, and three asterisks (***) indicate that the parameter estimate is significant at or beyond the .01 level.

We then interpreted the coefficient on the age covariate as the percent change in household income associated with a one-year delay in childbearing.

It is possible that the above methodology understates the effects of childbearing delays on marital status and family income at birth. In particular, note that we control for maternal educational attainment in both the marital status and family income at birth regressions, but do not allow changes in maternal education that result from delays in childbearing (Table 1) to impact either of these two outcomes. Similarly, while we model family income as a function of marital status and marital status as a function of family income, we do not allow changes in marital status to influence family income (or vice-versa). These modelling choices likely bias us towards underestimating the effects of postponing childbearing. On the other hand, it is also likely that the estimated age coefficients in both our marital status and family income regressions are biased upward due to selection effects, namely: the tendency for older mothers to be more advantaged along a variety of unobserved dimensions. Ultimately, the net effect of these two offsetting biases is unknown.

Estimating the effects of delaying childbearing on maternal education

As mentioned earlier, there is a varied literature on the effects of early childbirth on education with diverging conclusions. Because maternal education is one of the key inputs into SGM, parsing out what effect size to use from this literature is both important and difficult. As such, we ran the model using multiple different specifications as sensitivity checks before concluding that our first choice of specification was the appropriate measure to use moving forward.

Our original specification is the one described in text. For teenagers, we use an effect size described in Kane et al. (2014) in which the authors did a meta-analysis of multiple studies and replicated multiple methodologies to find the best causal estimate of the effect of teen childbearing on educational attainment. For those over 18, we use an estimate from one of the few papers to look at the impact of adult fertility on education (Herr, 2008). In this paper, Herr used miscarriages as an instrument to develop less biased estimators of the effects of having a child on wages and mediating factors, including educational attainment. She found that delaying childbearing by one year reduces the amount of education a woman attains by the time she has been in the workforce for 15 years by 6.1 percent. We chose to assume that this education accumulation would occur prior to the birth, meaning that delaying for one year increases education by 6.1 percent for women over 18.

However, we recognize that this estimate may be imperfect and therefore tested three other specifications as well.

For the first sensitivity test (labeled 1 in the tables below), we used the same estimate for teens, but made more conservative assumptions about Herr's effect sizes for adults. Rather than assuming that the woman accrues all of the education specified in Herr's effect size during the period of delay, we assume that she accrues the same amount of education every year over the 15-year span of time. We assume that the woman enters the labor force at 18, so the effect size is weighted by (age at birth – 18) divided by 15, or the number of years the woman is accruing education before birth divided by 15. In this case, the amount of education accrued at the time of the delayed child's birth is less than the total amount of education in the original specification, but instead is:

(1 + [(1.061^delay -1)*(age_at_birth_post – 18)/15])*amount_of_education_pre

This specification does err on the cautious side, however. It is unlikely that a woman is getting her education in bits and pieces over the course of 15 years and is far more likely that she will get it all in one chunk (as in the original specification).

For the second sensitivity test, we are working under the assumption that, for many women at least, education trails off after the teen years. Therefore, we use the Kane et al. estimates for teens and apply it to all originally mistimed births to women who were 19 or younger that are delayed until the mothers are 20 or older in the simulation. This, once again, is likely to be an underestimate, since many young women who seek a college education do so after the age of 20. Nonetheless, this estimate provides us with a low bound of the effects of improving maternal age (see the column labeled 2 in the table below).

For the third sensitivity test, we use estimates from a different empirical paper, Klepinger, Lundberg, and Plotnick (1995), which uses instruments including age at menarche and state policies about fertility decisions, such as laws about abortion and contraception, to estimate the effect of having an early teen birth (<18) or a late teen birth (18 to 20) on education. The authors break these effects down by race, with white early teen births resulting in 0.436 fewer years of education, black early teen births resulting in -1.234 fewer years, white late teen births resulting in -2.766 fewer years of education, and black late teen births resulting in -2.971. These are larger effect sizes than found in Kane et al., partially due to their choice of instrument (see earlier discussion of the weakness of using measures related to abortion as an instrument for fertility), but these estimates can provide an upper bound for the causal relationship between early fertility and educational attainment. We applied the early birth estimates to mothers who originally had their child before the age of 18 and delayed until after 18 in the simulation. We applied the late birth estimates to mothers who originally had their child before the age of 20 and delayed until after 22 (the typical age at which young adults graduate college). These effects can be seen in the column labeled 3 in the table below.

In Table A6, we show the effects of the four different methods of specifying education on the success measures for the full sample (see Table A6a, which corresponds to Figure 7 in the text) and just for mistimed children (see Table A6b, which corresponds to Figure 8 in the text). The final column of the table provides an average of the effect of the intervention for all four specifications. As you can see, the average effect of these specifications is very close to our original choice of specification, only varying by up to 1 percentage point. As such, we chose to use the original specification as described in text.

Table A6a. Sensitivity check of educational effect of the intervention, for full sample

	Baseline	Original specification	(1)	(2)	(3)	Average
ECS	57%	59%	58%	58%	60%	59%
MC	61%	63%	62%	63%	64%	63%
ADOL	46%	49%	49%	48%	51%	49%
TTS	57%	61%	59%	59%	63%	60%
ADULT	55%	56%	56%	56%	57%	56%

Table A6b. Sensitivity check of educational effect of the intervention, for mistimed children only

	Baseline	Original specification	(1)	(2)	(3)	Average
ECS	53%	56%	54%	53%	61%	56%
MC	56%	60%	58%	58%	62%	59%
ADOL	40%	47%	43%	43%	52%	46%
TTS	51%	59%	54%	53%	66%	58%
ADULT	48%	51%	49%	49%	53%	51%

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