Intergenerational Mobility Begins Before Birth*

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Abstract

Nearly 40% of all live births in the United States are unintended, and this phenomenon is disproportionately common among black Americans and women with lower 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 an endogenous choice of family planning. 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 policy counterfactual where states improve access to family planning services for the poor, intergenerational mobility improves by 0.3 standard deviations on average. 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 and 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)). Most of the recent policy recommendations focus on helping disadvantaged children foster human capital in their early childhood through policies that relax parents' credit constraints or improve the quality of the neighborhood (Heckman and Mosso (2014), Daruich (2018), Chetty and Hendren (2018)).

While the literature on intergenerational mobility has recognized the significant impact of parents' socioeconomic conditions on children's future outcomes, little attention has been paid to the frictions 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 at the aggregate level?

In this paper, we use data from the National Survey of Family Growth (NSFG) to show 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 where the respondents think the conception was either "too soon, mistimed" or "unwanted." The phenomenon is much more common among black Americans and 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), Bailey (2013)), we argue that the presence of costly family planning amplifies the degree of intergenerational persistence that would otherwise prevail had mothers been able to control their fertility freely. Using restricted-access data from Pregnancy Risk Assessment Monitoring System (PRAMS), we provide suggestive 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 correlates discussed in the literature.

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

To study policy counterfactuals, we calibrate the model to match intergenerational mobility and profiles of unintended fertility across states. State-level parameters map closely to factors that are good predictors of mobility (e.g., residential segregation) as well as indices reflecting costs of access to family planning services. In the policy counterfactual, we reduce the costs of family planning access among the poor to the lowest level across all states. We find that absolute upward mobility (c.f. Chetty et al. (2014)) could be improved, on average, by 0.3 standard deviations across states. Alongside this increase in social mobility is a reduction in income inequality by 0.3 standard deviations on average.

We also use the calibrated model to shed light on how much of the racial gap in upward mobility can be explained by differences in access to family planning services. When we match the model to differences in unintended fertility by race, we find that black women face 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 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 in 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 intergenerational mobility and address racial inequalities without massive system changes.

The rest of the paper is organized as follows. In Section 2, we present empirical findings on unintended fertility and intergenerational mobility. Section 3 describes the model and calibration. Key results of the paper, including policy counterfactuals, are presented in Section 4. Section 5 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 for 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 because childbirth 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, given that the adoption of abortion procedures could also be viewed as a form of family planning. 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 and race. 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 unintended births is 42%. 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 a college degree and above. Lastly, unintended birth rates are much higher among black Americans than among whites. Even conditional on education, black women are almost 20% more likely to report having unintended birth than white women.

2.1.2 Frictions and Sources of Disparities in Family Planning

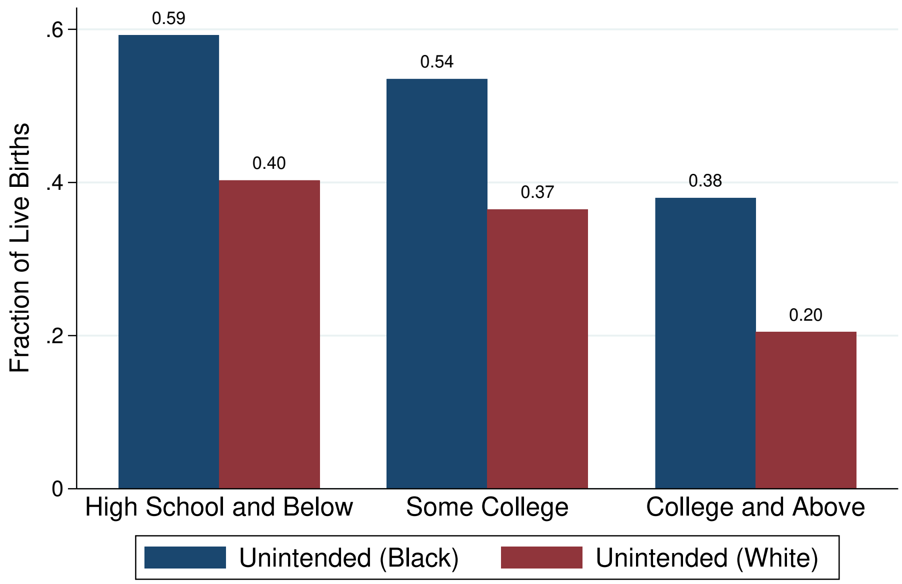
Since the invention of modern contraceptive technologies, especially the oral birth control pill, women have been empowered with a highly effective tool to conduct family planning (Goldin and Katz (2002), Bailey (2006)).[1] Therefore it might first come as a surprise to observe the high level of unintended birth rates presented in Figure 1. In this section, we use NSFG and the National Longitudinal Survey of Youth 1979 (NLSY79) to present patterns of contraceptive use and discuss some of the relevant factors.[2] This would help us to have a deeper understanding of the frictions that women face in family planning and also provide policymakers with a gateway to reduce unintended birth and increase social mobility.

Figure 2 shows the fraction of sexually active women who have consistently adopted contracep-

[1]In recent years, abortion pills, approved by the United States Food and Drug Association (FDA) in 2000, also provide an additional instrument to women with unintended pregnancy.

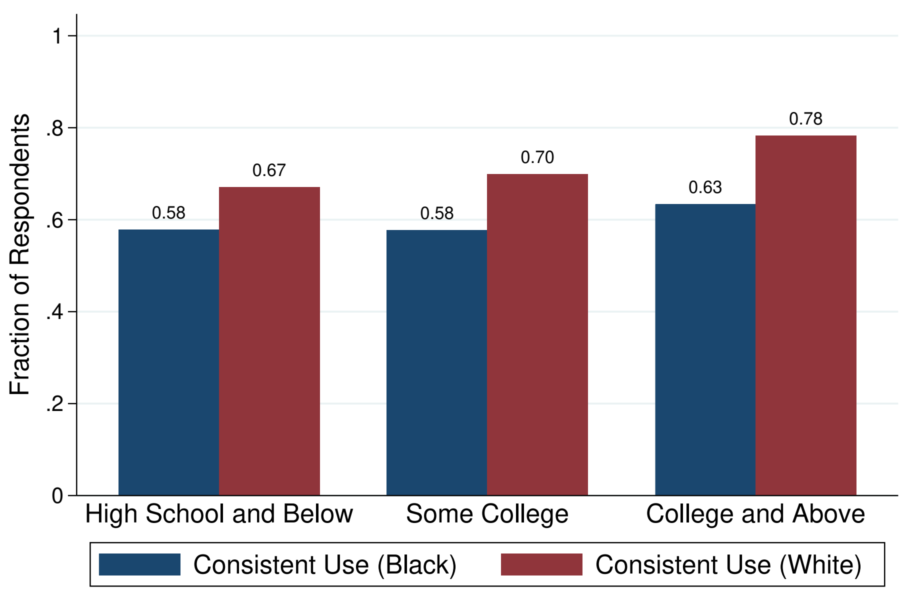
[2]One point worth noting is that women could report unintended fertility with and without consistent use of contraception. On the one hand, there are women who suffer from contraceptive failures despite consistent efforts in family planning. On the other hand, there are also women who did not consistently use contraceptives (or abortion) for various reasons but actually wanted to delay or avoid the birth.

Figure 1: Unintended Birth Rate by Education and Race



Notes: This figure plots the fraction of live births that are unintended by mother's education and race using data from NSFG wave 2015-2017.

Figure 2: Consistent Contraceptive Use by Education and Race



Notes: This figure plots the fraction of sexually active women that consistently use contraceptives in the year prior to the interview date by education and race using data from NSFG wave 2015-2017. We restrict the sample to the respondents who reported not wanting to have any more children in the future.

tives in the year before the interview *conditional on* indicating that they do not want any child in the future using data from the NSFG Female Respondent File. Like Figure 1, the statistics on contraceptive use reveal three findings. First, despite not wanting to have any more children, the level of consistent contraceptive adoption is far below 100%. Second, contraceptive use increases with education. Third, conditional on education, black women use contraceptives less consistently than white women. We also observe the same three patterns when we investigate whether the respondent had used any contraceptive methods between pregnancy intervals (or since the first intercourse) conditional on the following pregnancy was unintended.

As shown in Goldin and Katz (2002) and Bailey (2006), successful family planning offers various benefits to women in terms of human capital accumulation and career prospects. The statistics above, however, show that the adoption of family planning services is far from complete despite these benefits. Here, we briefly discuss the potential sources of family planning costs 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" (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. Using data from the National Survey of Family Growth (NSFG) and National Fertility Survey (NFS), Rosenzweig and Schultz (1989) uncover that more educated couples have a wider knowledge and are more efficient in using contraceptive methods. Shartzer et al. (2016) documents high degrees of misinformation towards highly effective long-acting, reversible contraceptive methods (LARC) 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 gap of 10 percentage points between respondents with and without a college degree. The next three rows indicate that the content of sex education courses is similar conditional on being taught.

Another contributing factor to contraceptive costs is disagreements between partners. Partners could have different bargaining power, fertility intention, or preferences over the usage of family planning. These could result in moral hazards in contraceptive use (Ashraf et al. (2014)) and affect

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

Table 1: Sex Education Ever Received

	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

Notes: This table displays the fraction of women respondents in NLSY79 who had ever attended a sexual education course, and if so, whether the course taught the effects of contraception and where to get contraceptives.

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 the education of female respondents. As can be seen, women with high school education or below report a 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.

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

		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

Notes: This table displays the fertility intentions of female respondents and their partners in NSFG by the respondents' education.

Financial costs of contraceptives and abortion also plays an important role. For instance, the National Campaign to Prevent Teen and Unplanned Pregnancy found that 17 percent of men and women aged eighteen to twenty-nine agree with the statement: "I/my partner would use better methods, but they cost too much" (Sawhill et al. (2010)). Using a randomized control trial, Bailey et al. (2021) find that women's choice of LARC are highly sensitive price, with the take-up elasticity ranging from -2.3 to -3.4.

In addition, Dehlendorf et al. (2010) discussed that access to family planning services and high-quality treatments from healthcare providers are important factors contributing to disparities in

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

		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

Notes: This table displays the fertility intentions of female respondents and their partners in NSFG by the respondents' race.

unintended fertility. Disadvantaged women are disproportionately uninsured in the United States (Ebrahim et al. (2009)). Women with no insurance coverage are 30% less likely to use prescription contraception (Culwell and Feinglass (2007)). Religion also plays a role in the provision of contraceptive services. For instance, Hill et al. (2019) showed that Catholic hospitals reduce the per bed rates of tubal ligation by 31%, which could increase the risk of unintended pregnancies.

Last, legal restrictions and state funding have a huge impact on family planning and abortion access. For instance, White et al. (2015) document that legislation changes in Texas resulted in a 25% closure of family planning clinics and 54% fewer clients served than that in previous periods. In the next section, we provide further discussions of the literature studying the effects of legislation and government programs.

This paper's goal is not to analyze the exact source and decompose the magnitude of those frictions discussed above. But the analyses clearly indicate that the cost of family planning could be sizable depending on an individual's education, race, and income. Moreover, these costs extend beyond the financial burden. Therefore, even though reducing out-of-pocket costs is an integral part of the solution to unintended fertility, the government can do more to improve access among disadvantaged women such as providing more sex education.

2.1.3 Consequences of Unintended Fertility

An important link between unintended fertility and intergenerational mobility is that the unpreparedness of mothers results in worse outcomes for the children. If unintended fertility only leads to a utility loss for mothers without affecting their children's human capital, heterogeneous exposures to unintended fertility do not necessarily lead to more persistence in economic status across generations. Yet if self-reported unintendedness reflects lack of financial resources, instability of the family structure, or other disadvantages when the child is young, 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. We broadly categorize them into "direct" evidence and "indirect" evidence.

The "direct" evidence literature uses individual-level data from those children who were reported to be unintended by their mothers. They are compared with children who have similar family backgrounds but are not unintended. Brown et al. (1995) presents 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. Mothers of unintended children are also at greater risk of depression, self-abuse, and suffering from a dissolution of relationships with their partners. 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."

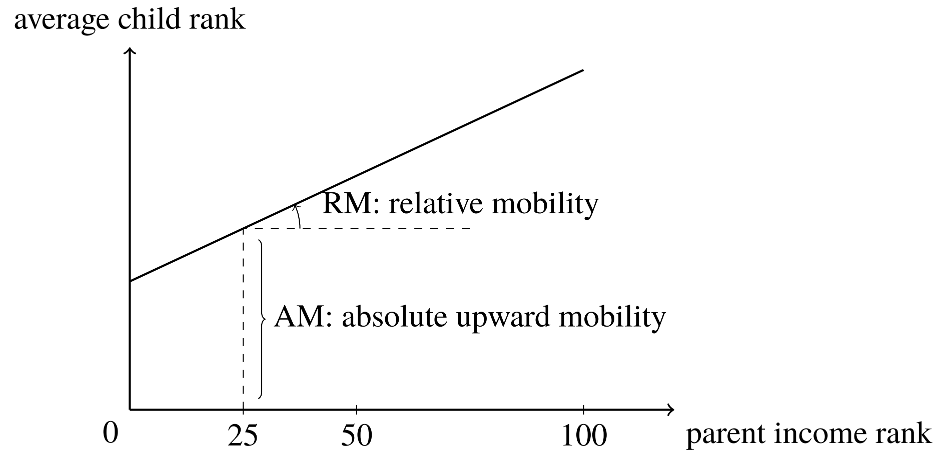
The "indirect" evidence literature uses historical events or policies that improved access to family planning services (e.g., expanded access to the Pill, Title X, and the War on Poverty) and compares mothers/children who were affected (treated) versus those who were not. Goldin and Katz (2002) and Bailey (2006) show that the legalization of the Pill and abortion in the 1960s and 1970s have resulted in women delaying births, getting more education, and earning more. Pop-Eleches (2006) finds that children born after a ban on abortions in Romania had worse educational and labor market achievements as adults after controlling for composition effects. Ananat and Hungerman (2012) show that access to oral contraceptives has negligible long-term effects on fertility. But better access increases the share of children with college-educated mothers and decreases the share with divorced mothers. Bailey (2013) finds suggestive evidence that individuals' access to contraceptives increased their children's college completion, labor force participation, wages, and family incomes decades later. Bailey et al. (2019) use the county-level introduction of U.S. family planning programs between 1964 and 1973. They find that children born after the programs had high family incomes, and the direct "resource effect", rather than changes in the composition of mothers, accounts for roughly two-thirds of these gains.

2.2 State-Level Evidence

In the previous section, we presented micro-level evidence on unintended fertility and contraceptive use. A natural question is whether these 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 3 illustrates the empirical content of these two measures. The horizontal axis plots parent 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 children whose parents' income rank being at the 25th percentile. Relative mobility (RM) measures the slope of the rank-rank relationship. Higher AM and lower RM means *larger* intergenerational mobility.

Figure 3: Measuring mobility



Notes: This figure illustrates the definition of absolute upward mobility (AM) and relative mobility (RM).

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 2008 to 2017 covering all contiguous 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.

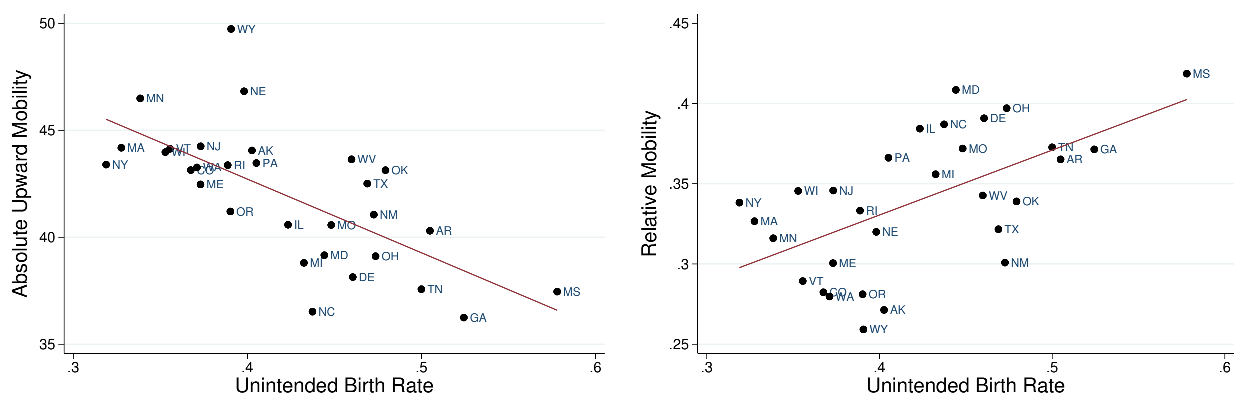
[4] We are extrapolating the level of unintended fertility rates in the 1980s, i.e., where children observed in Chetty et al. (2014) are born, using data from later years due to data limitations. We argue that this would not greatly harm our results for two reasons. First, with available data from 1990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

Figures 4a and 4b plots AM and RM against unintended birth rates across states. We find that states with higher unintended birth rates have lower AM and higher RM. Both figures show that the level of unintended fertility is negatively correlated with intergenerational mobility.

Figure 4: Correlation Between Intergenerational Mobility and Unintended Birth Rate

(a) AM and Unintended Birth Rate

(b) RM and Unintended Birth Rate



Notes: This figure plots measures of intergenerational mobility (AM and RM) against unintended fertility rate by state.

We further investigate the predictive power of unintended birth rates on AM and RM after controlling for the six factors that are the strongest predictors of mobility in Table VI of Chetty et al. (2014). These 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 using the distribution of parent family.

- (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.

- (Fraction black) The fraction of black population measured using 2000 Census data.

Table 4 reports the ordinary least squares (OLS) results by regressing AM and RM on the six controls and unintended birth rate. All dependent and independent variables are normalized to have a unit standard deviation 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). Because we only have observations for 28 states, some of the coefficients are not statistically significant. But the correlation between these controls and mobility is in line with the commuting-zone level results. Columns (3) and (4) add unintended birth rates as an additional predictor. As can be seen, unintended birth rates are highly correlated with mobility even after controlling for the six factors. A one standard deviation increase in unintended birth rate is correlated with a 0.59 standard deviation drop in AM and a 0.35 standard deviation increase in RM. The last two columns drop fraction of single moms, and the predictive power of unintended birth rate remains significant.

Table 4 displays two findings. First, unintended birth rates have a high predictive power of intergenerational mobility. Adding it to the regression increases the adjusted R^2 for AM (RM) by around 0.12 (0.04). Second, the correlation between intergenerational mobility and unintended birth rates is economically significant and is larger than almost all other correlates.

Table 4: Correlates of Intergenerational Mobility

	(1)	(2)	(3)	(4)	(5)	(6)
	AM	RM	AM	RM	AM	RM
Fraction short commute	0.276*	-0.337*	0.495**	-0.537**	0.541**	-0.593**
Gini bottom 99%	-0.351	0.796*	0.234	0.261	0.055	0.480
High school drop-out rate	0.009	0.070	0.004	0.074	0.002	0.077
Social capital index	-0.075	0.853**	0.054	0.735**	0.008	0.792**
Fraction single mothers	-0.384*	0.441*	-0.282*	0.347*		
Fraction black	-0.367	0.697**	-0.093	0.535**	-0.227	0.600**
Unintended birth rate			-0.591**	0.351*	-0.571**	0.342*
Adjusted R^2	0.556	0.747	0.678	0.785	0.666	0.789
N. of cases	28	28	28	28	28	28

Standardized beta coefficients. * p<0.1, * p<0.05, ** p<0.01

Notes: This table displays the coefficients of regressing measures of intergenerational mobility on common correlates in the literature and unintended birth rates. Both dependent and independent variables are normalized to have mean zero and unit standard deviation.

Like other control variables, the unintended birth rate is an endogenously determined object. Thus, we cannot make causal statements using regression results in Table 4. Moreover, because there is a lack of data that have repeated measures of intergenerational mobility at a granular level, we can not directly infer the causal impacts of family planning access using techniques from the "indirect evidence" literature discussed above. Therefore, in the next section, we construct and calibrate a structural model and use it to make predictions on policy counterfactuals.

3 The Model

3.1 Basic Becker-Tomes Model

We first present the basic Becker-Tomes model discussed in Lee and Seshadri (2019) to highlight sources of intergenerational persistence of income in a canonical setting without family planning.

Consider a two-period overlapping generation model where individual first lives as a child (period 0) and become a parent after one period (period 1).[5] Children live with their parents and do not make any choices until they become parents 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* that prevents the parent from using the child's future income to finance the parent's consumption or the child's education.

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: $\log(\epsilon) \sim \mathcal{N}(-\sigma_\epsilon^2/2, \sigma_\epsilon^2)$; ρ is a parameter governing the direct 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 the inheritance of biological traits. For example, it could capture the transmission of human capital through interactions within the family.

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

[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.

After solving the maximization problem, the parent's optimal child investment is given by

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

which means that 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:

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

Parameter ρ governs the "better parent" effect (Lefgren et al. (2012)) because it captures the direct influence of parents' human capital on that of their children. Parameter γ governs the "richer parent" effect since it reflects the productivity of additional investments due to greater financial resources.

After the dispersion of idiosyncratic shock σ_ϵ is chosen, there is a one-to-one mapping between ige and intergenerational mobility measured in AM or RM. With $\rho + \gamma < 1$, we can characterize the stationary distribution of income in this economy in closed form:

$$\log(h) \sim \mathcal{N}\left(\frac{\log(\overline{Z}) - \sigma^2/2}{1-(\rho+\gamma)}, \frac{\sigma_\epsilon^2}{2(1-(\rho+\gamma)^2)}\right),$$

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 using period 1 (early 20s) and period 2 (late 20s). We will make the assumption that individuals have one child over their lifetime, but whether the birth occurs in period 1 or period 2 depends on the family planning choice made by the agents.[7] Before period 1 starts, agents choose units of family planning adoption κ which determines $p(\kappa)$,

[7]By assuming that agents only have one child, we abstract away from unwanted births and focusing on mistimed ones. We make this assumption for simplicity of exposition. This assumption is likely going to make our results a lower bound because unwanted fertility has larger negative impacts on a child's human capital than mistimed ones (Finer and Kost (2011). Mistimed births also account for the majority of unintended fertility in the data. Last, Ananat and Hungerman (2012) show that increased access to family planning has negligible effects on fertility rates in the long run.

the probability of having the child in period 1. Function $p(\kappa)$ is the technology that transforms family planning adoption 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 choices.

Agents receive income h in period 1, i.e., when agents first enter the labor market. If the birth does not occur in period 1, agents will receive $(1+\lambda(h))\cdot h$ in period 2 where $\lambda(h)$ denotes income growth from the early 20s to 30s. We assume that $\lambda(h)$ is exogenous and depends on h to capture observed differences in the age-income profile by education. Here, $\lambda(h)$ is a reduced-form way of modeling heterogeneities in income growth across initial human capital without micro-founding it by invoking the human capital accumulation or marriage process. On the other hand, if the birth occurs in period 1, agents suffer a human capital depreciation and receive $(1-\delta(h))(1+\lambda(h))\cdot h$. We also allow the career costs of children $\delta(h)$ to differ by education following evidence from Miller (2011) and Adda et al. (2017). This feature captures the observation that losses of human capital (or experience) due to childbearing differ by occupation and mother's education.

Besides the intergenerational borrowing constraints as in the standard Becker-Tomes model, we assume that there is also an *intertemporal borrowing constraint* that prevents agents from borrowing from the income in period 2 to finance expenditures in period 1.[8] Therefore, birth timing would affect children's human capital because agents are restricted to use resources on hand to finance both consumption and child investments.

3.2.1 Consumption-Investment Problem

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

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

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

[8]See Daruich (2018) and Caucutt and Lochner (2020) for the implications of such constraints on children.

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

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

We allow for the possibility that children born in period 2 receive a direct boost to their human capital governed by the parameter ω. This captures the effects of birth timing on children's human capital beyond the investment channel, such as the presence of father, a more stable family structure, or more emotional maturity (Aizer et al. (2020)). 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 $V_1(h)$:

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

Note that $\Delta(h)$ summarizes the marginal benefits of family planning for parents with human capital h. The first term in (4) is the career costs of giving birth in period 1 on parent's consumption. The second and third terms represent the effects on children's human capital which is valued by the parent with the altruistic parameter θ. Given that $\Delta(h) > 0$, if a woman does not have a strong enough taste shock ι for having a child in period 1, she would prefer to delay the birth to period 2 because it is good both for her own career and also for the child's human capital development.

As both income growth $\lambda(h)$ and career costs of children $\delta(h)$ 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 more to gain from delayed birth (Kearney and Levine (2012)). This gives a demand-side explanation to the observed positive correlation between contraceptive use consistency and education.

For parents with human capital 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 family planning 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 family planning adoption leads to a utility cost of $\chi(h)$.[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 2.1.2, we allow the cost $\chi(h)$ to be different by adult's human capital. In the calibration section, we will discuss how the data would allow us to identify $\chi(h)$.

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 family planning:

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

Lastly, we define unintended fertility in a way that is most consistent with the definition of mistimed ones in the NSFG survey questionnaire.[10] 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

[9] Similar to Choi (2017) and Filote et al. (2019), we assume that family planning κ carries utility cost instead of financial costs given that past research suggests that financial barriers are not sufficient to explain why people are not using contraceptives consistently (see Sawhill et al. (2010) and Frost et al. (2008). Moreover, we abstract away from modeling different contraceptive measures defined by varying upfront costs and variable costs (see Michael and Willis (1976)).

[10] This model interprets family planning and unintended fertility within a rational agent's framework. We are aware that there are alternative interpretations that might lead to different policy recommendations (Rosenzweig and Wolpin (1993), Santelli et al. (2003)). For more recent development, see Aiken et al. (2016).

realized in period 1, we would categorize that as unintended births. We define unintended fertility rate by human capital of parents as

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

In the model, there are three channels why observed family planning adoption $\kappa^*(h,\cdot)$ is increasing in h, and also why unintended fertility rate $\eta(h)$ is decreasing in h:

1. Income growth rate $\lambda(h)$ is increasing in education h. This gives agents with high h more gains to postpone birth to period 2 so that they could invest more in their children.
2. Career costs of children $\delta(h)$ are higher for more educated women. This makes it more costly for highly-educated women to have early births, hence prompting them to adopt contraceptives more consistently.
3. Costs of contraceptives $\chi(h)$ are decreasing in education h. This captures various "supply-side" 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

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

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

$$\mathbb{E}_\epsilon h' = \underbrace{Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^\gamma \cdot h^{\rho+\gamma}}_{\text{standard Becker-Tomes}} \cdot \underbrace{(\overline{p}(h) + (1-\overline{p}(h))(1+\omega)(1+\lambda(h))^\gamma)}_{\text{family planning effect}}. \tag{8}$$

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, 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 ρ, γ and σ_ϵ, 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 are causing the additional source of intergenerational persistence. If $\lambda(h), \delta(h)$ and $\chi(h)$ 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 because the notion of mobility and inequality is inherently about differences, not levels. Therefore while reducing levels of contraceptive costs $\chi(h)$ 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

3.3.1 Calibrating The Standard Becker-Tomes Model

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). In Section 4.1, we use these parameters to contrast the degree of intergenerational mobility once we add family planning to the canonical model.

The parameters in the standard Becker-Tomes model includes direct transmission ρ, degrees of altruism θ, the productivity of education investment γ, dispersion of idiosyncratic shock σ_ϵ, and the normalizing parameter Z.[11] First, we set $\theta = 0.3$ exogenously following Lee and Seshadri (2019). Then, we can back out $\gamma = 0.16$ because in the model, $\frac{\theta\gamma}{1+\theta\gamma}$ gives to the fraction of household income that is spent on children's education.[12] We calibrate $Z = 2.08$ so that in the stationary economy, the median income is normalized to be one. Parameter σ_ϵ is calibrated to be 0.74 to generate a Gini coefficient of 0.42. Lastly, $\rho_{bt} = 0.26$ is calibrated to generate $\text{RM}_{bt} = 0.34$ in the standard Becker-Tomes model. In other words, parameter $\rho_{bt} = 0.26$ is the residual persistence that rationalizes observed intergenerational correlation of income.

Table 5: Becker-Tomes Model Parameters

Parameter	Z	θ	γ	σ_ϵ	ρ
Value	2.08	0.30	0.16	0.74	0.26

Notes: This table displays the parameters in the standard Becker-Tomes model.

[11] Alternatively, Z could be interpreted as the 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 in the data using PSID data. Daruich (2018) gives similar estimates.

3.3.2 Calibrating The Family Planning Model

We then proceed to the calibration of the family planning model. These parameters match the data moments mentioned in the previous section equally well, but in addition, they generate observed patterns of income growth, career costs of children, unintended fertility, and birth timing.

We maintain the assumption that $\theta = 0.3$, which in turn implies that $\gamma = 0.16$ because with family planning, the fraction of household income spent on children's education is still $\frac{\theta\gamma}{1+\theta\gamma}$. As before, parameters $Z = 1.85, \sigma_\epsilon = 0.7$, and $\rho = 0.15$ are chosen to match median income, Gini coefficient of income, and intergenerational persistence of income, respectively. Note that to rationalize the same degree of inequality and mobility, the family planning model requires smaller σ_ϵ and ρ than the standard Becker-Tomes model. This is an intuitive result – as we have shown in Equation (8), the family planning model features higher intergenerational persistence holding the levels of ρ and κ unchanged. This higher intergenerational persistence, in turn, supports a thicker right-tail of the income distribution in the steady-state.

The additional parameters in the family planning model include the profile of income growth $\lambda(\cdot)$, career costs of children $\delta(\cdot)$, costs of family planning $\chi(\cdot)$, the technology $p(\cdot)$ that transforms contraceptive use to the probability of birth in period 1, the direct boost to child human capital ω, and the distribution that governs taste shock for early birth $F(\iota)$. We discuss the calibration strategy for these parameters in turn.

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

We parameterize $\lambda(\cdot), \delta(\cdot), \chi(\cdot)$ as:

$$x(h) = x_b + (x_a - x_b) \cdot \frac{2\exp(-x_c \cdot h)}{1 + \exp(-x_c \cdot h)}, \qquad x \in \{\lambda, \delta, \chi\}. \tag{9}$$

so that the function $x(h)$ is governed by three parameters $\{x_a, x_b, x_c\}$ where $\lim_{h\to 0} x(h) = x_a$, $\lim_{h\to\infty} x(h) = x_b$, and x_c governs the curvature.

Because we do not observe the profile of income growth, career costs of children, or family planning costs by continuous levels of h, we calibrate $\{x_a, x_b, x_c\}, x \in \{\lambda, \delta, \chi\}$ to match empirical moments by mothers' education (high school and below, some college, and college and above), which are in turn mapped into income ranks. In particular, we calibrate $\{\lambda_a, \lambda_b, \lambda_c\}$ to match income growth by education calculated using data from the Current Population Survey 2010-2019.[13]

[13] We calibrate $\lambda(h)$ within the model because the observed growth in earnings are net of the effects of childbirth, and hence the career costs of children $\delta(h)$.

Parameters $\{\delta_a, \delta_b, \delta_c\}$ are calibrated to match the effects of fertility delays on earnings estimated by Miller (2011).

We assume the technology that maps family planning adoption κ to the probability of early birth takes the functional form

$$p(\kappa) = p_b + (p_a - p_b) \cdot \frac{2\exp(-p_c \cdot \kappa)}{1 + \exp(-p_c \cdot \kappa)}. \tag{10}$$

We exogenously choose $p_a = 1$ and $p_b = 0$ so that if the agent does not adopt any family planning, having a child in period 1 is a certain event, and if the agent adopts an infinite amount of family planning, having a child in period 1 can be entirely prevented. We can normalize $p_c \equiv 1$ so that the scale of contraceptive use κ is pinned down by parameters in $\chi(h)$. As the costs of family planning $\chi(h)$ directly affects family planning use $\kappa^*(h)$ and hence the profile of unintended fertility by parents' human capital $\eta(h)$, we calibrate $\{\chi_a, \chi_b, \chi_c\}$ to match the level of unintended birth rates by education calculated using NSFG data. Figure 5 shows the costs of family planning by agent's human capital – the horizontal axis plots the probability of birth in the first period $p(\kappa)$ while the vertical axis plots the utility costs of $\chi(h) \cdot \kappa$ in consumption equivalents. While the magnitude of family planning costs in this paper is estimated using data on unintended fertility, it is comparable to the estimates in other structural models that use pregnancy rates or contraceptive adoption. For instance, Filote et al. (2019) estimates that the costs of reducing $p(\kappa)$ to 20% is 11.4% in consumption equivalents; Choi (2017) estimates such costs to be around 14% for single women without college education.[14] The corresponding statistic in this paper for an agent with median human capital is 12%.

We use equation (5) and the estimates from Miller (2009) to calibrate ω. Using biological fertility shocks as instruments, 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 differences between children of college graduates and those of high school dropouts.[15] Therefore, the direct boost ω is calibrated as the residual after accounting for the effects through higher investments $\gamma \log(1+\lambda(h))$.

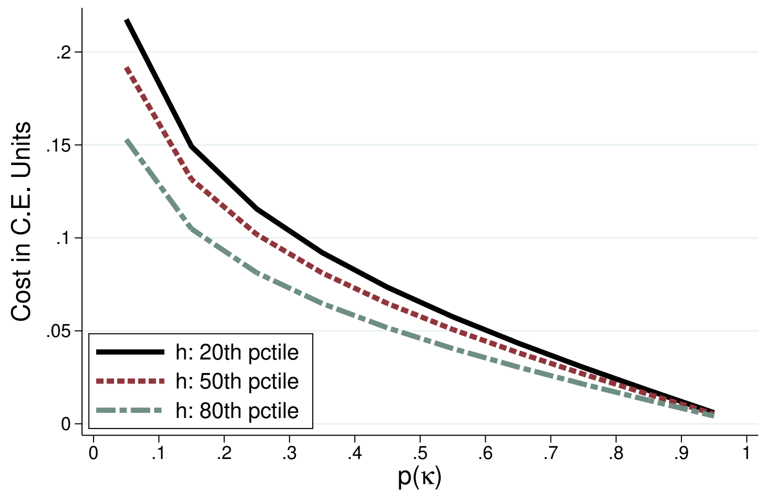
Last, we assume that the distribution of idiosyncratic taste for early birth ι is normally distributed with mean μ_ι and standard deviation σ_ι. We calibrate $\{\mu_\iota, \sigma_\iota\}$ to match the share of women having their first child in period 1 (i.e., six years into the labor market) by education.

To sum up, Table 6 presents the model parameters and Figure 6 shows the fit to data.

[14] Authors' own calculations based on parameter estimates reported in Filote et al. (2019) and Choi (2017).

[15] We make the simplifying assumption that gaps in test scores reflect differences in human capital.

Figure 5: Utility Cost of Family Planning by h



Notes: This figure plots the utility costs of reducing the probability of birth in the first period by agent's human capital percentile in the population.

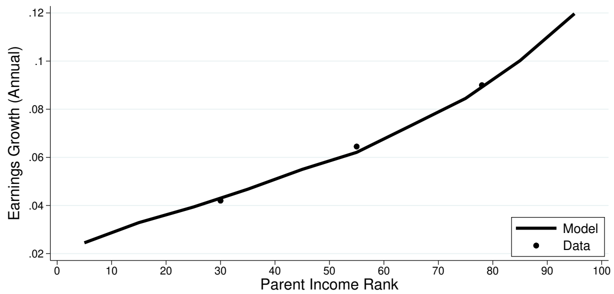
Table 6: Family Planning Model Parameters

	Value	Source		Value	Source		Value	Source
Costs of family planning			Career costs of children			Other Parameters		
χ_a	0.068	NSFG	δ_a	-0.005	Miller (2011)	Z	1.85	normalization
χ_b	0.03	NSFG	δ_b	0.17	Miller (2011)	σ_ϵ	0.70	Census
χ_c	0.9	NSFG	δ_c	0.40	Miller (2011)	ρ	0.15	Chetty et al. (2014)
						θ	0.30	Lee and Seshadri (2019)
Income growth			Taste shock distribution			γ	0.16	Lee and Seshadri (2019)
λ_a	0.01	CPS	μ_ι	0.045	NSFG	ω	0.05	Miller (2009)
λ_b	0.13	CPS	σ_ι	0.04	NSFG			
λ_c	0.88	CPS						

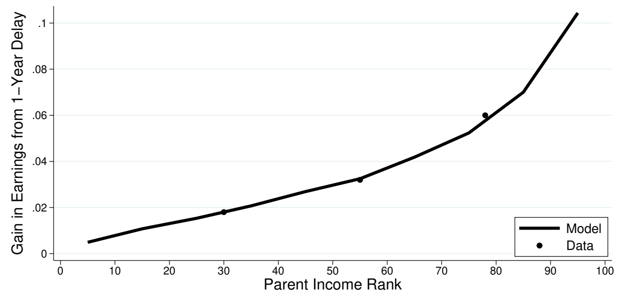
Notes: This table displays the parameters in the family planning model and sources of targeted moments.

Figure 6: Calibration of The Family Planning Model

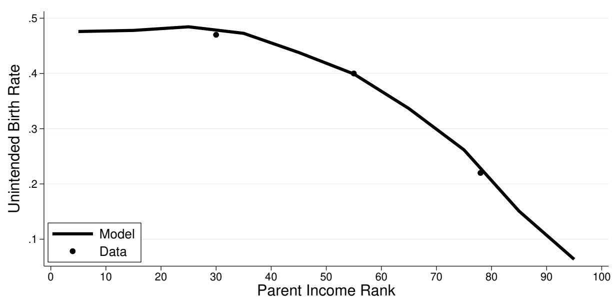
(a) Income Growth by Education



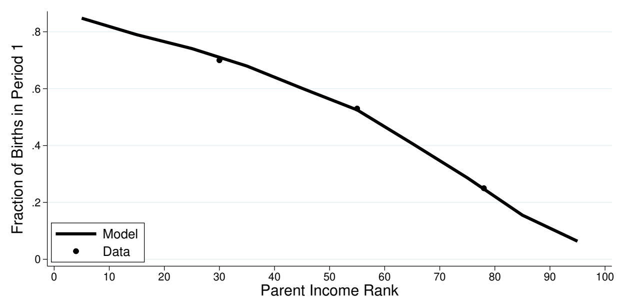
(b) Career Costs of Children by Education



(c) Unintended Birth Rate by Education



(d) Fraction of Early Births by Education



Notes: This figure plots the fit of the family planning model to the moments in data.

4 Results

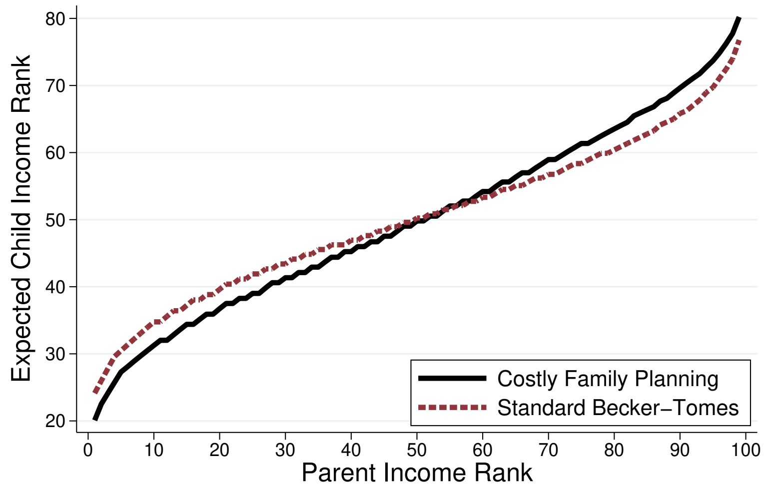
4.1 Intergenerational Mobility with Family Planning

In this section, we quantify the claim in Equation 8 which states that intergenerational persistence is higher with family planning. To do so, we fix the model parameters $\{Z, \theta, \gamma, \sigma_\epsilon, \rho\}$ at the Becker-Tomes level (see Table 5) and add family planning.

Figure 7 displays the comparison results. As can be seen, for fixed parameters, intergenerational persistence is significantly higher in the model with family planning. The increase in RM when we add family planning is more than two times the standard deviation of RM across states in the data.

As discussed in previous sections, the propagation mechanism in the family-planning model originates from *differences* in income growth $\lambda(h)$, career costs of children $\delta(h)$ and costs of family planning $\chi(h)$. We decompose the increase in intergenerational persistence in Figure 7 into these three sources. We start from the family planning model and set $\lambda(h), \delta(h)$ and $\chi(h)$ to be at its population average. When there are no heterogeneities across h, the family planning model collapses to the standard Becker-Tomes framework. By adding heterogeneities in $\delta(h)$, $\lambda(h)$ and $\chi(h)$ one step at a time to obtain the full family-planning model, we record the contribution of each

Figure 7: Intergenerational Mobility with Family Planning



Notes: This figure plots the rank-rank relationship between parents' and children's income with and without family planning.

element.[16]

Table 7: Decomposition of Additional Persistence

	ige	RM	AM
standard Becker-Tomes	0.42	0.34	41.7
+ heterogeneous $\lambda(h)$	+0.014	+0.02	-0.4
+ heterogeneous $\delta(h)$	+0.037	+0.07	-2
+ heterogeneous $\chi(h)$	+0.012	+0.02	-0.3
= family-planning model	0.483	0.45	39

Notes: This table displays the decomposition results of the additional intergenerational persistence into heterogeneous $\lambda(h), \delta(h)$ and $\chi(h)$.

Table 7 presents the decomposition results. Three factors all contribute to the additional persistence relative to the standard Becker-Tomes model, with heterogeneous career costs of children having the largest impacts. The results indicate that gaps in family planning and unintended fertility reflect not only discrepancies in access to family services $(\chi(h))$ but also different returns to family planning adoption due to lifetime income growth $(\lambda(h))$ and career costs of children $(\delta(h))$. Quantitatively, heterogeneous career costs of children play the most significant role, echoing the findings in Kearney and Levine (2012).

[16]Our results do not vary much when we experiment with other orders of decomposition.

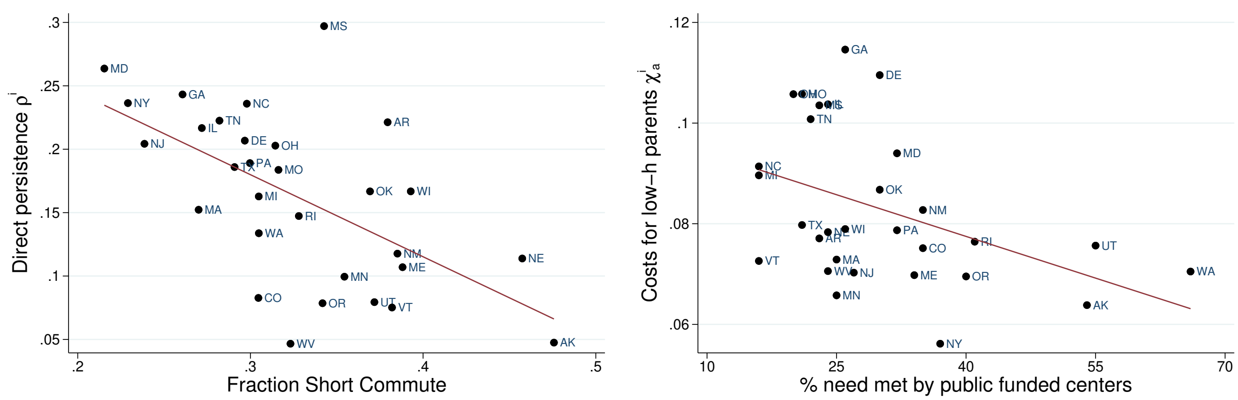
4.2 Counterfactual 1: Improving Access among Low-Income Women

In the first policy counterfactual, we study the changes in intergenerational mobility and inequality after we improve family planning access among the poor in different states.

Before conducting the policy counterfactual, we re-calibrate the family-planning model to match moments state by state. More specifically, for each U.S. state i, we calibrate $\{Z^i, \rho^i, \sigma_\epsilon^i, \chi_a^i, \chi_b^i, \chi_c^i\}$ 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 an accounting exercise given that we are attributing differences across states to fundamentals in the model, including costs of family planning. Allowing these parameters, especially ρ, to vary across states is necessary to explain geographical differences in mobility.

Figure 8: Correlates with State-specific Parameters

(a) ρ^i and Segregation (b) χ_a^i and "Family Planning Deserts"



Notes: This figure plots the correlation between state-specific model parameters and other state characteristics.

Figure 8 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 8a, we show that states with higher residential segregation, measured by "fraction short commute" in Chetty et al. (2014), have higher direct intergenerational persistence ρ. Figure 8b shows that in states where the model predicts to have higher costs of family planning services among the poor, χ_a^i, we observe a smaller fraction of likely family planning needs that are met by publicly funded centers.

In the counterfactual, we hold $\{Z^i, \rho^i, \sigma_\epsilon^i, \chi_b^i, \chi_c^i\}$ unchanged for each state, and reduce the con-

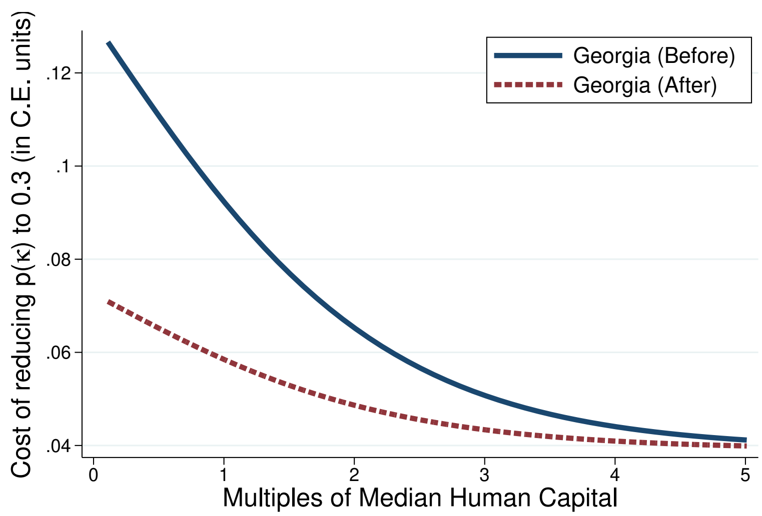
[17] For each state i, we compute its stationary distribution $G^i(h)$ and obtain $\{\text{AM}_i, \text{RM}_i\}$ by plotting the rank-rank relationship between parents' and children's income rank against the invariant national income distribution $G^*(h)$.

traceptive costs χ_a^i to the minimum level across all states,[18]. In other words, we set

$$\chi_a^i = \min_j \chi_a^j, \qquad \text{for all } i.$$

As the calibrated χ_a^j is the lowest in New York, the counterfactual is essentially granting low-income women in other states the same degree of family planning access as that in New York. To illustrate, consider the cost of reducing the probability of childbirth in period 1 (early 20s) to 0.3 depending on the agent's human capital for those residing in Georgia.[19] Figure 9 shows that before the policy counterfactual, the cost (in consumption equivalents) among low-income women is more than 9%, whereas the cost after implementing the policy counterfactual is almost halved.

Figure 9: Family Planning Costs, Before and After



Notes: This figure plots the cost of reducing the probability of childbirth in period 1 to 0.3 depending on the agent's human capital for those residing in Georgia, before and after implementing the policy counterfactual. Recall that $h = 1$ denotes the median level of human capital in the population.

Figure 10, 11, and 12 plot the changes for each state under the policy counterfactual. Figure 10 shows that every state (except New York) sees an increase in absolute upward mobility, with the average being 0.27 standard deviations. Figure 11 shows that every state also has a decrease in relative mobility that is 0.16 standard deviations on average. Lastly, Figure 12 indicates that improving family planning access also reduces inequality by 0.34 standard deviations on average. These improvements are larger in states with high initial (calibrated) family planning costs, such

[18]In practice, reducing family planning costs χ_a^i amounts to addressing various frictions discussed in Section 2. For instance, the government could encourage the use of contraceptives via mass media 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).

[19]0.3 equals to the probability of childbirth in period 1 among women with a college education and above.

Figure 10: Improvement (increase) in AM under Counterfactual 1

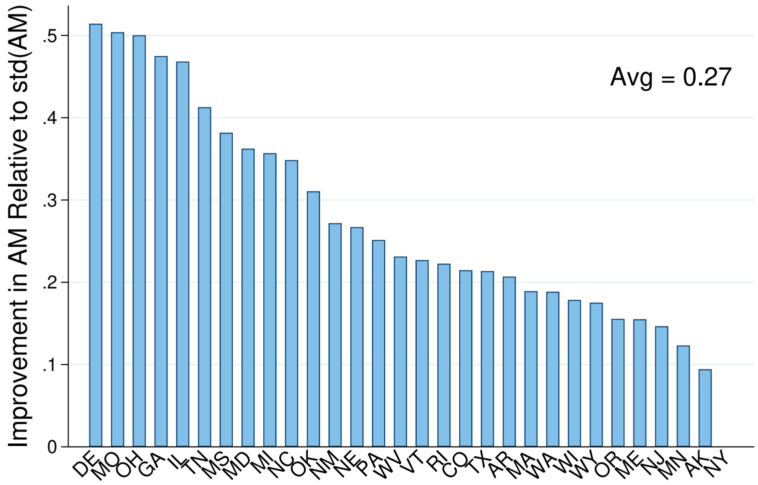


Figure 11: Improvement (decrease) in RM under Counterfactual 1

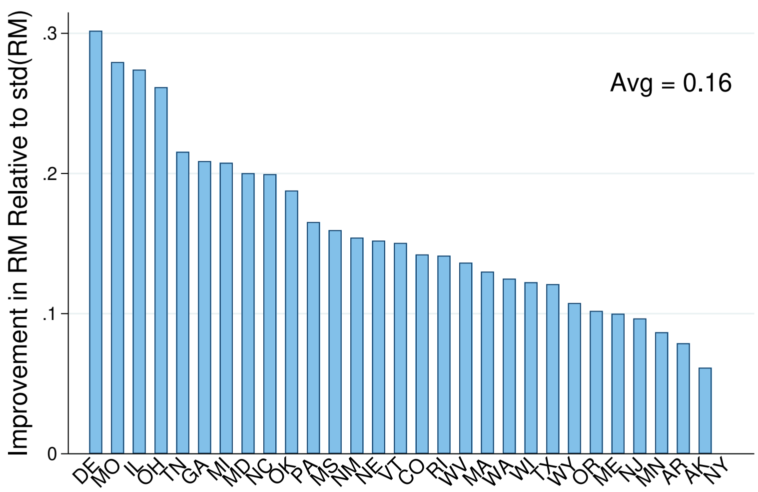
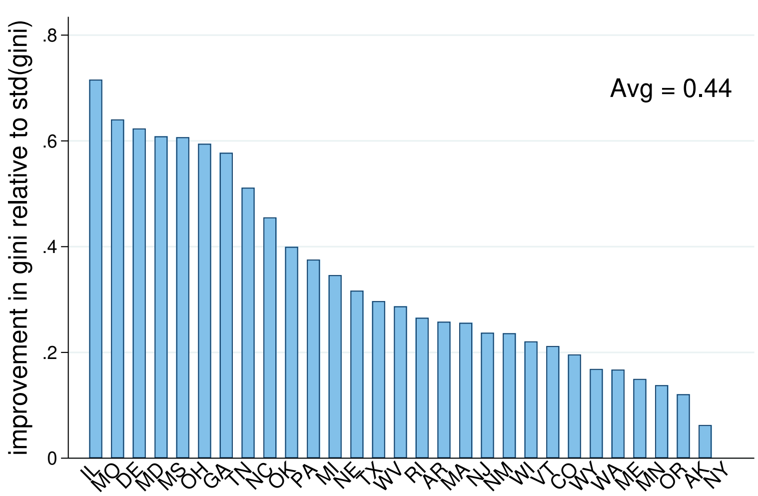


Figure 12: Improvement (decrease) in Gini under Counterfactual 1



as Delaware, Missouri, Ohio, and Georgia. After normalization, these results imply that a one-standard-deviation reduction in unintended fertility through changes in access causes a 0.15 (0.08) standard deviation change in AM (RM). If we compare these results to the correlations presented in Table 4, we find that almost a quarter of the raw correlations in the data is *causal* from the point of view of the model.

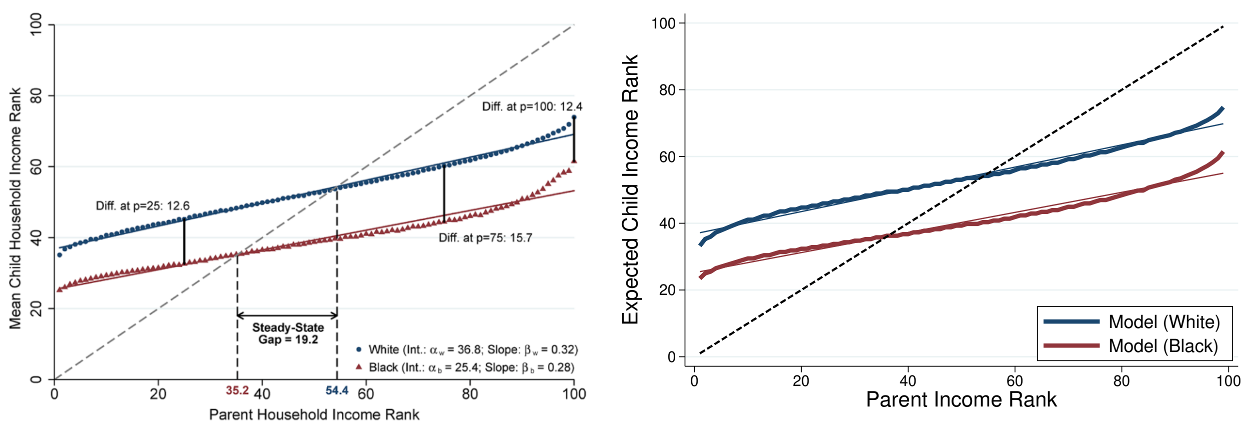
4.3 Counterfactual 2: Improving Access among Black Americans

Using anonymized longitudinal data covering nearly the entire U.S. population from 1989 to 2015, Chetty et al. (2020) uncover the large black-white gap in absolute upward mobility. Under the assumption that rates of mobility remain constant across generations, the observed black-white income gap is due almost entirely to differences in average child income rank *conditional on* parent income rank. Figure 13a 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 13: Black-White Gap in Absolute Upward Mobility, Data and Model

(a) Racial Gap in Chetty et al. (2020)

(b) Racial Gap in the Model

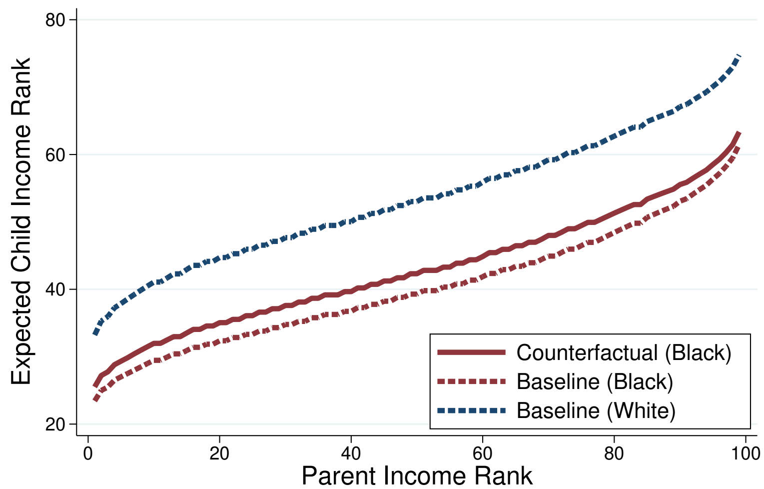


Notes: This figure plots the black-white gap in absolute upward mobility in Chetty et al. (2020) and in the calibrated model.

We use our model of intergenerational mobility with family planning to shed light on how much of the black-white mobility gap can be explained by different access to family planning services. Racial gaps in family planning access could play a role in explaining the mobility gap because Figure 1 shows that the 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 are not limited to, geographical locations of abortion clinics, misconceptions, and supply-side distortions (Dehlendorf et al. (2010)).

We calibrate the model to match race-specific moments. In particular, we calibrate $\{\lambda_a^i, \lambda_b^i, \lambda_c^i\}$ where $i \in \{\text{black}, \text{white}\}$ to match income growth by education and race in the Current Population Survey data. We also calibrate $\{\chi_a^i, \chi_b^i, \chi_c^i\}$ to match the unintended birth rates by education and race presented in Figure 1. Lastly, we allow Z to be different by race to generate the observed gaps in absolute upward mobility in Figure 13a.[20] Figure 13b presents the fit of the model.

Figure 14: Changes in Mobility When Family Planning Costs are Equalized Across Races



Notes: This figure plots the counterfactual rank-rank relationship between parents' and children's income by race.

In the policy counterfactual, we set $\{\chi_a^{\text{black}}, \chi_b^{\text{black}}, \chi_c^{\text{black}}\}$ to the level of $\{\chi_a^{\text{white}}, \chi_b^{\text{white}}, \chi_c^{\text{white}}\}$. This amounts to a more-than-half reduction in family planning cost across all education levels for black women. Figure 14 plots the results from the counterfactual: equating access to family planning across races shifts up the expected child income rank among black Americans by an average of 2.5. This eliminates 20% of the black-white gap in absolute upward mobility. The remaining gap is largely due to differences in Z which captures other frictions such as labor market discrimination and residential segregation.

5 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 hypoth-

[20]Given that RM and the Gini coefficient are similar across races, allowing ρ and σ_ϵ to be race-specific yield similar results. We assume that other parameters in Table 6 are the same across blacks and whites.

esis is that differences in access to family planning services affect intergenerational persistence of economic status and 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 to gaps in income growth, career costs of children, and access to family planning services across education. A decomposition exercise shows that the heterogeneous career costs of children play the primary role, but the other two factors are also quantitatively important.

In the policy counterfactual where each U.S. state improves access to family planning services among the poor, intergenerational mobility (AM) could be improved by 0.3 standard deviations on average while income inequality also drops by 0.3 standard deviations on average. When we calibrate the model to match unintended fertility by race, we find that improving family planning access among black women can close 20% of the black-white gap in upward mobility documented by Chetty et al. (2020).

Policies to reduce family planning costs are also achievable and scalable without dramatic changes as 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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