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Intergenerational mobility begins before birth[☆]

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ABSTRACT

Nearly 40% of births in the United States are unintended, and this phenomenon is disproportionately common among Black Americans and women with lower education. Given that being born to unprepared parents significantly affects children's outcomes, could family planning access affect intergenerational persistence of economic status? We extend the standard Becker–Tomes model by incorporating an endogenous family planning choice. In a policy counterfactual where states reduce family planning costs for the poor, intergenerational mobility improves by 0.3 standard deviations on average. We also find that differences in family planning costs account for 20% of the racial gap in upward mobility.

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 studying the mechanisms behind the observed degrees of intergenerational persistence (Lee and Seshadri, 2019).

Most analyses of intergenerational mobility focus on the structural forces after childbirth, such as credit constraints (Heckman and Mosso, 2014, Daruich, 2018) or neighborhood effects (Chetty and Hendren, 2018), while assuming that the childbirth itself is exogenous or controlled with perfection. Relatively little attention has been paid to the frictions that determine the conditions into which the children are born and the aggregate implications of government policies aimed at mitigating these frictions.

In this paper, we first discuss several motivating facts which suggest that intergenerational mobility begins before childbirth. We use data from the National Survey of Family Growth (NSFG) to show that the fertility process is far from being frictionless or exogenous, contrary to what is commonly assumed in the literature. Overall, 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

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"unwanted." The phenomenon is much more common among Black Americans and women with low socioeconomic status. Given that unintended fertility has a detrimental effect on both the mother and the child (Logan et al., 2007, Bailey, 2013), we argue that the presence of family planning adoption 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 also 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.

We then extend the standard Becker–Tomes model by incorporating endogenous adoption of family planning services to understand unintended fertility and to quantify its effect on intergenerational mobility. Differences in career costs of children, life-cycle income profile, and family planning costs by education all contribute to the disparities in 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 family planning services. In policy counterfactuals, we reduce the cost of family planning among the poor to the lowest level across all states. We find that absolute upward mobility rises, on average, by 0.3 standard deviations across states.

We also use the calibrated model to shed light on how much of the racial gap in absolute upward mobility can be explained by differences in family planning costs. When we calibrate the model to match differences in unintended fertility by race, we find that Black women face much higher costs of family planning than white women with similar incomes. If the government reduces family planning costs among Black Americans to match that of the whites, the racial gap in upward mobility can be eliminated by 20%. At the same time, the racial income gap could be reduced by 25% in the long-run steady-state, and more than half of this gain can be achieved in one generation.

The rest of the paper is organized as follows. In Section 2, we discuss the motivating facts on unintended fertility, family planning adoption, and intergenerational mobility. Section 3 presents the model and calibration. Section 4 contains the key results of the paper. Section 5 concludes.

2. Motivating facts

In this section, we present several facts, some of which are stylized and extensively studied in the literature of family planning and unintended fertility.[1] Here, we provide a brief overview of these facts and make a connection to intergenerational mobility.

2.1. Unintended fertility

We use data from the National Survey of Family Growth (NSFG) to characterize some 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 5554 women, 9553 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 point of view 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 and view the adoption of abortion procedures as another form of family planning for simplicity. We categorize a live birth to be unintended if the corresponding pregnancy is reported to be unintended by the mother.

Fig. 1 displays unintended birth rates by education and race. The figure conveys three stark observations. First, the overall level of unintended fertility rate is high. Finer and Zolna (2016) report that in 2011, nearly half (45%) of the 6.1 million pregnancies in the United States were unintended. In NSFG data, the percentage of unintended births is 42%. This implies that a significant portion of childbirth would have been delayed or avoided had the mothers utilized family planning better. 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.

[1] For instance, see Brown et al. (1995), Rosenzweig and Wolpin (1993), and Kost and Henshaw (2014).

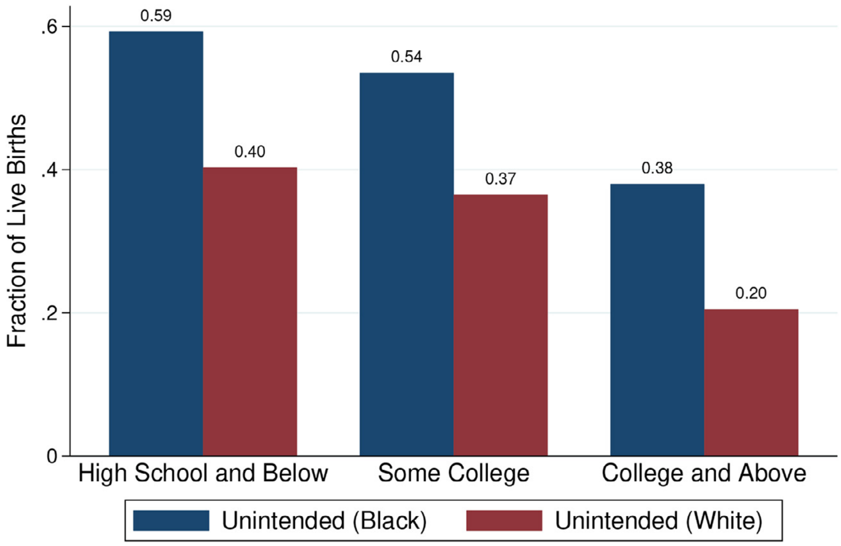

Fig. 1. Unintended birth rate by education and race. *Notes*: This figure plots the fraction of live births that are unintended by mother's education and race using data from NSFG wave 2015–2017.

Table 1
Family planning utilization by education and race.

	Consistent use		P(Carry to term|unintended)	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Black-Some College	−0.001	0.084	−0.044	0.039
Black-College	0.055	0.102	−0.157**	0.066
White-High School	0.092	0.061	0.015	0.031
White-Some College	0.121*	0.063	−0.067*	0.036
White-College	0.205***	0.058	−0.129***	0.044
N. of Observation	1515		4231	

* $p < 0.1$, * $p < 0.05$, *** $p < 0.01$.
Notes: This table displays the coefficients and standard errors of regressing consistent contraceptive use and the fraction of unintended pregnancies carried to term on education and race dummies.

2.2. 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 (Bailey, 2010).[2] Therefore, it might first come as a surprise to observe the high level of unintended birth rates presented in Fig. 1. In this section, we use NSFG and the National Longitudinal Survey of Youth 1979 (NLSY79) to present patterns of family planning adoption and discuss some of the relevant factors.[3] 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.

Fig. 2 shows the fraction of sexually active women who have consistently adopted contraceptives 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 Fig. 1, the statistics on contraceptive use reveal three observations. First, despite not wanting to have any more children, the level of consistent family planning adoption is far below 100%. Second, contraceptive use increases with education. This increase is more pronounced among White women but not statistically significant among Black Americans (see Table 1). Third, conditional on education, Black women use contraceptives less consistently than white women. This could be potentially due to the more widespread belief among Black Americans that the government encourages contraceptive use to limit minority populations (Rocca and Harper, 2012). We also observe similar patterns when we investigate

[2] 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.

[3] Women could report unintended fertility with and without consistent use of family planning. On the one hand, there are women who suffer from contraceptive failures despite consistent efforts. 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 ex post. Quantitatively, the latter group accounts for the vast majority of unintended fertility: Finer and Zolna (2016) documents that 32% of women who used contraceptives inconsistently account for 95% of unintended pregnancies.

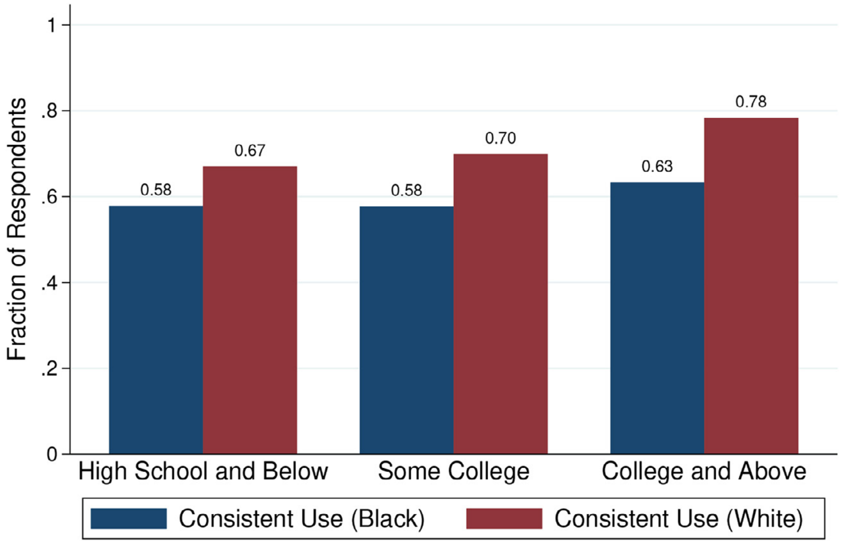

Fig. 2. Consistent contraceptive use by education and race. *Notes*: This figure plots the fraction of sexually active women that consistently use contraceptives in the year prior to the interview date by education and race using data from NSFG wave 2015–2017. We restrict the sample to the respondents who reported not wanting to have any more children in the future.

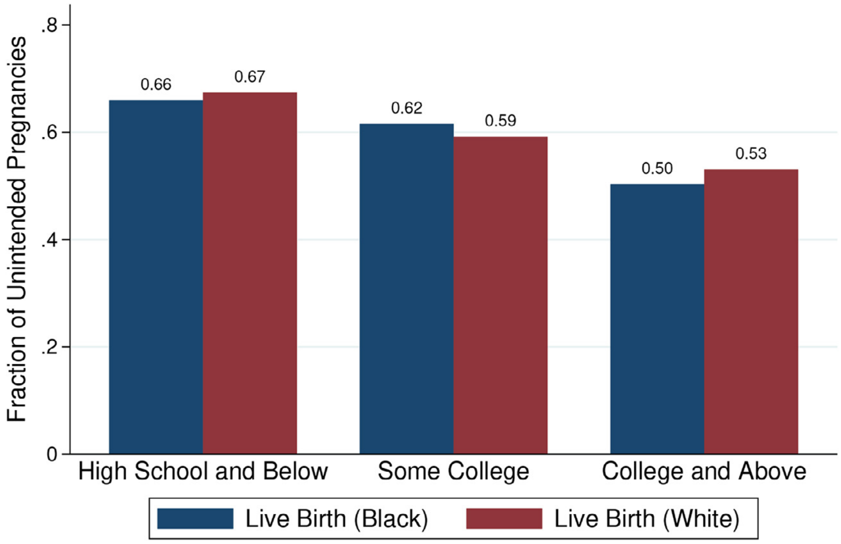

Fig. 3. Fraction of unintended pregnancies that were carried to term. *Notes*: This figure plots the fraction of unintended pregnancies that were carried to term by education and race using data from NSFG wave 2015–2017.

whether the respondent had used any contraceptive methods between pregnancy intervals (or since the first intercourse) conditional on the following pregnancy was unintended.

Given that abortion is a measure that women can use to terminate unintended pregnancies, we also investigate the fraction of unintended pregnancies that were carried to term by education and race.[4] Fig. 3 shows that unintended pregnancies are less likely going to result in live birth among women with higher education. Regression results in Table 1 indicate that conditional on education, the racial differences here are less pronounced.

The statistics above show that the adoption of family planning services is far from perfect or frictionless. Taking both contraception and abortion adoptions into account, there are large disparities by education and race. Here, we briefly discuss the potential sources of family planning costs using NSFG and NLSY79.[5]

[4] We do not examine reported abortions directly because it is subject to severe underreporting in NSFG data (Fu et al., 1998).

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

Table 2
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.

Table 3
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.

Table 4
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.

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 2 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 family planning 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 family planning 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 3 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 4 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.

The financial costs of contraceptives and abortion also play 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 choices of LARC are highly sensitive to 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 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 family planning 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 (Bailey et al., 2021), policymakers can do more to improve access among disadvantaged women, such as providing more sex education.

2.3. 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.

2.4. State-level correlations

In the previous section, we presented micro-level observations on unintended fertility and family planning adoption. 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

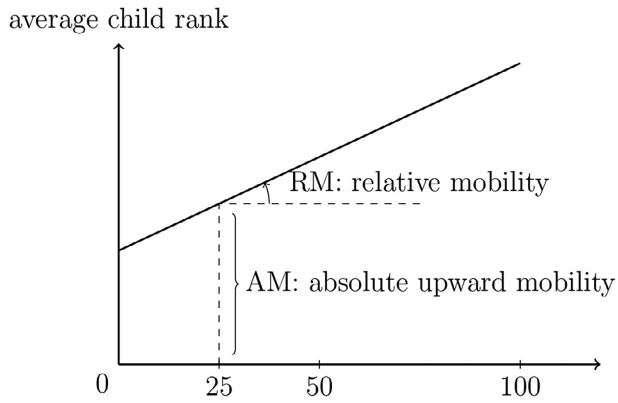

Fig. 4. Measuring mobility. *Notes*: This figure illustrates the definition of absolute upward mobility (AM) and relative mobility (RM).

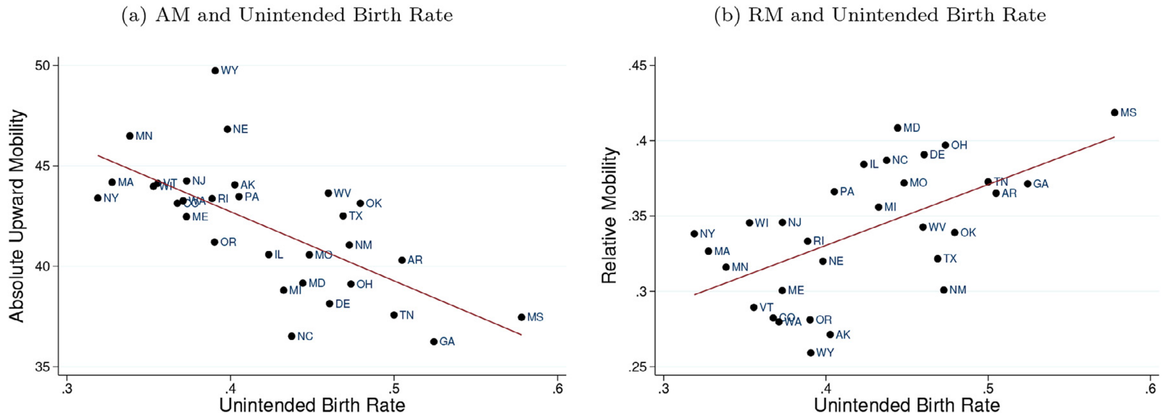

Fig. 5. Correlation between intergenerational mobility and unintended birth rate. *Notes*: This figure plots measures of intergenerational mobility (AM and RM) against unintended fertility rate by state.

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. Fig. 4 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 is at the 25th percentile. Relative mobility (RM) measures the slope of the rank-rank relationship. Higher AM and lower RM means *larger* intergenerational 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 2008 to 2017 covering all contiguous United States that participate in PRAMS.[6] Unfortunately, we can not go to more granular levels such as county or commuting-zone. The sample contains around 600,000 pregnancies.

Fig. 5 a and b 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.

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:

[6] 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 across time at the state level. Second, the rank of unintended fertility rate across states is highly stable.

Table 5
Correlates of intergenerational mobility.

	(1) AM	(2) RM	(3) AM	(4) RM	(5) AM	(6) RM
Fraction short commute	0.197	−0.186	0.461***	−0.343*	0.443*	−0.334*
Gini bottom 99%	−0.199	0.507*	0.236	0.248	0.122	0.304
High school drop-out rate	0.061	−0.029	0.018	−0.003	0.036	−0.012
Social capital index	0.014	0.684***	0.068	0.652***	0.059	0.656***
Fraction single mothers	−0.202	0.095	−0.242	0.118		
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 Observation	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.

- (Fraction short commute) The share of workers that commute to work in less than 15 min 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.
- (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 5 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 the unintended birth rate remains significant.

Table 5 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.

The observations above suggest that family planning adoption and unintended fertility play a role in determining intergenerational mobility. Moreover, reducing family planning costs may be an effective way in to boost mobility. There are, however, two challenges in using historical policy variations to directly assess such a hypothesis. First, there is a lack of high-quality panel data that measures mobility at a granular level to exploit policy variations. Second, policies have dynamic effects because children being affected will become better parents when they grow up (Daruich, 2018). As a result, short-run policy evaluations are likely going to understate long-run effects.

Therefore, in the next section, we develop and calibrate a structural model with three goals in mind. First, we use it to understand trade-offs in family planning adoption. Second, we use the calibrated model to examine the implications of individual's family planning adoption choices for intergenerational mobility. Last, we use the framework to conduct two policy counterfactuals.

3. Model

In this section, we first present the basic Becker–Tomes model to highlight sources of intergenerational persistence of income in a canonical setting without family planning. Then, we extent this canonical framework by incorporating endogenous family planning decisions.

3.1. Basic becker-tomes model

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).[7] 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.[8]

The introduction of parental human capital in the human capital production captures many benefits accruing to a child by virtue of being attached to a more educated parent. This broad view of the intergenerational spillover should be kept in mind when interpreting our results. First, higher human capital parents are better able to transmit learning to their child. A parent with higher human capital could provide better neighborhoods and surroundings which would augment his child's human capital. Another interpretation is that the parental human capital reflects an inherited component of innate ability.

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:

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

where $\bar{Z} = Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^\gamma$.

3.2. Incorporating family planning adoption

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.[9] Before period 1 starts, agents choose units of family planning adoption κ which determines

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

[8] 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: $\epsilon_i = \delta + \rho\epsilon_{i-1} + \nu_i$ with white noise ν_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.

$p(\kappa)$, 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, or age effects, 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 loss 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 *inter-temporal borrowing constraint* that prevents agents from borrowing from the income in period 2 to finance expenditures in period 1.[10] Therefore, birth timing would affect children's human capital because agents are restricted to using 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:

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

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.

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

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

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, 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

[9] 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). Moreover, 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.

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

from delayed birth (Kearney and Levine, 2012). This gives a demand-side explanation to the observed positive correlation between family planning adoption 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 observe their idiosyncratic taste for early birth ι and solve

$$\max_{\kappa\geq 0} p(\kappa)(V_1(h)+\iota) + (1-p(\kappa))V_2(h) - \chi(h)\cdot\kappa. \tag{6}$$

We assume that each unit of family planning adoption leads to a utility cost of $\chi(h)$. The utility costs encapsulate possible frictions such as misinformation, disagreement between partners, and access to family planning services. With ample evidence presented in Section 2.2, we allow the cost $\chi(h)$ to be different by adult's human capital. In the calibration section, we will discuss how the data allow us to identify $\chi(h)$.

The first-order condition compares the marginal benefits and the marginal costs of family planning adoption:

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

which gives the optimal level of family planning:

$$\kappa^*(h,\iota) = \begin{cases} 0 & \iota \geq \Delta(h) \\ p'^{-1}\left(\frac{\chi(h)}{\iota-\Delta(h)}\right) & \iota < \Delta(h) \end{cases}. \tag{7}$$

Lastly, we define unintended fertility in a way that is most consistent with the definition of mistimed ones in the NSFG survey questionnaire.[11] 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 realized in period 1, we would categorize that as unintended births. We define unintended fertility rate by human capital of parents as

$$\eta(h) \equiv \int \underbrace{p(\kappa^*(h,\iota)}_{\text{births in period 1}} \cdot \underbrace{\mathbb{1}(\Delta(h) > \iota)}_{\text{prefers to delay}} dF(\iota). \tag{8}$$

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 family planning more consistently.
3. Costs of family planning $\chi(h)$ are decreasing in education h. This captures various "supply-side" reasons such as misinformation and insurance coverage.

3.2.3. Discussion of modeling assumptions

Before we proceed to the implications of family plannings on intergenerational mobility, some discussions of the modeling assumptions are in order.

First, the unit of κ is not relevant in the interpretation of the model because agents are simply choosing the probability of early birth subject to utility costs whereas κ is an intermediate variable in this mapping.

Second, 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 play a relatively small role in explaining why people are not using contraceptives consistently (see Frost et al., 2008; Sawhill et al., 2010). Nevertheless, more recent evidence reveals that financial costs could matter for individual's adoption of more effective contraceptive methods (Bailey et al., 2021). In this model, introducing financial costs will strengthen our conclusion because it interacts with agents' borrowing constraints, leaving more room for policy intervention.

[11] 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).

Third, we abstract away from modeling different contraceptive measures defined by varying efficacy rate, upfront costs, and variable costs (see Michael and Willis, 1976). From a modeling point of view, $\chi(h)$ can be viewed as the lower envelope of the costs after choosing the optimal method of family planning. Introducing fixed costs of family planning into the model raises the fraction of agents choosing $\kappa^* = 0$. Therefore, it is largely captured by the mean value of the idiosyncratic taste for early birth ι.

Last, we assume that agents have the same preferences towards their children but face different costs in labor market (Adda et al., 2017) and family planning (see Section 2.2). As a result, differences in unintended fertility across education and race are attributed to heterogeneous family planning benefits $\Delta(h)$ and costs $\chi(h)$. In this paper, we quantify the role of $\chi(h)$ in shaping intergenerational mobility, but remain silent on the exact composition of $\chi(h)$ and how the government could reduce it in the most cost-effectively way.[12]

3.2.4. 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 family planning adoption, we can write expected child human capital $\mathbb{E}_\epsilon h'$ as

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

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

$$\mathbb{E}_\epsilon h' = \underbrace{Z \cdot \left(\frac{\theta\gamma}{1+\theta\gamma}\right)^\gamma \cdot h^{\rho+\gamma}}_{\text{standard Becker–Tomes}} \cdot \underbrace{\left(\overline{p}(h) + (1 - \overline{p}(h))(1+\omega)(1+\lambda(h))^\gamma\right)}_{\text{family planning effect}}. \quad (9)$$

If we compare it with Eq. (2), we find that it contains an additional term that summarizes the effects of family planning adoption 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 family planning adoption 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 family planning 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. Quantifying the model

This section discusses how we use data to inform model parameters and how our results will be affected under alternative calibration.

3.3.1. Calibration

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.[13] We calibrate parameters $Z = 1.85$ so that the median income in the economy is normalized to one. Parameters $\sigma_\epsilon = 0.7$ and $\rho = 0.15$ are calibrated to match the Gini coefficient of income Gini = 0.42 and rank-rank mobility RM = 0.34 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 Eq. (9), 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 family planning adoption to the probability of

[12] We thank Martha Bailey for pointing us to a large and burgeoning literature that seeks to understand the determinants of differences in contraceptive use and non-marital childbearing between Black and White Americans. For example, see Guzzo and Hayford (2012), Barber et al. (2015), and Kusunoki et al. (2016). Whether the racial gap in family planning should be closed and, if so, how to close is an ongoing and hotly debated question.

[13] 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.

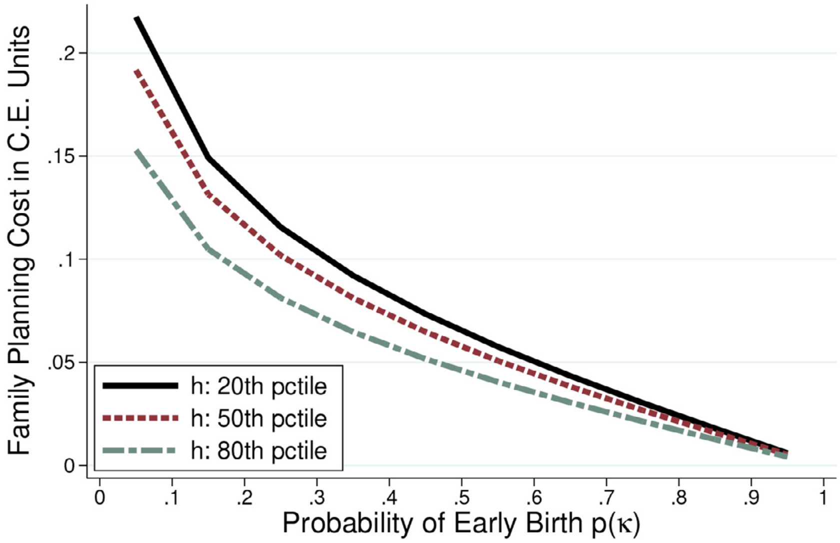

Fig. 6. Utility cost of family planning by *h*. *Notes*: This figure plots the utility costs of reducing the probability of birth in the first period by agent's human capital percentile in the population.

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:

$$x(h) = x_b + (x_a - x_b) \cdot \frac{2\exp(-x_c \cdot h)}{1 + \exp(-x_c \cdot h)}, \qquad x \in \{\lambda, \delta, \chi\}. \tag{10}$$

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 using the Current Population Survey (CPS) data. In particular, we calibrate $\{\lambda_a, \lambda_b, \lambda_c\}$ to match income growth by education calculated using data from the CPS 2010–2019.[14] 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

$$p(\kappa) = p_b + (p_a - p_b) \cdot \frac{2\exp(-p_c \cdot \kappa)}{1 + \exp(-p_c \cdot \kappa)}. \tag{11}$$

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 family planning adoption 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. Fig. 6 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 family planning 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.[15] The corresponding statistic in this paper for an agent with median human capital is 12%.

[14] 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 $\delta(h)$.

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

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.

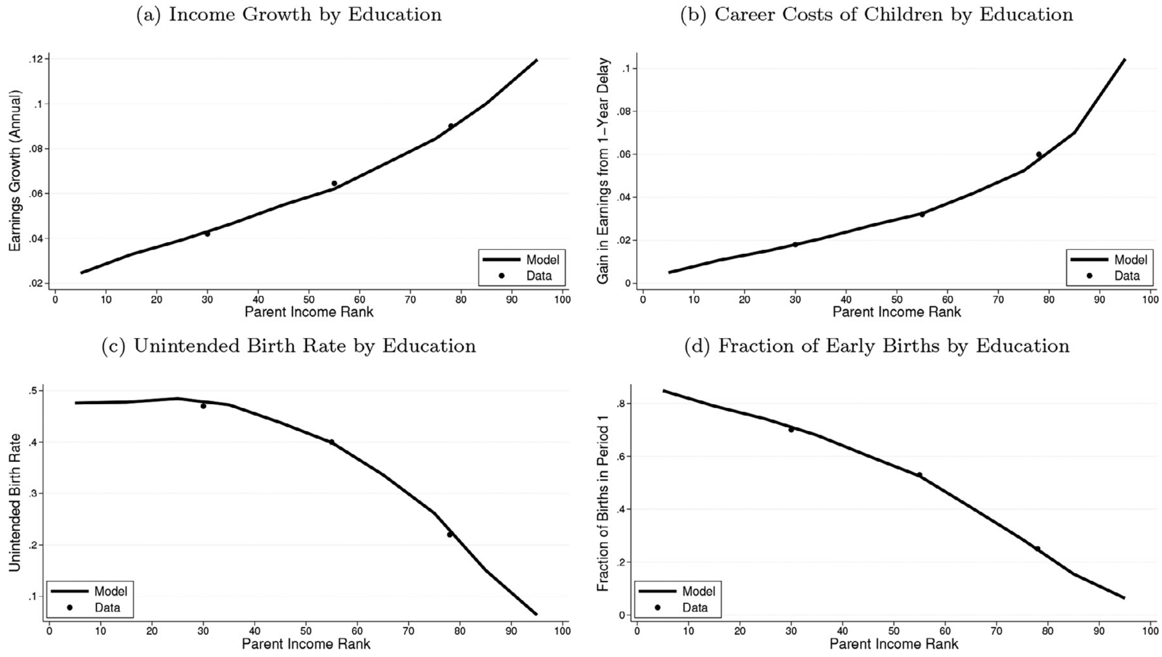

Fig. 7. Calibration of the family planning model. *Notes*: This figure plots the fit of the family planning model to the moments in data.

We use Eq. (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 drop-outs. Assuming that gaps in test scores reflect differences in human capital, we calibrate ω using an iteration procedure. We first guess ω_0, then calibrate the model and compute the human capital differences between children of college graduates and those of high school drop-outs. Then, we multiply this difference by 10 percent and compute ω_1 by deducting $\gamma\log(1+\lambda(\overline{h}))$ following Eq. (5). We iterate until ω_0 and ω_1 are sufficiently close.

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 Fig. 7 shows the fit to data.

3.3.2. Discussion of parameters and moments

Before we proceed to the results, we briefly discuss the parameters and moments that matter most for the model mechanism and counterfactual results.

Eq. (9) shows that comparing with the standard Becker–Tomes model, the mechanism of this model is summarized by the "family planning effect", i.e., $(\overline{p}(h) + (1-\overline{p}(h))(1+\omega)(1+\lambda(h))^\gamma)$. The magnitude of this effect depends on the fraction of early birth $\overline{p}(h)$ and the effects of birth timing on children's human capital $(1+\omega)(1+\lambda(h))^\gamma$, both of which are measured in the data. While $\overline{p}(h)$ is measured quite precisely using NSFG, the empirical evidence on the magnitude of $(1+\omega)(1+\lambda(h))^\gamma$ is relatively scant in the literature. We rely on the estimates from Miller (2009), but we note that the quantitative strength of the mechanism will be stronger (weaker) if this estimate is larger (smaller).

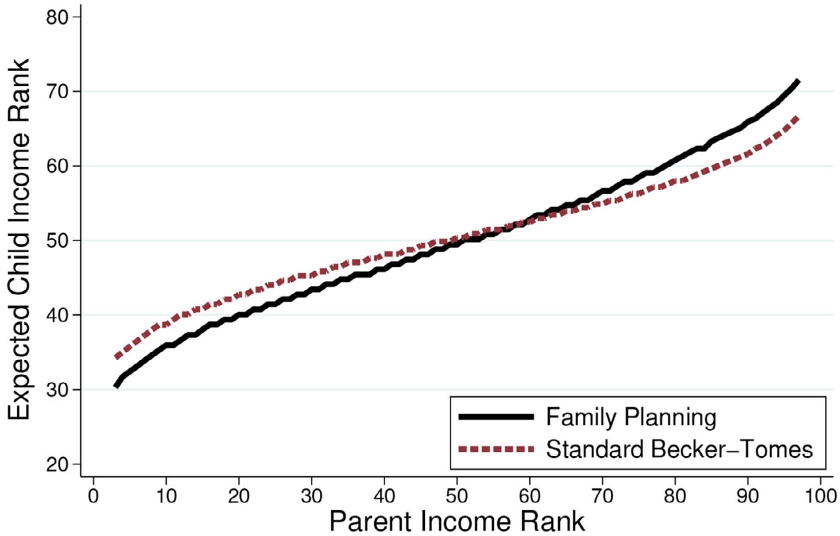

Fig. 8. Intergenerational mobility with family planning. *Notes*: This figure plots the rank-rank relationship between parents' and children's income with and without family planning.

On the other hand, even though we do not calibrate the altruism parameter θ inside the model, its value is not critical to the counterfactual results because Eq. (9) shows that it is not a part of the family planning effect.[16]

4. Results

This section presents the main results of the paper. We first quantify the role that endogenous family planning decisions play in shaping intergenerational mobility. Then, we present results from two policy counterfactuals.

4.1. Intergenerational mobility with family planning

We use the calibrated model to evaluate Eq. (9) which indicates that intergenerational persistence is higher with family planning. We use the model parameters displayed in Table 6 and shut down family planning decisions in the model so that parents across h have the same timing of birth.

Fig. 8 displays the comparison results. As can be seen, intergenerational persistence is significantly higher in the model with family planning. The difference in RM when we include 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 Fig. 8 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 equalizing $\delta(h)$, $\lambda(h)$ and $\chi(h)$ one step at a time, we record the contribution of each element.[17]

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 family planning costs $\chi(h)$, i.e., supply-side factors, but also different returns to family planning adoption due to lifetime income growth $\lambda(h)$ and career costs of children $\delta(h)$, i.e., demand-side factors. Quantitatively, demand-side explanations play the most significant role, echoing the findings in Kearney and Levine (2012).

4.2. Counterfactual 1: reducing costs among low-income women

In the first policy counterfactual, we study the changes in intergenerational mobility after we reduce family planning costs among the poor in different states.

[16] Calibrating θ within the context of this model is difficult unless we directly observe the marginal benefits of family planning $\Delta(h)$ in the data. If we can only observe birth timing, then an increase in θ is largely offset by a reduction in family planning costs $\chi(\cdot)$ in the calibration. In particular, when we experiment with a larger or smaller value of θ and re-calibrate the model, the main results in the policy counterfactuals remain largely unchanged.

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

Table 7
Decomposition of additional persistence.

	RM	AM
family-planning model	0.341	41.7
- heterogeneous $\lambda(h)$	−0.011	+0.3
- heterogeneous $\delta(h)$	−0.067	+1.9
- heterogeneous $\chi(h)$	−0.014	+0.4
= standard Becker–Tomes	0.249	44.3

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

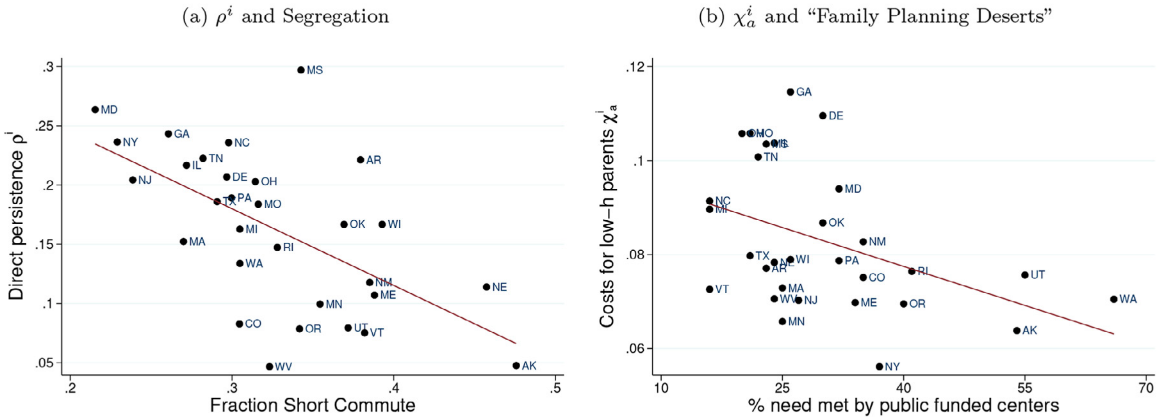

Fig. 9. Correlates with state-specific parameters. *Notes*: This figure plots the correlation between state-specific model parameters and other state characteristics.

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.[18] 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.

Fig. 9 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 Fig. 9a, we show that states with higher residential segregation, measured by "fraction short commute" in Chetty et al. (2014), have higher direct intergenerational persistence ρ. Fig. 9b 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 family planning costs χ_a^i to the minimum level across all states,[19] 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 costs 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.[20] Fig. 10 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.

Figs. 11 and 12 plot the changes for each state under the policy counterfactual. Fig. 11 shows that every state (except New York) sees an increase in absolute upward mobility, with the average being 0.27 standard deviations. Fig. 12 shows that every state also has a decrease in relative mobility that is 0.16 standard deviations on average. These improvements

[18] 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 $G^*(h)$.

[19] 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 family planning 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).

[20] 0.3 equals to the probability of childbirth in period 1 among women with a college education and above.

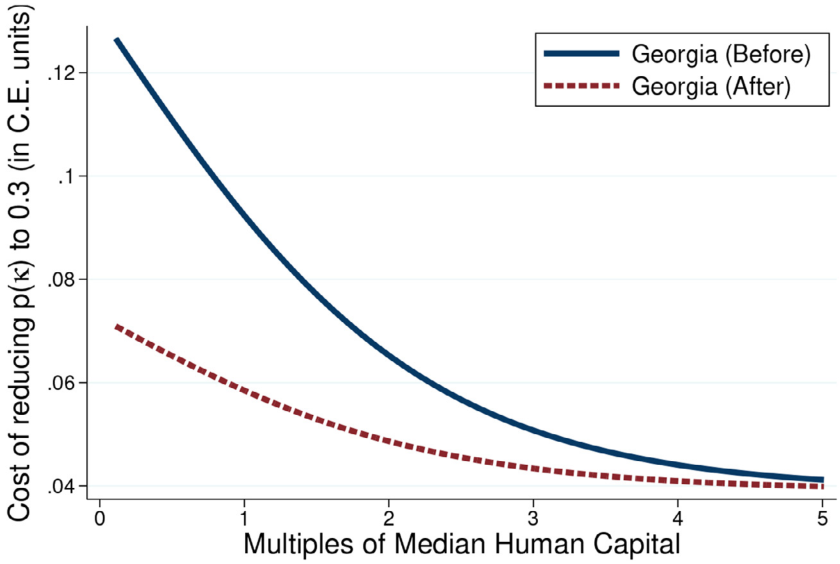

Fig. 10. Family planning costs, before and after. *Notes*: This figure plots the cost of reducing the probability of childbirth in period 1 to 0.3 depending on the agent's human capital for those residing in Georgia, before and after implementing the policy counterfactual. Recall that $h = 1$ denotes the median level of human capital in the population.

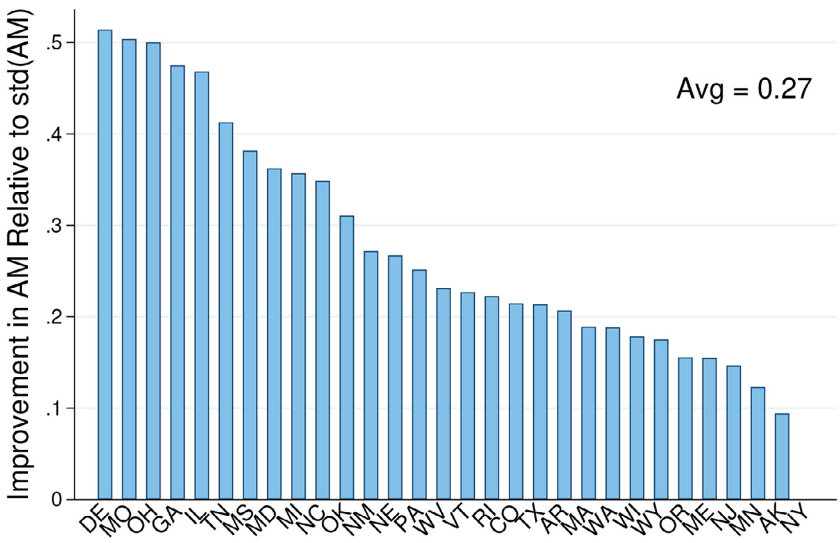

Fig. 11. Improvement (increase) in AM under Counterfactual 1.

are larger in states with high initial (calibrated) family planning costs, such as Delaware, Missouri, Ohio, and Georgia. After normalization, these results imply that a one-standard-deviation reduction in unintended fertility through changes in costs causes a 0.15 (0.08) standard deviation change in AM (RM). If we compare these results to the correlations presented in Table 5, 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: reducing costs 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. Fig. 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.

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 costs of family planning services. Racial gaps in family planning costs could play

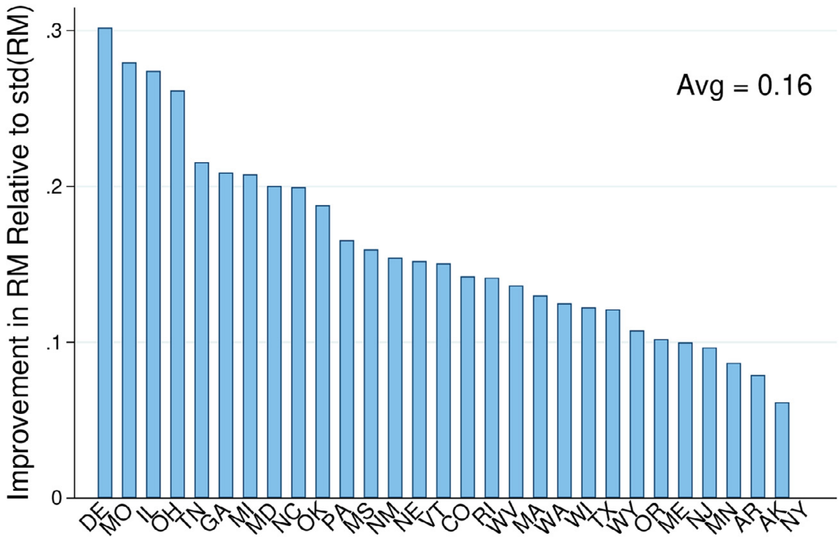

Fig. 12. Improvement (decrease) in RM under Counterfactual 1.

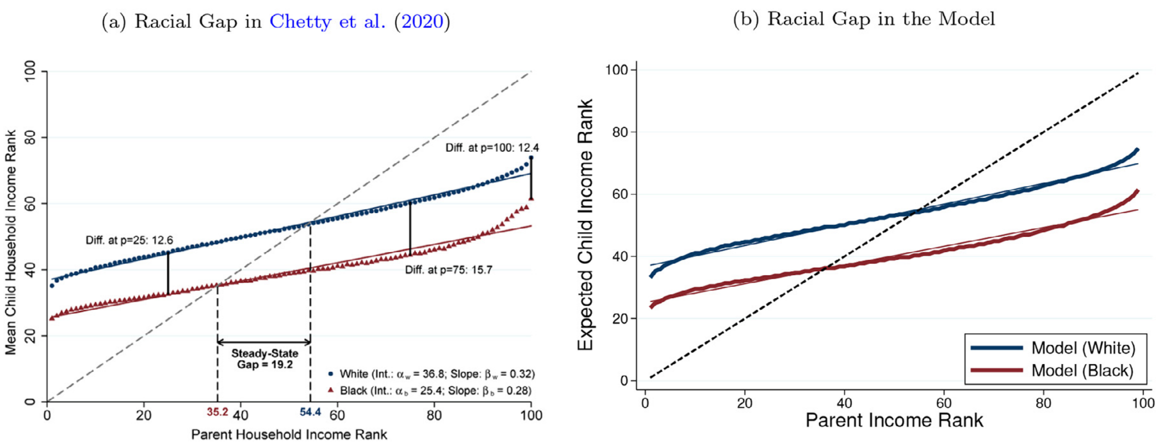

Fig. 13. Black-white gap in absolute upward mobility, data and model. *Notes*: This figure plots the Black-White gap in absolute upward mobility in Chetty et al. (2020) and in the calibrated model.

a role in explaining the mobility gap because Fig. 1 shows that the unintended fertility rate is much higher among Black women conditional on education. Potential factors contributing to disparities in family planning costs 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 Fig. 1. Lastly, we allow Z to be different by race to generate the observed gaps in absolute upward mobility in Fig. 13a.[21] Fig. 13b presents the fit of the model.

In the policy counterfactual, we set $\{\chi_a^{\text{Black}}, \chi_b^{\text{Black}}, \chi_c^{\text{Black}}\}$ to the level of $\{\chi_a^{\text{White}}, \chi_b^{\text{White}}, \chi_c^{\text{White}}\}$.[22] This amounts to a more-than-half reduction in family planning costs across all education levels for Black women. Fig. 14 plots the results from the counterfactual: equating family planning costs 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

[21] 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.

[22] The exact policy prescription to achieve this goal is complicated and sensitive, and deserves further research. For instance, Bailey et al. (2021) documents that non-Hispanic Black women is the only group that exhibits small responses to vouchers that subsidize the use of LARCs. The counterfactual results in this paper provide an estimate of the potential gains once such improvements are made.

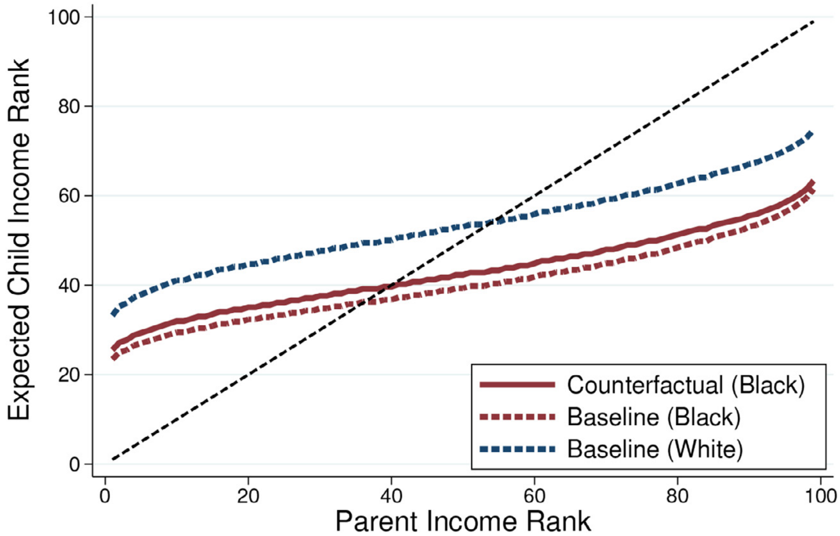

Fig. 14. Changes in mobility when family planning costs are equalized across races. *Notes*: This figure plots the counterfactual rank-rank relationship between parents' and children's income by race.

gap is largely due to differences in Z^i which captures other frictions such as labor market discrimination and residential segregation.[23]

Fig. 14 also indicates that the racial income gap (in ranks) reduces by 25% in long-run steady-states from 19.2 to 14.4 (comparing intersections with the 45-degree line). By fixing parents' human capital distribution at the original steady-state, we find that more than half of this reduction in racial inequality can be achieved within one generation.

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 children's development of human capital, a natural hypothesis is that differences in family planning costs affect intergenerational persistence of economic status and income inequality.

We extend the standard Becker–Tomes model of intergenerational mobility with endogenous family planning 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 costs of adopting 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 reduces costs of family planning services among the poor, intergenerational mobility (AM) could be improved by 0.3 standard deviations on average. When we calibrate the model to match unintended fertility by race, we find that equating racial gaps in family planning costs can close 20% of the Black-White gap in upward mobility documented by Chetty et al. (2020). This policy also eliminates 25% of the Black-White income gap in the long run. More than half of this improvement can be achieved within one generation.

Declaration of Competing Interest

None.

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[23] In a recent paper, Gayle et al. (2015) find that the racial differences in the marriage matching patterns lead to racial differences in the time allocation of parent(s) and explain a large fraction of the black-white achievement gaps. Their findings are related to the results from this model even though we do not consider marriage explicitly. In our framework, racial gaps in parental human capital and family planning costs result in a larger fraction of early birth among Black Americans. Besides receiving lower financial investments, these children do not enjoy the direct boost ω, which could reflect the consequences of the absence of fathers.

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