Intergenerational Mobility Begins Before Birth*

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Abstract

Nearly 40% of all live births in the United States are unintended. This phenomenon is disproportionately common among women with low socioeconomic status. Given that being born to unprepared parents significantly affects a child's human capital development, could family planning access affect intergenerational persistence of economic status and income inequality? We extend the standard Becker-Tomes model with endogenous choice of contraceptive adoption. When the model is calibrated to match observed patterns of unintended fertility, we find that intergenerational mobility is significantly lower than that in the standard model. In a counterfactual where states improve the access to family planning services for the poor, intergenerational mobility improves by 0.4 standard deviations while income inequality decreases by 0.4 standard deviations on average at the same time. When we calibrate the model to match unintended birth rates by race, we find that differences in family planning access alone can account for 20% of the racial gap in upward mobility. Helping women fulfill their goals about family planning and childbearing is a desirable, achievable and scalable policy to improve social mobility and address racial inequality.

Keywords: family planning access; human capital; intergenerational mobility; PRAMS

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1 Introduction

If the United States has a civic religion, it is that each individual should have the opportunity to achieve the American Dream. Enhancing socioeconomic mobility is often regarded as an important policy goal and has always been a central issue in public policy discussions as well as academic research. Significant research efforts have been directed towards documenting patterns of intergenerational mobility (Chetty et al. (2014)) and estimating the structural forces shaping the intergenerational persistence of income (Corak (2013), Lee and Seshadri (2019)). Most of the recent policy recommendations focus on helping disadvantaged children foster human capital through early childhood interventions (Heckman and Mosso (2014), Chetty and Hendren (2018)).

While the literature has recognized the significant impact of parental background on children's future outcomes, little attention has been paid to the underlying factors that determine the conditions into which the children are born. In other words, how do women make fertility choices, and how does this affect children's outcomes and intergenerational mobility? In this paper, we use data from National Survey of Family Growth (NSFG) to establish that the fertility process is far from frictionless or exogenous, contrary to what is commonly assumed in models of intergenerational mobility. Nearly half of all pregnancies and 40% of all live births are unintended, and the phenomenon is much more common among women with low socioeconomic status. Given that unintended fertility has detrimental effects both to the mother as well as the child (Logan et al. (2007)), we argue that the presence of costly family planning amplifies the degree of intergenerational persistence that would otherwise prevail had mothers been able to freely control their fertility. Using restricted-access data from Pregnancy Risk Assessment Monitoring System (PRAMS), we provide evidence supporting this inquiry by showing that the level of unintended fertility is highly correlated with measures of intergenerational mobility at the state level after controlling for various common correlates discussed in the literature.

To rationalize unintended fertility and to quantify its effect on intergenerational mobility, we extend the standard Becker-Tomes model by incorporating the endogenous adoption of family planning services. Differences in career costs of children, lifecycle income profile, and family planning costs by education all contribute to disparities in the observed degrees of family planning adoption, unintended fertility rates, and birth timing. We show that compared with the standard Becker-Tomes model, the costly-family-planning framework generates significantly lower social mobility.

To study policy counterfactuals, we calibrate the model to match intergenerational mobility (c.f. Chetty et al. (2014)) and profiles of unintended fertility across states. State-level parameters map closely to factors that are good predictors of mobility (e.g. residential segregation and social capital index) as well as indices reflecting costs of access to family planning services. In the first counterfactual, the family planning costs and inequality in access are reduced to the lowest level across all states. In the second counterfactual, each state reduces the family planning costs by one-third, which would reduce the overall level of unintended fertility to that of Western Europe. We find that intergenerational mobility could be improve, on average, by as much as 0.4 standard deviations across all the states. Alongside this increase in social mobility is a reduction in income inequality by 0.4 standard deviations on average

We also use the calibrated model to shed light on how much of the racial gap in upward mobility documented by Chetty et al. (2020) can be explained by differences in access to family planning services by race alone. When we match the model to differences in unintended fertility by race, we find that black women are faced with much higher costs of accessing family planning services than white women with similar incomes. The disparities in family planning costs can explain up to 20% of the observed racial gap in upward mobility.

Given the huge success of reducing teenage pregnancy rates in the United States in the past few decades (Kost and Henshaw (2014)), the institutional knowledge acquired in that process could potentially be applied to promoting access to family planning services among women at their early 20s and those of disadvantaged socioeconomic backgrounds. To conclude, we suggest that helping women fulfill their own goals on family planning and childbearing is a desirable, feasible, and scalable policy to improve social mobility and address racial inequalities without massive system changes.

The rest of the paper is organized as follows. In Section 2, we present empirical evidence on unintended fertility and intergenerational mobility. Section 3 contains the model and calibration. Policy counterfactual results are displayed in Section 4. We use the model to study racial gaps in upward mobility in Section 5. Section 6 concludes.

2 Empirical Findings

2.1 Micro-level Evidence

2.1.1 Unintended Fertility

We use data from the National Survey of Family Growth (NSFG) to define unintended pregnancy/birth and to characterize stylized facts about unintended fertility in the United States.

NSFG is administered by the U.S. National Center for Health Statistics starting from 1973, designed to be nationally representative of women 15-44 years of age in the civilian, non-institutionalized population of the United States. It gathers information on pregnancy and births, marriage and cohabitation, infertility, use of contraception, family life, and general and reproductive health. We use the 2015-2017 sample where the dataset contains 5,554 women, 9,553 recorded pregnancies, and 6693 live births.

The interview question of particular interest here concerns fertility intention. Respondents were asked about their wantedness of each pregnancy. The answer is one of “later, overdue", “right time", “too soon, mistimed", “didn’t care, indifferent", “unwanted" or “don’t know, not sure". A pregnancy is categorized as “unintended" if it is either “too soon, mistimed" or “unwanted". Information on fertility intention is highly valuable to modeling fertility choice since a birth that would be otherwise interpreted as “chosen" from a revealed preference could actually be the result of contraceptive failure, misinformation, or lack of access to family planning services. We restrict the sample to pregnancies that end up in live births since the adoption of abortion procedures could also be viewed as a form of birth control. We categorize a live birth to be unintended if the corresponding pregnancy is reported to be unintended by the mother.

Figure 1 displays unintended birth rates by education. The figure conveys three striking facts. First, the overall level of unintended fertility rate is high. Guttmacher Institute reports that in 2011, nearly half (45%) of the 6.1 million pregnancies in the United States were unintended. Using NSFG data, we find that the percentage of pregnancies (births) that are unintended in 2015-2017 is 42.4% (36.7%). This implies that a significant portion of childbirth would have been delayed or avoided had the mothers had better access to family planning. Second, the unintended fertility rate declines sharply with education. While 45% of the births are unintended for women with high school degrees and below, only 22% are unintended for women with college degree and above. When we compare unwanted births, a form of unintendedness more strongly associated with poor outcomes for the child (Logan et al. (2007)), women with college degrees report one-fourth of the unwanted birth rates found among women with high school degrees and below. Lastly, we see a relationship between unintended fertility rate and college completion. This indicates that the occurrence of an unintended birth could affect the schooling choice of women in early 20s and impose a significant costs on their careers.

Figure 2 displays unintended birth rates by race of the respondent. As can be seen, unintended birth rates are much higher among blacks than in white or other race groups (mainly Hispanics and Asians). While more than half of the live births are unintended among blacks, less than one-third are unintended in other racial groups.

2.1.2 Consequences of Unintended Fertility

An important link between unintended fertility and intergenerational mobility is that the unpreparedness of mothers results in worse outcomes of the children. If unintended fertility only leads to a utility loss for mothers without affecting children’s human capital, the fact that disadvantaged women experience higher unintended fertility does not necessarily lead to more persistence in economic status across generations. Yet if self-reported unintendedness is correlated with lack of financial resources, instability of family structure or other disadvantages when the child is young,

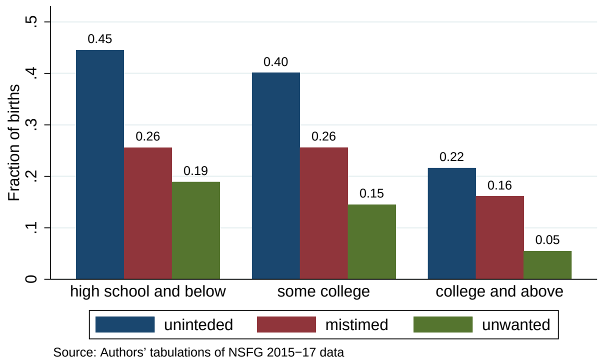


Figure 1: Unintended Birth Rates by Education

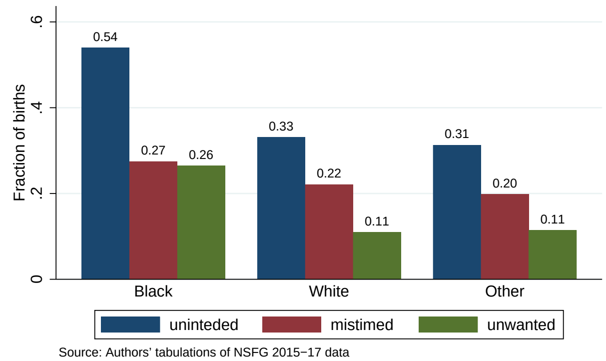


Figure 2: Unintended Birth Rates by Race

improving family planning access would have profound implications on child outcomes and social mobility.

There is a large body of work investigating the consequence of unintended fertility on both mothers and children. Brown et al. (1995) presents compelling evidence showing that unintended children are at greater risk of being born at low birth weight, being abused, and of not receiving sufficient resources for health development. The mothers are also at greater risk of depression, self-abuse, and suffer from a dissolution of relationship with partner. Baydar (1995) uses National Longitude Survey of Youth data to show that unintended children have lower test scores and a less-positive relationship with their mothers. Miller (2009) shows that giving birth to the first child one year earlier, potentially due to mistimed pregnancies, results in a significant decrease in the child's future test scores that is equivalent to 10 percent of the gap between children of college graduates and those of high school dropouts. In a comprehensive survey of the recent literature, Logan et al. (2007) concludes that "Overall, unintendedness seems to be most clearly associated with poor physical health, poor mental health, a close mother-child relationship, and poorer educational outcomes."

On the flipside, the legalization of the Pill and abortion in the 1960s and 1970s have resulted in women delaying births, getting more education, and earning more (see Goldin and Katz (2002)). Ananat and Hungerman (2012) has also argued that there are significant spillover effects for future children. They showed that in the in long-term, access to the Pill increases the share of children with college-educated mothers and decreases the share with divorced mothers.

2.1.3 Frictions and Sources of Disparities in Family Planning

Since the invention of modern contraceptive technologies, especially the oral birth control pill, women are empowered with a more effective tool to conduct family planning (Goldin and Katz (2002)). Therefore it might first come at a surprise to observe the high level of unintended birth rates presented in Figure 1. In this section, we use information from NSFG and NLSY to present patterns of contraceptive use and discuss some of the relevant factors. This would help us to have a deeper understanding of the frictions that women face in family planning and also provide policy makers with a gateway to reduce unintended birth and increase social mobility.[1]

One point worth noting is that unintended pregnancies could be reported by women with and without consistent use of contraception. On one hand, there are women who suffer from contraceptive failures despite consistent family planning. On the other hand, there are also women who did not consistently use contraceptives or abortion for all kinds of reasons but actually wanted to delay or avoid the birth. The fertility intention question is designed to let women compare the actual outcome with a hypothetical scenario where she has perfect control over birth in the first place.

Figures 3 and 4 display patterns of contraceptive adoption using data from the female respondent files in NSFG. These figures document the fraction of respondents who have *ever* used condom or the Pill by education and race respectively. The fraction of women that have ever used a condom is above 90% for all education background and race categories. However, the use of oral contraceptive pills, a method with higher effective rate under perfect or typical use, is lower among black women or women with lower education.

Figures 5 and 6 show the fraction of sexually active women who consistently adopt contraceptives in the year prior to the interview *conditional on* indicating that they do not want any child in the future. For women with high school degree and below, only 65% consistently use contraceptives despite not wanting to have more children. This is substantially lower than women with college education and above, of which 76% use contraceptives consistently. Similarly, for black women this percentage is only 59%, compared with 72% among white women and 67% for other racial groups.[2]

As discussed in Goldin and Katz (2002), successful family planning offers various benefits to women in terms of human capital accumulation and career prospects. Here, we would provide some examples of costs of family planning using data from NSFG and NLSY79.[3]

First of all, misinformation among women at risk of unintended pregnancy is quite common. In a nationally representative survey conducted by the Guttmacher Institute for the National Campaign to Prevent Teen and Unplanned Pregnancy, 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" (see Sawhill et al. (2010)). The survey also found that among unmarried adults aged 18-29, about six in ten said they know “little" or "nothing" about birth control pills, and three in ten said they know “little" or “nothing" about condoms. Shartzer et al. (2016) documents

[1]See Brown et al. (1995) and Dehlendorf et al. (2010) for more comprehensive discussions.

[2]We observe the same pattern when we investigate whether the respondent had used any contraceptive methods between pregnancy intervals (or since the first intercourse) conditional on the following pregnancy being unintended.

[3]See Brown et al. (1995) and Dehlendorf et al. (2010) for a more comprehensive treatment of factors determining contraceptive use.

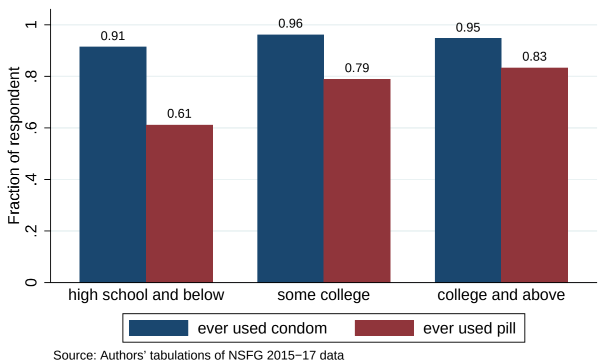


Figure 3: Ever Use by Education

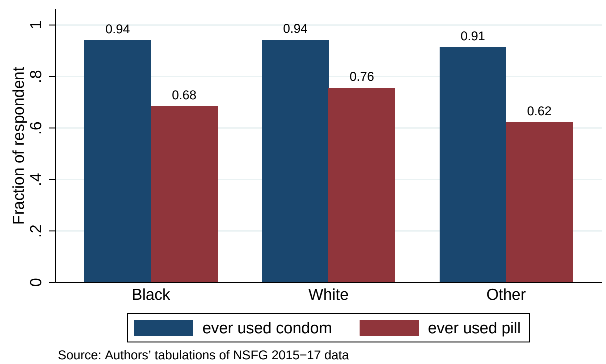


Figure 4: Ever Use by Race

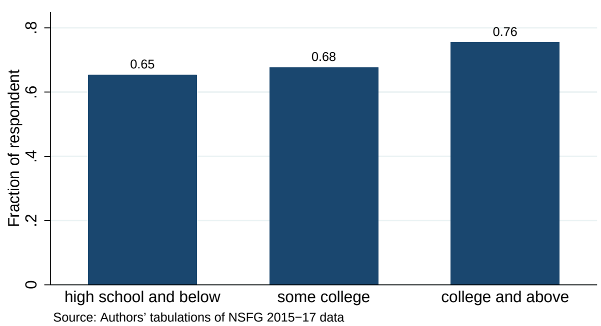


Figure 5: Consistency by Education

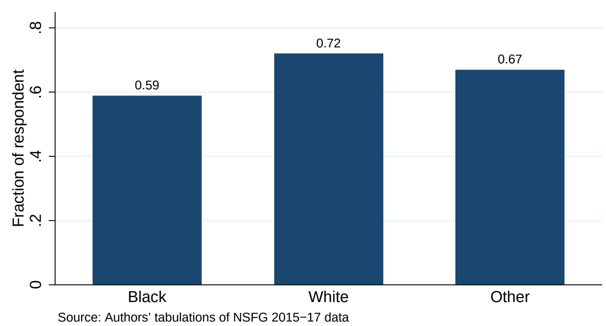


Figure 6: Consistency by Race

high degrees of misinformation towards effective birth control methods such as IUDs and implants, and the knowledge gap is larger among non-white, non-Hispanic women with low income. We provide additional evidence using the response to a survey question in NLSY79 where respondents were asked whether they had ever attended a sex education course, and if so, whether the course taught the effects of contraception and where to get contraceptives. The first row in Table 1 shows that not all respondents have ever attended a sex education course, and there is a 0.1 gap between people with and without a college degree. The next three rows indicate that the contents of the course are quite similar conditional on being taught.

	without college	college
ever have a sex education course	0.549	0.657
course teaches effects of contraception	0.700	0.703
course teaches types of contraception	0.793	0.799
course teaches where to get contraception	0.654	0.649

Source: Author's calculations using NLSY79 data.

Table 1: Sex Education Ever Received

Another contributing factor to contraceptive cost is disagreements between partners. Partners could have different bargaining power, fertility intention and/or preferences over family planning. These could result in moral hazard in contraceptive use (Ashraf et al. (2014)) and affect aggregate fertility (Doepke and Kindermann (2019)). In NSFG, respondents were also asked about their partners' intentions about each pregnancy. Table 2 presents the degree of (dis)agreements between partners by education of respondents (women). As can be seen, women with high school education or below report higher incidence of pregnancies where both parties do not want the child (0.325 versus 0.204). Moreover, they are also more likely to indicate that they do not want the child themselves, yet their partners do (0.196 versus 0.110). Similarly, Table 3 shows that black women report higher incidences of pregnancies where both parties do not want the child than white women (0.278 versus 0.190). Black women are also much more likely to indicate that they do not want the child themselves, yet their partners do (0.212 versus 0.103). These disagreements between fertility intentions could lead to higher costs to adopt contraception consistently for women with disadvantaged backgrounds through coercion or conflict within the relationship.

Lastly, Dehlendorf et al. (2010) discussed that access to family planning services and high-quality treatments from health-care providers are important factors contributing to disparities in unintended fertility. Disadvantaged women are disproportionately uninsured in the United States (Ebrahim et al. (2009)) and women with no insurance coverage are 30% less likely to use prescription contraception (Culwell and Feinglass (2007)). Religion also plays a role in provision of contraceptive services. For instance, Hill et al. (2019) showed that Catholic hospitals reduce the

		high school		college	
		partner wants the child		partner wants the child	
		Yes	No	Yes	No
respondent	Yes	0.412	0.067	0.630	0.056
wants the child	No	0.196	0.325	0.110	0.204

Table 2: Fertility Intentions of Both Parties, by Respondents' Education

		Black		White	
		partner wants the child		partner wants the child	
		Yes	No	Yes	No
respondent	Yes	0.431	0.079	0.640	0.066
wants the child	No	0.212	0.278	0.103	0.190

Table 3: Fertility Intentions of Both Parties, by Respondents' Race

per bed rates of tubal ligations by 31%, which could increase the risk of unintended pregnancies and impose a potentially large cost for less reliable contraception on women and their partners. Expanding the provision of family planning services and treatments to disadvantaged women could improve on the levels and disparities in unintended fertility.

It is not the goal of this paper to analyze the exact source and composition of those frictions discussed above. Instead in Section 3, we model the overall cost to conduct family planning using a single variable.

2.2 State-level Evidence

In the previous section, we present micro-level evidence on unintended fertility and contraceptive use. A natural question is whether their effects are visible at a more aggregate level. For instance, do places that have higher unintended birth rates have worse child outcomes and lower mobility? In this section, we present suggestive evidence supporting this conjecture by combining intergenerational mobility measures from Chetty et al. (2014) and restricted-access data on unintended fertility from PRAMS.

We construct state-level mobility measures by aggregating commuting-zone (CZ) level estimates in Chetty et al. (2014) using population weights. Figure 7 illustrates the empirical content of these two measures. The horizontal axis plots parents income rank in the national distribution while the vertical axis plots the corresponding average children's income rank in the national distribution. Absolute upward mobility (AM) measures the average income rank of the child with parents' income rank being 25th percentile. Relative mobility (RM) measures the slope of the rank-rank relationship. Higher RM means *lower* intergenerational mobility.

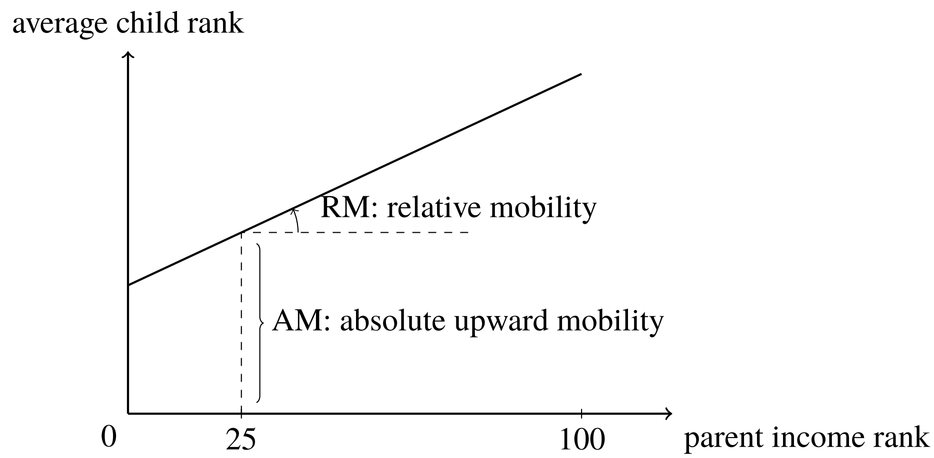


Figure 7: Measuring mobility

We use restricted-access data from PRAMS to calculate unintended birth rates by education at the state-level. Besides uncovering the correlation between unintended fertility and mobility in this section, these statistics also help us identify state-specific parameters and conduct policy counterfactuals in Section 4. PRAMS is a surveillance project of the Centers for Disease Control and Prevention (CDC) and state health departments that collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after birth. We use the data from year 2008 to 2017 covering all continuous United States that participate in PRAMS.[4] Unfortunately, we can not go to more granular levels such as county or commuting-zone. The sample contains around 600,000 pregnancies.

Figure 8 and 9 plots AM and RM against unintended birth rates across states. States with higher unintended birth rates have lower AM and higher RM. Both indices show that the level of unintended fertility is negatively correlated with intergenerational mobility.

We investigate the predictive power of unintended birth rates on AM and RM after controlling for the five factors that are chosen to be the strongest predictors of mobility in Table VI of Chetty et al. (2014). These five factors are:

Fraction short commute The share of workers that commute to work in less than 15 minutes calculated using data for the 2000 Census. Chetty et al. (2014) uses it as a proxy for income segregation with higher “fraction short commute" indicating lower segregation.

Gini bottom 99% The Gini coefficient minus the top 1% income share within each CZ, computed

[4] We are extrapolating the level of unintended fertility rates in 1980s, i.e. where children observed in Chetty et al. (2014) are born, using data from later years due to data limitations. We argue that this would not greatly harm our results for two reasons. First, with available data from 1990 to 2017, we find that unintended fertility rates are persistent over time at the state-level. Second, and perhaps more importantly, the rank of unintended fertility rate across states is highly stable.

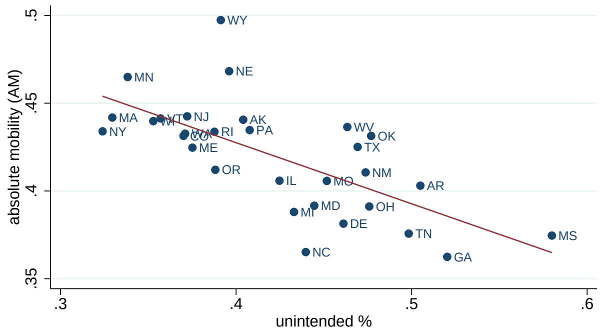


Figure 8: AM and Unintended %

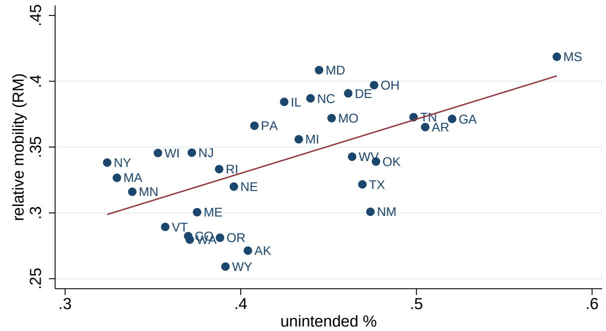


Figure 9: RM and Unintended %

using the distribution of parent family. We measure income within each CZ for parents in the core sample from Chetty et al. (2014) and then aggregate it to the state-level

High school drop-out rate Residual from a regression of the fraction of children who drop out of high school in the CZ, estimated using data from the NCES Common Core of Data for the 2000-2001 school year, on mean household income in 2000. We aggregate it to the state-level.

Social Capital Index Standardized index of social capital constructed by Rupasingha and Goetz (2008). It measures the strength of local norms and networks that facilitate collective action and efficient “round-about" means of production (Rupasingha and Goetz (2008)).

Fraction single mothers The fraction of children being raised by single mothers in each state measured using 2000 Census data.

Table 4 reports the ordinary least squares result by regressing AM and RM on the five controls and unintended birth rate. All dependent and independent variables are normalized to have unit standard deviations, so that we can interpret the coefficients as responses in mobility to a one-unit deviation in controls.

The first two columns replicate the regression specification in Table IV of Chetty et al. (2014). Since we only have observations for 28 states, some of the coefficients are not statistically significant. But the correlation between these controls and mobility are in line with the commuting-zone level results. Column (3) and (4) adds unintended birth rate as an additional predictor. As can be seen, unintended birth rates is highly correlated with mobility even after controlling for the five factors. In particular, unintended birth rate is statistically significant even after controlling for the fraction of single mothers which also measures family structures. A one standard deviation increase in unintended birth rate is correlated with a 0.638 standard deviation drop in AM and a 0.588 standard deviation increase in RM. The last two columns drop fraction of single moms and the predictive power of unintended birth rate becomes even stronger.

	(1) AM	(2) RM	(3) AM	(4) RM	(5) AM	(6) RM
Fraction short commute	0.276	-0.337*	0.497**	-0.540***	0.543***	-0.597***
Gini bottom 99%	-0.351	0.796*	0.255	0.238	0.084	0.449
High school dropout rate	0.009	0.070	-0.001	0.079	-0.003	0.082
Social capital index	-0.075	0.853**	0.068	0.721**	0.025	0.775**
Fraction single mom	-0.384	0.441*	-0.278	0.343*		
Unintended birth rate			-0.638**	0.588**	-0.698***	0.661**
Observations	28	28	28	28	28	28

Standardized beta coefficients

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Correlates of Intergenerational Mobility

Like other control variables, the unintended birth rate is an endogenously determined object. We cannot make causal statements or policy counterfactuals using regression results in Table 4. Therefore, we proceed to a structural model with endogenous choice of family planning, unintended birth and intergenerational mobility in the next section.

3 Model and Calibration

3.1 Basic Becker-Tomes Model

We first present the basic Becker-Tomes model with log utilities discussed in Lee and Seshadri (2019) to highlight sources of intergenerational persistence of income.

Consider a two-period overlapping generation model where individuals spend the first period as child and the second period as a parent.[5] Children live with their parent in the first period and do not make any choices until they become a parent themselves. Parents are heterogeneous by lifetime income h, they choose consumption c and investments into child's human capital e to maximize:

$$\max_{c,e\geq 0} \log(c) + \theta \log(\mathbb{E}_{\epsilon} h')$$

where θ governs parent's altruism towards children's income. The budget constraint is given by:

$$c + e = h$$

The model imposes an *intergenerational borrowing constraint* which prevents parent from using the child's future income to finance the parents' consumption or the child's education.

[5]Here we assume that each family is composed of one parent and one child for simplicity.

Child human capital production function is assumed to take the form:

$$h' = Z \cdot \epsilon \cdot h^{\rho} \cdot e^{\gamma} \tag{1}$$

In (1), h' denotes children's income when they becomes a parent; Z is a scaling parameter; ϵ is an idiosyncratic shock that is assumed to take lognormal distribution, i.e. $\log(\epsilon) \sim \mathcal{N}(0, \sigma_\epsilon^2)$; ρ is a parameter governing the direction transmission of economic status from parent to children, and γ is the productivity of child investments.[6] Note that ρ should be interpreted broadly beyond inheritance of biological traits. Rather, it should be viewed as a residual term that captures various factors, such as within-family interactions, segregation and so on, that shape intergenerational persistence besides the economic channel captured by investments e.

In this simple maximization problem, we have optimal child investment:

$$e^* = \frac{\theta\gamma}{1+\theta\gamma} \cdot h$$

which means the expected child human capital $\mathbb{E}_\epsilon h'$ can be written as

$$\mathbb{E}_\epsilon h' = Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^{\gamma} \cdot h^{\rho+\gamma} \tag{2}$$

Therefore, when we calculate the intergenerational elasticity of earnings (ige) in this basic Becker-Tomes model, we have

$$\text{ige}_{bt} \equiv \frac{d \log \mathbb{E}_\epsilon h'}{d \log h} = \rho + \gamma \tag{3}$$

After the dispersion of idiosyncratic shock σ_ϵ is chosen, we can also generate intergenerational mobility measured in AM and RM. In fact, with $\rho + \gamma < 1$, we can characterize the stationary distribution of income in this economy in closed form. Similar to the exercise in Benabou (2002), we have $\log(h) \sim \mathcal{N}\left(\frac{\log(\overline{Z})-\sigma^2/2}{1-(\rho+\gamma)}, \frac{\sigma_\epsilon^2}{1-(\rho+\gamma)^2}\right)$ where $\overline{Z} = Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^{\gamma}$.

3.2 Incorporating Costly Family Planning

Consider an extension of the standard Becker-Tomes model where adult individuals make dynamic decisions in two sub-periods which we denote period 1 and period 2. We will make the assumption that individuals have one child over her lifetime, but whether the birth occurs in period

[6] Instead of direct transmission through h^ρ, another formulation of the Becker-Tomes model (see Solon (2014)) interprets ϵ as innate ability and assumes it is persistent across generations following: $\epsilon_i = \delta + \rho\epsilon_{i-1} + v_i$ with white noise v_i. As a result, one needs to correct for the serial correlation in ability ϵ when estimating the intergenerational persistence of income and will obtain $\text{ige}_{bt} = \frac{\rho+\gamma}{1+\rho\gamma}$. Here, we do not need to make the adjustment given the assumption that ϵ is white noise and the direct transmission acts through the term h^ρ.

1 or period 2 depends on the contraceptive adoption choice made by the agents.[7] Before period 1 starts, agents choose units of contraceptive adoption κ which determines $p(\kappa)$, the probability of having the child in period 1. Function $p(\kappa)$ is the technology that transforms contraceptive choice units κ into birth probabilities. With probability $1 - p(\kappa)$, the birth will take place in period 2. We assume that each agent receives an idiosyncratic taste shock for early birth ι with distribution $F(\iota)$. We will present the determination of κ after discussing the agent's consumption and education investment problem with child below.

Agents receive income h in the period 1, i.e. when agents first enter the labor market.[8] If the birth does not occur in period 1, agents will receive $(1 + \lambda_h) \cdot h$ as income in period 2. Here, we use λ_h to capture the growth of income from early 20s to 30s. We make income growth λ_h exogenous and vary it by h to capture observed differences in the age-income profile by education. On the other hand, if the birth occurs in period 1, agents suffer a human capital depreciation and receives $(1 - \delta_h)(1 + \lambda_h) \cdot h$. We allow the career costs of children δ_h to differ by education following evidence from Miller (2011) and Adda et al. (2017).

Besides the intergenerational borrowing constraints as in the standard Becker-Tomes model, we assume in addition that there is an *intertemporal borrowing constraint* that prevents agents from borrowing from period 2 income to finance expenditures in period 1. Therefore, birth timing would affect child's human capital since agents are restricted to use resources on hand to finance both consumption and child investments.

3.2.1 Consumption-Investment Problem

If birth of the child occurs in period 1, the individual's maximization problem is given by:

$$\begin{aligned} V_1(h) \equiv \max_{c_1, c_2, e \geq 0} \; & \log(c_1) + \log(c_2) + \theta \log(\mathbb{E}_\epsilon h') \\ & c_1 + e = h \\ & c_2 = (1 - \delta_h)(1 + \lambda_h) \cdot h \\ & h' = Z \cdot \epsilon \cdot h^\rho \cdot e^\gamma \end{aligned} \tag{V1}$$

where c_1 and c_2 denotes consumption in period 1 and 2 respectively. Other variables follows the definition in the standard Becker-Tomes model. We use V_1 to denote the maximized utility (value) of this problem.

[7] By assuming that agents only have one child, we are abstracting away from unwanted births and focusing on mistimed births. We make this assumption for simplicity of exposition. This assumption is likely going to make our results a lower bound since unwanted fertility have larger negative impacts on child's human capital than mistimed ones (Finer and Kost (2011). Mistimed births also accounts for the majority of unintended fertility in the data.

[8] We also use h as a proxy for education level.

If birth occurs in period 2, the individual's maximization problem is given by:

$$\begin{aligned} V_2(h) \equiv \max_{c_1, c_2, e \geq 0} & \log(c_1) + \log(c_2) + \theta \log(\mathbb{E}_\epsilon h') \\ & c_1 = h \\ & c_2 + e = (1 + \lambda_h) \cdot h \\ & h' = (1 + \omega) \cdot Z \cdot \epsilon \cdot h^\rho \cdot e^\gamma \end{aligned} \tag{V2}$$

We allow for the possibility that children born in period 2 receives a direct boost in their human capital governed by parameter ω. This captures the effects of birth timing on children's human capital beyond investment channel such as a more stable family structure or more emotional maturity (Miller (2009). We use V_2 to denote the maximized utility (value) of this problem.

The optimal child investments, depending on the birth timing, are given by:

$$e_1^*(h) = \frac{\theta\gamma}{1 + \theta\gamma} \cdot h \qquad \text{less than} \qquad e_2^*(h) = \frac{\theta\gamma}{1 + \theta\gamma}(1 + \lambda_h)h$$

We define $\Delta(h)$ as the difference between $V_2(h)$ and $V_1(h)$:

$$\Delta(h) \equiv V_2(h) - V_1(h) = \underbrace{-\log(1 - \delta_h)}_{\text{career costs}} + \underbrace{\theta}_{\text{altruism}} \left(\underbrace{\gamma \log(1 + \lambda_h)}_{\text{higher investment}} + \underbrace{\log(1 + \omega)}_{\text{direct boost}} \right) > 0 \tag{4}$$

The first term captures the career costs of giving birth in period 1 on parent's consumption. The second and third term represent the effects on child's human capital which is valued by the parent with altruistic weight θ. Since $\Delta(h) > 0$, if a women does not have a strong enough taste shock ι for having child in period 1, she would prefer to delay the birth to period 2 since it is good both for her own career and also for the child's human capital development.

An important point to note here is that since both income growth λ_h and career costs of children δ_h are increasing in education h (Miller (2011) and Adda et al. (2017)), we can show that $\Delta(h)$ is also increasing in h. In other words, women with higher education have higher returns to delaying birth timing. This gives a demand-side rationale for why we observe the positive correlation between contraceptive use consistency and education in Section 2.1.3.

For given education of parent - h, the model also gives a formula for the effects of birth delay on child human capital. If we use $h_1'(h)$ and $h_2'(h)$ to denote the human capital conditional birth timing and parent's human capital h, we have:

$$\log\left(\frac{\mathbb{E}_\epsilon h_2'(h)}{\mathbb{E}_\epsilon h_1'(h)}\right) = \underbrace{\log(1 + \omega)}_{\text{direct boost}} + \underbrace{\gamma \log(1 + \lambda_h)}_{\text{higher investment}} \tag{5}$$

This equation will be used later to calibrate the direct boost parameter ω.

3.2.2 Family-Planning Problem

With $V_1(h)$ and $V_2(h)$ defined, now we present the contraceptive choice problem. Before period 1 starts, agents solve:

$$\max_{\kappa \geq 0} p(\kappa)(V_1(h) + \iota) + (1 - p(\kappa))V_2(h) - \chi_h \cdot \kappa \tag{κ}$$

We assume that each unit of contraceptive adoption entails utility costs χ_h.[9] The utility costs encapsulates possible frictions such as misinformation, disagreements between partners and access to family planning services. With ample evidence presented in Section 2.1.3, we allow the cost χ_h to be different by adult's human capital. In the calibration section, we will discuss how the data would allow us to identify χ_h.

The first-order condition compares marginal benefits and costs of using contraceptives:

$$\underbrace{-p'(\kappa) \cdot (\Delta(h) - \iota)}_{\text{marginal benefits}} \leq \underbrace{\chi_h}_{\text{marginal costs}}$$

which gives the optimal level of contraceptive use:

$$\kappa^*(h, \iota) = \begin{cases} 0 & \iota \geq \Delta(h) \\ p'^{-1}\left(\frac{\chi_h}{\iota - \Delta(h)}\right) & \iota < \Delta(h) \end{cases} \tag{6}$$

Lastly, we define unintended fertility in a way that is most consistent with the definition of mistimed ones in the NSFG survey questionnaire. Individuals compare the utility of having a birth in period 1 and period 2. If she would prefer the births to occur in period 2 and yet the birth realizes in period 1, we would categorize that as unintended births.[10] Define unintended fertility rate by human capital of adults:

$$\eta(h) \equiv \int \underbrace{p(\kappa^*(h, \iota)}_{\text{births in period 1}} \cdot \underbrace{\mathbb{1}(\Delta(h) > \iota)}_{\text{prefers to delay}} \, dF(\iota) \tag{7}$$

In this simple model, there are three why observed consistent contraceptive use is increasing in

[9]We assume that contraceptive use κ carries utility cost instead of financial costs since past research suggests that financial barriers are not the main reasons for people not using contraceptives consistently (see Sawhill et al. (2010) and Frost et al. (2008).

[10]This model interprets contraceptive use and unintended fertility within a rational agent's framework following . We are aware that there are alternative interpretations which might lead to different policy recommendations.

education:

1. Income growth rate λ_h is increasing in education h. This gives agents more reason to postpone the birth to period 2 so that she could invest more in the child.
2. Career costs of children δ_h are higher for more educated women. This makes it more costly for highly-educated women to have an early birth, hence prompting them to adopt contraceptives more consistently.
3. Costs of contraceptives χ_h are decreasing in education h. This captures various reasons such as misinformation and insurance coverage.

3.2.3 Intergenerational Mobility in the Family-Planning Model

Define $\overline{p}(h)$ as the fraction of mothers giving birth in period 1 by human capital h,

$$\overline{p}(h) = \int p(\kappa^*(h, \iota)\, dF(\iota)$$

In the economy with costly family planning, we can write expected child human capital $\mathbb{E}_\epsilon h'$ as:

$$\mathbb{E}_\epsilon h' = Z \cdot h^\rho \underbrace{\left(\overline{p}(h)(e_1^*(h))^\gamma + (1-\overline{p}(h))(1+\omega)(e_2^*(h))^\gamma\right)}_{\text{average investment}} \tag{8}$$

Plugging in $e_1^*(h)$ and $e_2^*(h)$, we obtain:

$$\mathbb{E}_\epsilon h' = \underbrace{Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^\gamma \cdot h^{\rho+\gamma}}_{\text{standard Becker-Tomes}} \cdot \underbrace{\left(\overline{p}(h) + (1-\overline{p}(h))(1+\omega)(1+\lambda_h)^\gamma\right)}_{\text{additional term}} \tag{9}$$

If we compare it with equation (2), we find that it contains an additional term that summarizes the effects of costly family planning on intergenerational mobility. Note that if this additional term is increasing in h (which is the empirically relevant case in the calibration), then when we try to find intergenerational elasticity of earnings with family planning, ige_{fp}, by computing $\frac{d\log(\mathbb{E}_\epsilon h')}{d\log h}$, we would get an answer that is higher than $\text{ige}_{bt} = \rho+\gamma$. Conditional on the dispersion of idiosyncratic ability shock σ_ϵ, the relative mobility in this economy would also be higher, i.e. $\text{RM}_{fp} > \text{RM}_{bt}$. The presence of costly family planning propagates the intergenerational persistence of income through its heterogeneous effects on child human capital across parents.

It is important to note here that it is the *differences* in income growth, career costs of children and costs of family planning across parents that is causing the additional source of intergenerational persistence. If λ_h, δ_h and χ_h are all positive but constant in h, then conditional on ι, agents will make the same family planning choices and it leads to the same social mobility as in the standard

Becker-Tomes model. This is intuitive since the notion of mobility and inequality is inherently about differences not levels. Therefore while reducing levels of contraceptive costs χ_h equally for everyone could increase aggregate output and boost growth (Cavalcanti et al. (2020)), the government needs to reduce the *gaps* in family planning costs if the goal is to increase mobility.

3.3 Calibration

We first choose the parameters such that in the standard Becker-Tomes model, we have $\text{RM}_{bt} = 0.34$ as in Chetty et al. (2014). Then we inspect how relative mobility changes when we hold these parameters unchanged but add the features of the costly planning model discussed in Section 3.2.2.

To calibrate the standard Becker-Tomes model, we choose the direct transmission parameter ρ, degrees of altruism θ, productivity of education investment γ, dispersion of idiosyncratic shock σ_ϵ and productivity in the child human capital production Z.[11] Out of these five parameters, we set $\theta = 0.30$ exogenously following Lee and Seshadri (2019) and the rest will be calibrated using the method of simulated moments.

Since all parameters affect the stationary distribution of the economy, they need to be calibrated jointly. But there are certain moments of the data that are particularly informative about some parameters. The intuition for identification is as follows: parameter Z is a scaling parameter for the aggregate economy. We calibrate Z so that the average income in the economy is one. We calibrate γ to match the expenditure share in child human capital investments calculated using data from PSID.[12] Parameter σ_ϵ is calibrated to match the Gini coefficient in earnings since it directly shapes the dispersion of agents' income. Lastly, we calibrate ρ to obtain $\text{RM}_{bt} = 0.34$. The calibrated parameters are displayed in Table 5.

Parameter	Z	θ	γ	σ_ϵ	ρ
Value	1.82	0.30	0.16	0.75	0.24

Table 5: Becker-Tomes Model Parameters

The additional parameters in the costly family planning model include (1) the profile of income growth λ_h, career costs of children δ_h and costs of family planning χ_h, (2) the technology $p(\kappa)$ that transforms contraceptive use to probability of birth in period 1, (3) the direct boost to child human capital ω, and (4) the distribution that governs taste shock for early birth $F(\iota)$. We discuss the calibration strategy for these parameters one by one.

First of all, we use period 1 to denote the first six years that individuals enters labor market after completing education while period 2 stands for the rest of their fertile years. We assume the gap

[11] Alternatively, Z could be interpreted as wage paid to efficiency units of human capital.
[12] We follow the procedures described in Section III.B of Lee and Seshadri (2019) to calculate this moment.

between births in period 1 and period 2 to be four years, which is the average year that respondents say their pregnancies are mistimed (too soon) in NSFG.

Since we do not observe the complete profile of income growth or career costs of children, we make flexible parametric assumptions on λ_h and χ_h and pick the parameters so that their values at different levels of education (mapped to the corresponding average percentiles in the income distribution) equal to that calculated in the data. In other words, we assume:

$$x_h = x_a \cdot \frac{\exp(x_c \cdot h)}{x_b + \exp(x_c \cdot h)} \qquad x \in \{\lambda, \delta\}$$

where $\lim_{h\to\infty} x_h = x_a$, $\lim_{h\to 0} x_h = \frac{x_a}{1+x_b}$ and x_c governs the speed that x_h changes w.r.t. h. We choose $\{\lambda_a, \lambda_b, \lambda_c\}$ to match income growth by education using moments calculated from the Current Population Survey 2010-2019. We take estimates from Miller (2011) to inform us the values of $\{\delta_a, \delta_b, \delta_c\}$ where a one-year delay is estimated to result in a 9% increase in earnings and larger for women with higher education.

We assume the unit costs of family planning takes the form:

$$\chi_h = \chi_a + \chi_b \cdot \frac{2\exp(-\chi_c \cdot h)}{1 + \exp(-\chi_c \cdot b)}$$

so that $\lim_{h\to 0} \chi_h = \chi_a + \chi_b$, $\lim_{h\to\infty} \chi_h = \chi_a$, and χ_c governs the speed that χ_h changes w.r.t. h. Since costs of family planning directly affect the choice of κ and hence unintended fertility, we calibrate $\{\chi_a, \chi_b, \chi_c\}$ to match unintended birth rates by education. In other words, we can interpret the unobservable family planning costs χ_h as the residual term needed to match unintended fertility rates after taking into account calibrated λ_h and δ_h.

We specify the contraceptive technology as:

$$p(\kappa) = p_a + p_b \cdot \frac{2\exp(-p_c \cdot h)}{1 + \exp(-p_c \cdot h)}$$

so that $\lim_{\kappa\to 0} = p_a + p_b$ gives the birth probability with no contraceptive use at all. $\lim_{\kappa\to\infty} = p_a$ gives the contraceptive failure rate which we set to match the typical use failure rate of combined oral contraceptives (CDC). We can normalize $p_c \equiv 1$ so that the scale of contraceptive use κ is pinned down by parameters in χ_h.

We use equation (5) and the estimates from Miller (2009) to calibrate ω. Miller (2009) estimates that a year of motherhood delay leads to an improvement of test scores that is equivalent to 10 percent of the test score[13] differences between children of college graduates and those of high school dropouts. Therefore, the direct boost ω will be the residual after taking out the effects through higher

[13]We make the simplifying assumption here that test scores are measuring human capital.

investments channel $\gamma \log(1+\lambda_h)$.

Lastly, we assume that the distribution of idiosyncratic taste for early birth ι is normally distributed with mean μ_ι and standard deviation σ_ι. We calibrate $\{\mu_\iota, \sigma_\iota\}$ to match the share of women having their first child in period 1 (i.e. six years into the labor market) by education.

3.4 Calibration Results

The calibrated parameters are presented in Table 6.[14] To explain high unintended birth rates among women with low human capital, the model predicts that the costs of family planning could be as high as 6.5% of consumption equivalent under log utility. For agents with high human capital, the calibration result attributes most unintended fertility to contraceptive failures rather than costs of adoption since χ_a is close to zero. Moreover, the direct boost to children human capital due to birth timing (ω) is calibrated to be 22%. Delayed birth timing offers additional benefits to child human capital formation beyond the more abundant financial resources available to parent(s).

Costs of family planning		Income growth	
χ_a	0.001	λ_a	1.48
χ_b	0.065	λ_b	3.92
χ_c	0.71	λ_c	1.50
Career costs of children		**Contraceptive technology**	
δ_a	0.35	p_a	0.07
δ_b	2.50	p_b	0.85
δ_c	1.20		
Direct boost to h'		**Taste for early birth**	
ω	0.22	μ_ι	0.045
		σ_ι	0.145

Table 6: Family-Planning Model Parameters

Figure 10 compares mobility in the family-planning model with that in the standard Becker-Tomes framework. As we can see, the rank-rank relationship rotates counter-clockwise indicating lower mobility. More specifically, relative mobility increases from $\text{RM}_{bt} = 0.34$ to $\text{RM}_{fp} = 0.43$ and absolute mobility reduces from $\text{AM}_{bt} = 0.42$ to $\text{AM}_{fp} = 0.39$. We can scale these changes by the standard deviation of mobility across states to give a better understanding of its scale. Using data from Chetty et al. (2014), the increase in RM is more than two standard deviations while the de-

[14]The intuition for identification is discussed in the previous section. We have the same number of data moments and model parameters. Hence these moments are exactly matched.

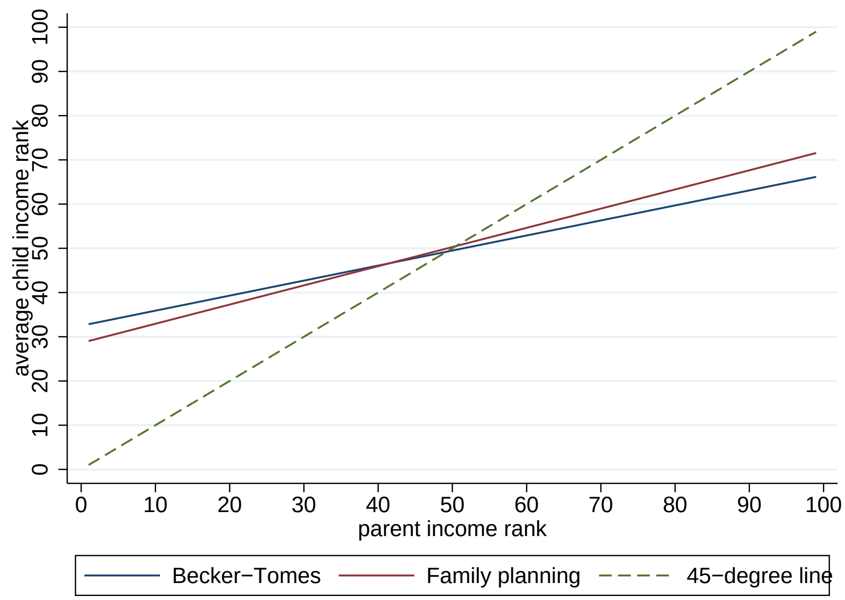


Figure 10: Comparing Mobility

crease in AM is slightly more than one standard deviation. As the model predicts, intergenerational elasticity of earnings is also much higher with costly family planning: $\text{ige}_{fp} = 0.48 > \text{ige}_{bt} = 0.40$.

The Gini coefficient is higher in the stationary income distribution with costly family planning: $\text{Gini}_{fp} = 0.45 > \text{Gini}_{bt} = 0.42$. As intergenerational persistence increases, the stationary distribution is able to sustain thicker tails for given ability shock dispersion σ_ϵ.

3.5 Decomposition

As discussed in previous sections, the propagation mechanism in the family-planning model is caused by *differences* in income growth λ_h, career costs of children δ_h and costs of family planning χ_h. In this section we discuss the decomposition of factors contributing to disparities in family planning adoption, unintended fertility rate and hence the additional intergenerational persistence of income.

We conduct the decomposition by starting from the family planning model and set λ_h, δ_h and χ_h to be at its population average. When there is no heterogeneities across h, the family planning model collapses to the standard Becker-Tomes framework. By allowing for heterogeneities in δ_h, λ_h and χ_h one step at a time to obtain the full family-planning model, we record the contribution of each feature.[15]

[15]Like many decompositions, our results here will depend on the order that we add these factors. When we experiment with different orders, the quantitative results do not vary much.

	ige	RM	AM
standard Becker-Tomes	0.40	0.34	0.42
+ heterogeneous δ_h	+0.027	+0.027	-0.009
+ heterogeneous λ_h	+0.029	+0.032	-0.008
+ heterogeneous χ_h	+0.021	+0.033	-0.009
= family-planning model	0.478	0.434	0.39

Table 7: Decomposition of Additional Persistence

Table 7 presents the decomposition results. Three factors contribute roughly equally to the additional persistence relative to the standard Becker-Tomes model. The results indicate that gaps in family planning and unintended fertility reflect not only discrepancies in access to family services (χ_h) but also different returns to family planning adoption due to lifetime income growth (λ_h) and career costs of children (δ_h).

4 Policy Counterfactuals

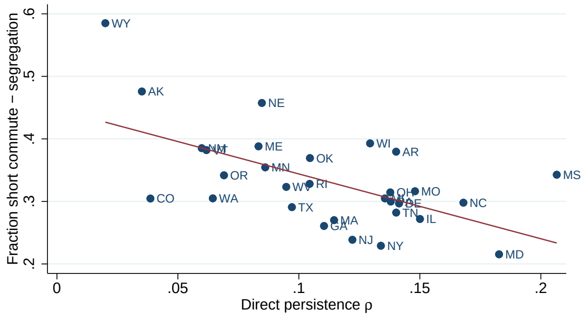
The additional intergenerational persistence presented in the previous section is likely going to be an upper bound for policies that aim to improve access to family planning services since we are switching from an environment with positive and heterogeneous costs to an environment where these costs are reduced completely to zero. Therefore we conduct two counterfactuals to provide policy makers with cost-benefit analysis under realistic policy goals. Before computing the counterfactuals, we conduct two calibrations.

First, since we think the family-planning model is the data-generating-process (DGP) governing patterns in intergenerational mobility and unintended fertility simultaneously, we recalibrate the family-planning model so that it generates the intergenerational mobility and inequality observed in the data. We hold all parameters in Table 5 and 6 unchanged except for ρ and σ_ϵ since both are residuals parameters to explain intergenerational persistence and inequality.[16] This gives us $\rho = 0.135$ and $\sigma_\epsilon = 0.736$. We calculate the new stationary distribution, denoted $G^*(h)$, and use it as the invariant national income distribution to benchmark state-level mobility measures in the second calibration as well as in counterfactuals.

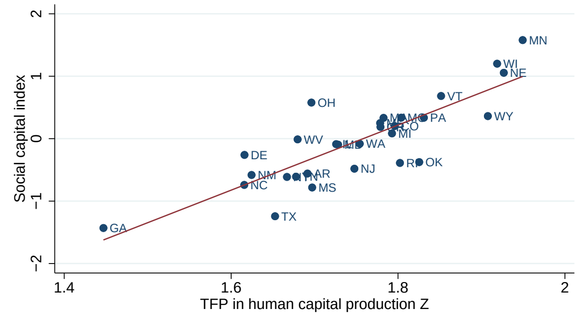
Second, for each U.S. state i, we vary $\{Z^i, \rho^i, \sigma^i_\epsilon, \chi^i_b, \chi^i_c\}$ to match $\{\text{AM}_i, \text{RM}_i, \text{Gini}_i\}$ and the unintended fertility profile by education in state i.[17] This calibration is similar to a development

[16]Similar to the notion of total factor productivity in development accounting, ρ and σ_ϵ here are "measures of ignorance" (Hulten (2000)).

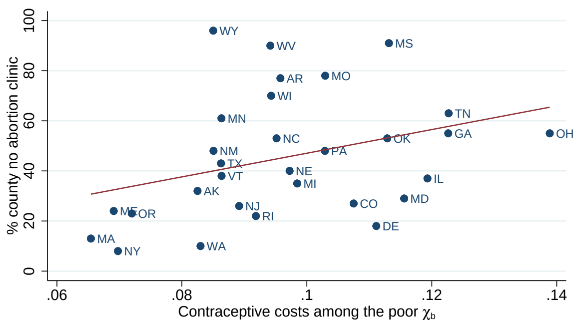
[17]For each state i, we compute its stationary distribution $G^i(h)$ and obtain $\{\text{AM}_i, \text{RM}_i\}$ by plotting the rank-rank relationship between parents' and children's income rank against the national distribution $G^*(h)$ following the definition of these variables in Chetty et al. (2014).



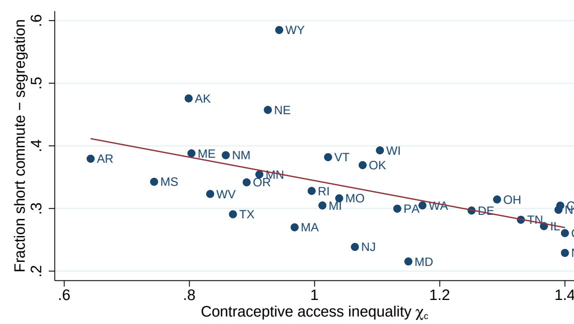
(a) Correlates with ρ^i



(b) Correlates with Z^i



(c) Correlates with χ_b^i



(d) Correlates with χ_c^i

Figure 11: Correlations with State-Specific Parameters

accounting exercise since we are attributing differences across states to fundamentals including costs of family planning. Allowing these parameters, especially ρ, to vary across states is necessary to explain geographical differences in mobility.

Figure 11 plots correlations between the calibrated state-specific parameters with control variables in Chetty et al. (2014) and information on public provision of family planning services obtained from the Guttmacher Institute. In Figure 11a and 11d, we find that “fraction short commute", a measure of residential segregation in Chetty et al. (2014), is highly correlated with the direct persistence ρ and the gradient of contraceptive cost with respect agents' human capital χ_c. Figure 11b shows that social capital index constructed by Rupasingha and Goetz (2008) is positively correlated with productivities in forming children's human capital at the state level Z. Lastly, Figure 11c shows that in states where the model predicts to have higher costs of family planning services among the poor, χ_b, we observe a larger percentage of women living in a county without an abortion clinic. These plots indicate that these state-level parameters generated in the calibration have some empirical content.

In the first counterfactual, we hold $\{Z^i, \rho^i, \sigma_\epsilon^i\}$ unchanged for each state, and reduce the contraceptive costs χ_b^i and inequality in access χ_c^i to the minimum level across all states, i.e.:

$$\chi_b^i = \min_j \chi_b^j, \quad \chi_c^i = \min_j \chi_c^j, \qquad \forall i$$

As indicated in Figure 11c and 11d, this entails larger government interventions in states with high initial χ_b^i and χ_c^i such as Georgia or Ohio, and lower efforts in states such as Massachusetts, Oregon or Maine. We record how absolute AM, RM, and the Gini coefficient improve relative to the benchmark and normalize the changes by the corresponding standard deviation across states.

Figure 12, 13, and 14 plot the changes for each state under the first counterfactual. Figure 12 shows that the majority of the states see an increase in absolute upward mobility with the average being 0.22 standard deviations. Figure 13 shows that all the states sees a decrease in relative mobility that is on average 0.42 standard deviations. Lastly, Figure 14 indicates that improving family planning access also reduces inequality by 0.14 standard deviations on average. These improvements are larger in states with high initial (calibrated) costs of family planning such as Georgia or Ohio.

In the second counterfactual, we hold $\{Z^i, \rho^i, \sigma_\epsilon^i, \chi_c^i\}$ unchanged for each state, and reduce the contraceptive costs χ_b^i by one-third for each state. This would reduce the overall level of unintended fertility rate to that observed in Western European countries. This counterfactual requires a similar amount of improvement across states, if not more effort by states with initially low χ_b^i.

Figure 15, 16, and 17 plot the changes for each state under the second counterfactual. We see that the improvements in AM, RM, and the Gini coefficient are similar and sizable across all states. By cutting χ_b^i by one-third for each state, the model predicts that mobility will improve by 0.4 standard deviations on average, and inequality decreases by 0.39 standard deviations on average.

In practice, reducing family planning costs χ_h amounts to addressing various frictions discussed in Section 2. For instance, the government could encourage the use of contraceptives via mass media and social-marketing campaigns, reduce misinformation through sex education programs and extend accessible family planning services to all women of childbearing age regardless of her insurance status (e.g. expanding eligibility and coverage of Medicaid and Title X).[18]

5 Black-White Mobility Gap

Using anonymized longitudinal data covering nearly the entire U.S. population from 1989 to 2015, Chetty et al. (2020) uncovers the large black-white gap in upward mobility between blacks and whites. Under the assumption that rates of mobility remain constant across generations, the

[18]See Sawhill et al. (2010). There has been a large literature in public health on the cost-benefit analysis of historical programs.

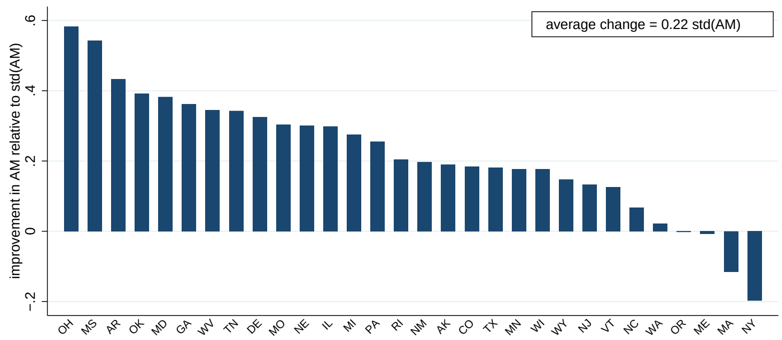


Figure 12: Improvement (increase) in AM under Counterfactual 1

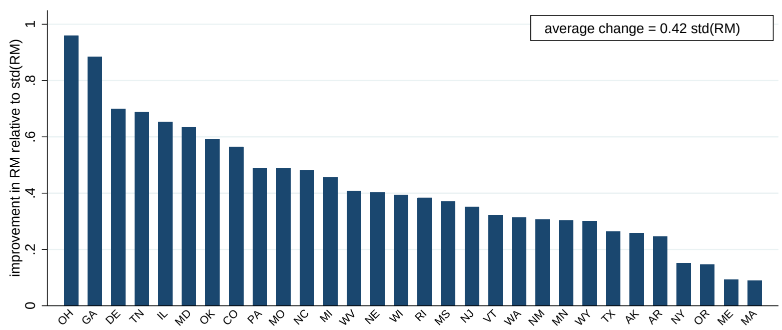


Figure 13: Improvement (decrease) in RM under Counterfactual 1

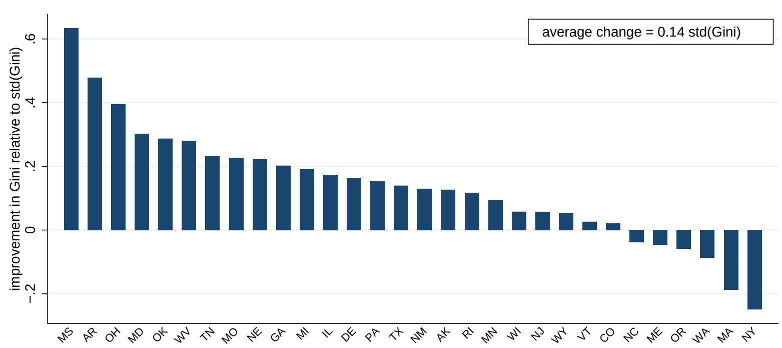


Figure 14: Improvement (decrease) in Gini under Counterfactual 1

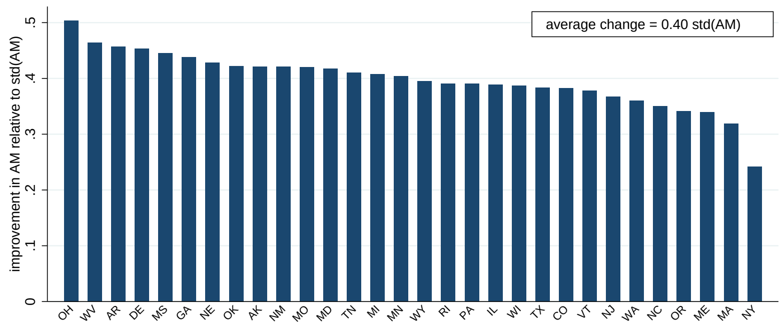


Figure 15: Improvement (increase) in AM under Counterfactual 2

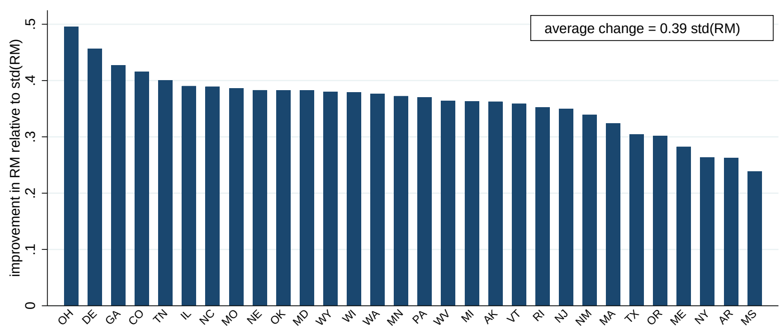


Figure 16: Improvement (decrease) in RM under Counterfactual 2

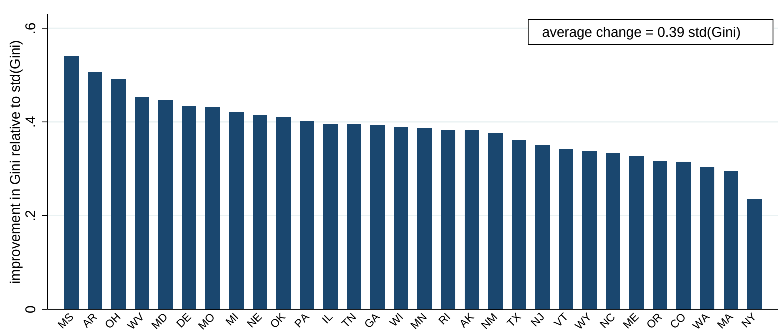


Figure 17: Improvement (decrease) in Gini under Counterfactual 2

observed black-white income gap is due almost entirely to differences in average child income rank *conditional on* parent income rank. Figure 18 displays their main finding where conditional on parent household income rank, the average child income rank of white families is roughly 12.5 points higher than the average child rank of black families.

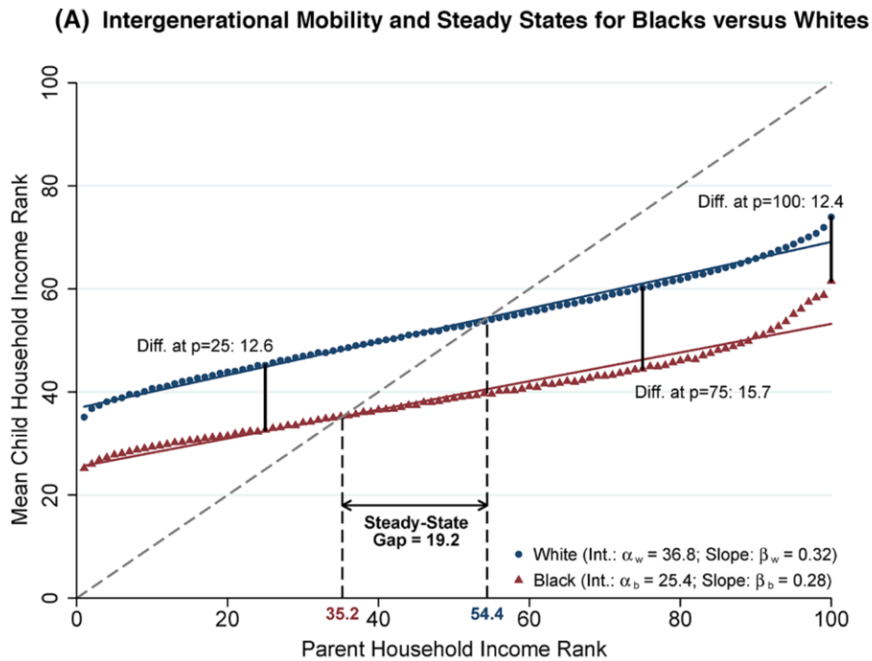


Figure 18: Black-White Gap in Intergenerational Mobility from Chetty et al. (2020)

We use our model of intergenerational mobility with costly family planning to shed light on how much of the black-white mobility gap can be explained by different access to family planning services alone. We argue that differences in family planning access by race could play a role in explaining the mobility gap since Figure 19 shows that unintended fertility rate is much higher among black women conditional on education. Potential factors contributing to disparities in family planning access by race include, but not limited to, geographical locations of abortion clinics and supply-side distortions where health care providers treat patients differently based on their race/ethnicity (see Dehlendorf et al. (2010)).

To obtain the sole effect of family planning access in explaining black-white mobility gaps, we keep the calibrated parameters in 6 to be the same across whites and blacks while only indexing the costs of family planning $\{\chi_a, \chi_b, \chi_c\}$ by race. Therefore, we calibrate $\{\chi_a^R, \chi_b^R, \chi_c^R\}$ where $R \in \{W, B\}$ (whites and blacks) so that the model generates unintended fertility by education and race in stationary distribution that matches the level we see in Figure 19. For each race, we compute mobility measures by simulating parent-child pairs and rank them under the national distribution $G^*(h)$ defined in the previous section.

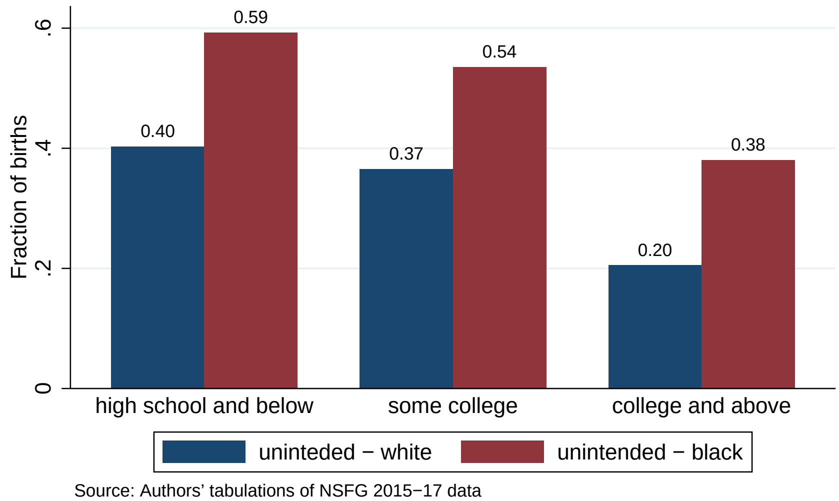


Figure 19: Black-White Gap in Unintended Birth Rates by Education

The calibration result is presented in Table 8. By comparing χ_b, we see that family planning is 60% more costly among black women with low income than that for white women. The cost decays more slowly for black women as their human capital rises ($\chi_c^B < \chi_c^W$). Even when we compare women with high human capital such as those with college degree, black women still faces higher family planning costs (χ_a^B is three times that of χ_a^W).

	χ_a	χ_b	χ_c
White	0.001	0.058	0.71
Black	0.003	0.092	0.44

Table 8: Family Planning Costs by Race

Figure 20 produces the counterpart to Figure 18 in the model where we only allow family planning costs to be different by race. With family planning costs for blacks being higher than whites, black women will conduct less family planning (c.f. Figure 4) and have higher unintended fertility rate. This results in a smaller investment in child human capital among black families even when the parents human capital is comparable to that of the whites. This generates a black-white gap in average child income rank. Differences in family planning costs alone can generate a mobility gap of 2.5, which is 20% of that observed in Chetty et al. (2020).[19] This implies that addressing disparities in family planning access by race could potentially be an effective policy to reduce black-white differences in upward mobility and income in the steady-state.

[19] A complete explanation of the black-white mobility gap using the model would entail quantifying differences in other parameters as well. In particular, differences in Z by race could capture gaps in neighborhood quality and payoffs

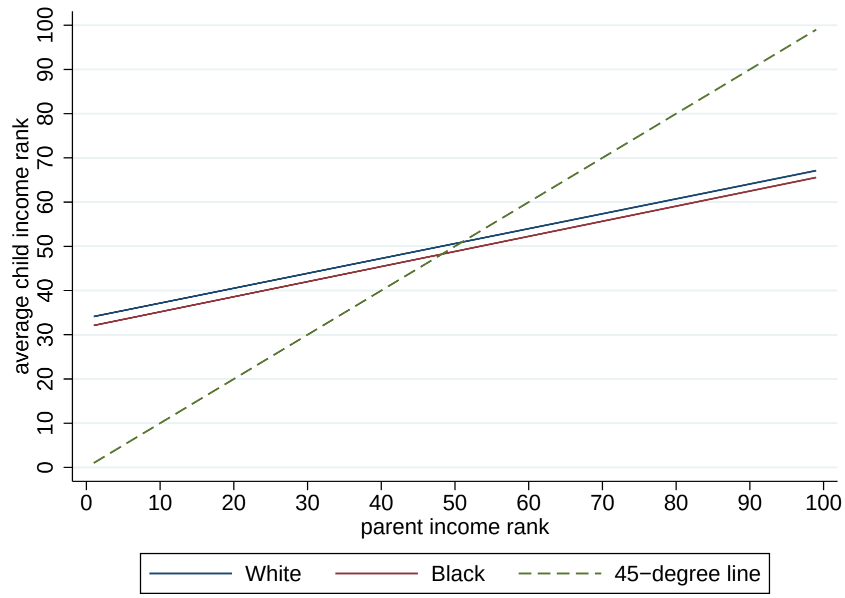


Figure 20: Black-white Gap in Intergenerational Mobility with Different Family Planning Costs

6 Conclusion

Nearly 40% of all live births in the United States are unintended. This phenomenon is disproportionately common among women with low socioeconomic status. Given that being born to unprepared parents significantly affects a child's development of human capital, a natural hypothesis is that differences in access to family planning services affects intergenerational persistence of economic status as well as income inequality.

We extend the standard Becker-Tomes model of intergenerational mobility with endogenous choice of contraceptive adoption. When the model is calibrated to match observed patterns of unintended fertility, we show that social mobility is significantly lower than that in the standard model. We attribute this reduction into differences in income growth, career costs of children and access to family planning services across education. A decomposition exercise shows that all three are quantitatively important.

In two counterfactuals where U.S. states improve the access to family planning services, intergenerational mobility could be improved by 0.4 standard deviations on average while income inequality is also reduced by 0.4 standard deviations on average. When we calibrate the model to match unintended fertility by race, we find that differences in family planning access alone can account for 20% of the black-white gap in upward mobility documented by Chetty et al. (2020).

United States has witnessed significant progress in reducing teenage pregnancy in the past few

to human capital in the labor market, i.e. racial discrimination.

decades (Kost and Henshaw (2014)). The institutional knowledge acquired in that process can be applied to promoting access to family planning services among women at their early 20s and those of disadvantaged socioeconomic backgrounds. For example, sex education programs geared toward adolescents, commonly known as “teen pregnancy prevention programs", could be extended to address the lack of knowledge about contraception among young adults (Sawhill et al. (2010)). The government could also use mass media programs to improve young women’s understanding of how unintended fertility affects the children’s outcomes and their own career. An example of such effect is the widely viewed MTV franchise “16 and Pregnant", which is shown by Kearney and Levine (2015) to reduce teen births by 4.3 percent.

Policies to reduce family planning costs are also achievable and scalable without dramatic changes since existing programs, such as Medicaid and Title X, provide the institutional infrastructures on which additional government efforts can be channeled to reach women in need.

To conclude, our analysis demonstrates that helping women fulfill their own goals about family planning and childbearing is a desirable policy that can have a substantial impact on socioeconomic mobility and address racial inequalities.

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