The Implications of Family Structure, Education Prices, and Policy Reforms for Inequality and Intergenerational Mobility*

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Abstract

Parents devote considerable resources towards their children's development, making trade-offs between time and education investments and working, consumption, and leisure. In recent decades, families in the United States experienced rising rates of single parenthood, increasing education prices, and changes to taxes and transfers, which altered available resources and trade-offs to investments across families. This paper explores the implications of these trends for inequality and intergenerational mobility. After documenting changes in family resources and parental investments over time, I develop a dynastic model of human capital investment to quantify the contributions of these trends to increases in inequality and intergenerational persistence. I find that single parenthood is a major contributor through two channels: (1) less available time for single parents limits work hours, family income, and investments for their children's human capital development and (2) the resulting lower human capital comes with a greater probability of becoming a single parent as an adult, as single parents tend to have less education and lower wages. Education prices, on the other hand, had only minimal effects as families reduce investments at similar rates in response to price increases. Moreover, changes to taxes and transfers had heterogeneous impacts on parental investments by producing differing income and substitution effects depending on family characteristics. The results highlight the importance of considering parental investments when designing assistance programs.

JEL classification codes: J11, J12, J22, J24, J62
Keywords: inequality, intergenerational mobility, human capital investment, family structure

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1 Introduction

During the past several decades in the United States, families experienced numerous changes affecting parental investments for children's development. One of these changes is the rise of single parenthood. In 1970, about one in ten children grew up in single-parent families; today it is over one in four. Single parents are more constrained than married parents, in large part due to differences in available time. Less parental time limits not only time investments for children, but also labor supply, family income, and education expenditures. Compounding the issue is the greater prevalence of single parents among those with less education and lower wages. Evidence suggests that this deficit of resources for children in single-parent families leads to poorer outcomes later in life (Kearney, 2023; Kalil and Ryan, 2020; Wasserman, 2020). Another change impacting investments is the increasing price of education. Over the last 50 years, education prices have risen roughly four times faster than overall prices. A declining return to education leads to less education investment all else equal. Lastly, means-tested transfers and tax credits have undergone several reforms since the mid-1960s, impacting time use and expenditure choices across families.

In this paper I evaluate how cross-cohort changes in family time resources, expenditure costs, and public policies affected inequality and intergenerational mobility. Income inequality has increased substantially in the United States over the past few decades. Recent work by Guvenen et al. (2022) indicates that a significant share of the increase is due to greater dispersion in initial outcomes for newer cohorts, suggesting rising dispersion of the permanent components of income. Over the same period, there is growing evidence of declining intergenerational mobility. Aaronson and Mazumder (2008), for instance, find that the intergenerational elasticity (IGE) of income has risen since 1950, reflecting greater income persistence across generations.[1] Numerous theories exist linking inequality to mobility, but it is not yet clear quantitatively what forces are contributing most to these two trends.[2] In my analysis I first document changes in family resources and trends in parental investments. I then develop a model of heterogeneous dynasties to quantify the effects of trends in family structure, education prices, and policy reforms on inequality and intergenerational mobility.

I begin by analyzing trends in family structure, education prices, and taxes and transfers. These factors are important features of my model. They provide a more complete picture of family resources and the trade-offs parents face when allocating time and expenditures towards their children's development. The rise of single parenthood means a greater share of children are growing up in home environments with more limited resources, and increasing relative prices for education reflects a declining return to education, which discourages investments. In the mid-1960s,

[1] The IGE is the coefficient from regressing an estimate of children's log permanent income on their parent's permanent income. For further trends in persistence see Davis and Mazumder (2022), Jácome et al. (2021), Chetty et al. (2017), Chetty et al. (2014), Lee and Solon (2009).

[2] See Acemoglu and Autor (2011) for a summary of key drivers of income inequality and Corak (2013) on the connection between inequality and intergenerational mobility.

means-tested transfers, such as Aid to Families with Dependent Children (AFDC), were greatly expanded with the additions of Medicaid, Food Stamps, and Supplemental Security Income (SSI), particularly for single-parent families. With the introduction of the Earned Income Tax Credit (EITC) in 1975, lower-income families were also eligible to receive a wage subsidy. Subsequent reforms led to additional changes in the generosity of transfers and tax credits (e.g. addition of child tax credit (CTC) in 1997) for lower-income families. These various changes to family time resources, expenditure costs, and public policies affect parental investment choices differently across families.

I then document growing gaps in parental time and education investments over time. Using data from both the Panel Study of Income Dynamics (PSID) Child Development Supplement (CDS) and the American Heritage Time Use Study (AHTUS), I show that time investments are highly unequal across families and the disparities are growing. Children from single-parent families receive almost half as many hours in time investments from their parents compared to children with married parents, and these differences increase with parental education. For education investments, the level of expenditures heavily depends on parental resources, both for private and public education. Using data from the Consumer Expenditure Survey (CEX), I find that families with greater resources are spending increasingly more on their children's education over time. Further, due to how public education is funded in the United States, where variation in public education funding is driven largely by local revenues generated through property taxes, richer areas have better-funded schools. As inequality increases over time, so does dispersion in investments.

With these cross-cohort changes in mind, I develop a model of heterogeneous dynasties to quantify the effects of changes in family resources and trade-offs to investments on inequality and intergenerational mobility. In the model, families are heterogeneous along a number of dimensions, including parent human capital, wages, and child learning ability. Parents make decisions over family formation and how to allocate their time and expenditures. Differences in family characteristics lead to differences in investments as parents internalize their children's learning ability and their own human capital, which both affect the productivity of investments for child development. Additionally, changes in education prices alter the return to investments, though this is not uniform across families.

An important feature of the model is that tax and transfer policies vary by family structure. This variation in policy treatment generates different trade-offs for parents. First, differences in tax progressivity and the generosity of transfers for single versus married parents influence the decision of parents to separate or not. The choice to separate depends on family characteristics, parents' (exogenous) match quality, and policy. More generous tax and transfer policies for single parents may lead to higher rates of single parenthood. Second, following family formation, different policy treatment by family structure creates variation in available resources and trade-offs to in-

vestments across families. More generous transfers provide greater non-labor income and allows parents to work less, while tax credits act as a wage subsidy, increasing the returns in the labor market and incentivizing more work.

After discussing implications of the model, I use it to quantify to what extent trends in family resources impacted inequality and intergenerational persistence. I next parameterize the model and evaluate model fit. I feed as driving forces into the model skill-biased technical change (SBTC), changes in non-economic factors that influence family structure, education prices, and taxes and transfers for three periods: (1) 1947-1970, (2) 1971-1994, and (3) 1995-2018. I estimate the model targeting key moments related to family structure, parental investments, and the distribution of family income. The model is successful in accounting for changes across cohorts in single parenthood, mean and dispersion of investments, inequality, and intergenerational mobility.

With the quantitative model I perform three counterfactual exercises. First, taking all else equal, I shut off the increase in the share of single-parent families. Second, taking family structure as given from the Baseline model, I turn off (1) SBTC, (2) rising education prices, and (3) changes to taxes and transfers. Finally, I repeat the three alternative scenarios from the prior step allowing for endogenous family structure. I first evaluate the impact of each factor on family income. I then calculate their contributions to increases in inequality and persistence of wages, which here is the permanent component of income.

The main results are as follows. The increase in single-parent families contributed to both growing inequality and intergenerational persistence of family income and wages. Of the change in inequality from the initial cohort of adults in 1947-1970 to the third cohort in 1995-2018, over 50 percent is due to the rise in single parenthood. Further, intergenerational persistence would be lower if the share of single-parent families had not risen, with the IGE falling from 0.51 in the baseline outcome to 0.46 in the counterfactual.[3] These results are driven by two factors: (1) less available time for single parents limits work hours, family income, and investments for their children's human capital development and (2) the resulting lower human capital comes with a greater probability of becoming a single parent as an adult, as single parents tend to have less education and lower wages. SBTC had the largest impact on inequality and intergenerational mobility, amplifying differences in human capital and prior human capital investments. Education prices, on the other hand, had a minimal effect on inequality and persistence as families reduce investments at similar rates with price changes. These two results are largely unchanged with fixed or endogenous family structure.

Turning to the effects of taxes and transfers, the policy changes preceding 1971-1994 helped mit-

[3]For the permanent component of income, the rise in single parenthood contributed to 20-25 percent of the increase in inequality and about 4 percent of the increase in persistence as measured by the IGE.

igate the rise in inequality and persistence when taking family structure as given. This is due to the increased generosity of transfers for single parents, which allowed for more time at home with their children and less time working. With endogenous family structure, the increase in benefits for single parents led to a higher rate of single parenthood (20 percent in the Baseline, 16 percent in the counterfactual without expanded benefits). Thus, the policy change led to greater inequality as it increased the share of single parents, but the expanded generosity helped those parents who would become single parents regardless of the policy changes invest more in their children, which reduced persistence.

A large body of research emphasizes the importance of human capital investments for outcomes in adulthood (Heckman and Mosso, 2014; García et al., 2021). However, most of these studies are based on short-term, smaller-scale programs, so the aggregate effects of changing trends in investments are difficult to extrapolate. This paper builds on a large literature in economics concerning the intergenerational transmission of economic status, both on the theoretical side (Becker and Tomes, 1979, 1986; Loury, 1981; Benabou, 2002; Han and Mulligan, 2001; Becker et al., 2018) and for quantitative applications (Caucutt et al., 2020; Herrington, 2015; Lee and Seshadri, 2019; Blandin and Herrington, 2022; Daruich, 2022). The innovation of my framework is that it incorporates key factors for family resources (e.g. family structure) as well as those that impact the relative benefits and costs to different allocations of time and money. Despite ample evidence that single parenthood, education prices, and policy changes impact family-level investments, there are surprisingly few studies that consider the implications of these factors together. The results highlight the importance of considering parental investments when designing assistance programs.

I make three contributions. First, I develop a model that incorporates family structure, education prices, and income assistance programs into a unified framework. Surprisingly, there are few papers in macroeconomics concerning the role of trends in family structure and education prices on inequality and mobility. In a recent paper, Blandin and Herrington (2022) studies the impact of the rise in single-parent families, among other factors, on children's college preparedness and resulting economic outcomes, finding an important role for family structure as single parents are more constrained in their ability to invest in their children's development. Another paper, Moschini (2023), looks at differences in child skill development between families with married and single parents, but focuses on the effect of childcare subsidies on lifetime consumption. I provide some of the first estimates of the impact of the rise in single parenthood on overall inequality and intergenerational mobility.

Second, I contribute to a literature on empirical trends on changing family resources and parental investments. The results of these studies, just as I find, indicate that over the past several decades investments became more unequal across families, where positive investment gradients for parents with higher education, income, and who are married steepened. Blandin and Herrington

(2022) show that college-educated parents who are married are spending more time and expenditures for their children's development. This trend is shown for time investments in Guryan et al. (2008) and Ramey and Ramey (2010). They find that highly educated parents spend considerably more time actively engaging with their children for development. These results correspond to findings in Belley and Lochner (2007) and Bailey and Dynarski (2011), who find that family characteristics, such as income and wealth, are becoming more important for investments over time.

Third, I provide evidence of the effects of policy on parental investments, and in particular how tax credits and transfers produce varying substitution and income effects that impact investment choices. Similar to Agostinelli and Sorrenti (2022), I find that increased tax credits like the EITC and CTC can have negative impact on time investments for disadvantaged mothers. This aligns with findings in Mullins (2022) regarding the design of policy for assisting low-income single mothers. Kalil et al. (2022) and Kalil and Ryan (2020) finds that policy changes to assistance programs that incentivize work, such as after welfare reform in the 1990s, may lead to lower quality in time investments.

The remainder of the paper is structured as follows: in Section 2.1 I document cross-cohort changes in family resources and trade-offs to parental investments. Section 2.2 presents evidence of growing inequality in parental investments across families. In Section 3 I develop a dynastic model of human capital investment. Section 4 discusses how I quantify the model and study the effects of changes in family resources and parental investments on inequality and intergenerational mobility with counterfactual exercises. In Section 5 I conclude.

2 Trends in family resources and investments devoted to children

In this section I present evidence of changes affecting family resources and investments. I document trends in family structure, education prices, and the generosity of means-tested transfers and tax progressivity. I then present evidence of growing gaps in investments between families with different resources. There are three time periods I focus on: (1) 1947-1970, (2) 1971-1994, and (3) 1995-2018.

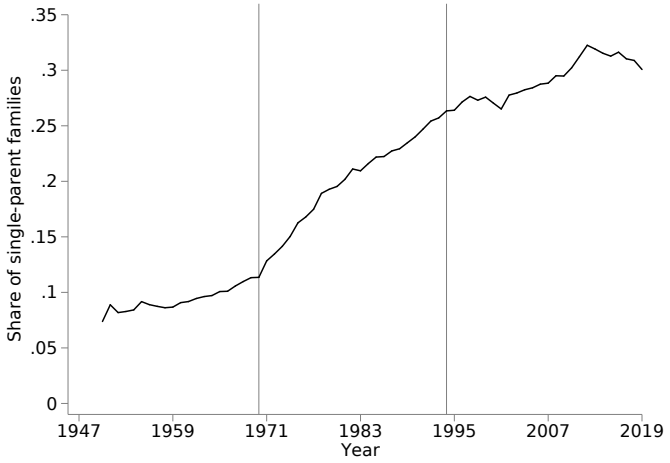
2.1 Changes affecting resources and trade-offs to investments

2.1.1 Single parenthood

Figure 1 shows the share of single-parent families in the United States from 1950-2019. The share of single-parent families is the number of families with children under 18 headed by one parent as a fraction of all families with children under 18.[4] Over the course of about 50 years, the share of single-parent families rose from 11% in 1970 to just below 31% in 2018. This trend represents a

[4]Data from US Census Table FM-1.

Figure 1: Share of single-parent families



Notes: This figure shows the share of single-parent families, which is the number of families with children under 18 headed by one parent as a fraction of all families with children under 18. US Census Table FM-1.

major decline in resources at home for a large number of children relative to prior cohorts.

Single parents tend to have lower education and income compared to married parents. Figure 2 displays the share of single-parent families by normalized household income for each cohort using data from the Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC), where normalized household income is household income (pre-taxes and transfers) divided by mean household income.[5] The graphs show that the rate of single parenthood increases as household income declines. Among families with the lowest incomes, the rate of single parenthood is close to 80%.

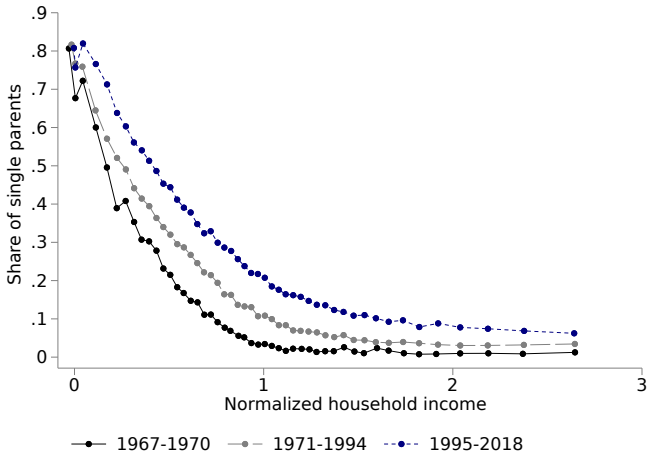
Why did single parenthood become more common? In a review of numerous hypotheses, Ellwood and Jencks (2004) state

> ...there is still no consensus about why single parenthood spread, much less about why it spread faster in some populations than in others. The most widely cited empirical papers seem to be those that disprove various hypotheses. Indeed, it is only as light exaggeration to say that quantitative social scientists' main contribution to our understanding of this change has been to show that nothing caused single-parent families to become more common. Nonetheless, they did.

The authors suggest that what likely had the biggest effects were a combination of changes in contraceptive technology, evolving attitudes towards non-marital sex and births, and dramatic shifts in gender roles and expectations surrounding maternal employment coupled with declining

[5]CPS data provided by Integrated Public Use Microdata Series (Flood et al., 2023).

Figure 2: Share of single-parent families by normalized household income



Notes: This figure shows the share of single-parent families at different multiples of mean household income for each cohort in the data. Figures are binned scatter plots of the share of single-parent families by normalized household income, which is a household's income divided by mean household income in a given year. Data from the CPS-ASEC.

economic opportunity for less-educated men. There is evidence of a weakly positive relationship between the expansion of welfare generosity during the 1960s and the subsequent increase in single parenthood (Moffitt, 1998). Whatever the reasons, children growing up in single-parent families likely have significantly fewer resources than children with married parents.

2.1.2 Education prices

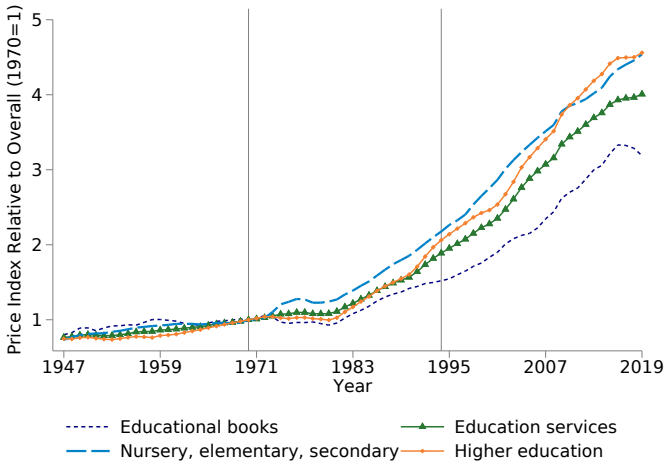
The price of education in the United States has risen significantly faster than overall prices over the past 40-50 years. Figure 3 displays this trend. It plots the change in education prices relative to overall prices since 1970.[6] By 2019, education prices have risen roughly four times faster than overall prices. Consistent with substitution effects of prices changes, the rise in the relative price of education lowers the effective return to investments and evidence suggests this leads to less education expenditures all else equal. Kim (1988) and Savoca (1990) find negative own-price elasticities of education expenditures and Hemelt and Marcotte (2016, 2011) find that higher tuition weakens the propensity of high school graduates to enroll in college.

2.1.3 Taxes and transfers

Here I document changes in tax progressivity and the generosity of means-tested transfers for families with children. First I show how average taxes and transfers across the income distribution have changed for households with and without children using data from the Congressional

[6]Price indices from the Bureau of Economic Analysis for education services and educational books are divided by the overall price index and normalized to 1 in 1970.

Figure 3: Relative prices of education goods and services



Notes: This figure shows relative changes in education prices since 1970. Price indices from the Bureau of Economic Analysis for education services and educational books are divided by the overall price index and normalized to 1 in 1970. Price indices: Personal Consumption Expenditure Price Index (PCEPI) for Educational books; Education services; Nursery, elementary, and secondary schools; and Higher education. These include prices for both public and private education expenditures per the BEA.

Budget Office (CBO). Next, I turn to household survey data in the CPS-ASEC and document how benefits changed across cohorts for households headed by single and married parents.

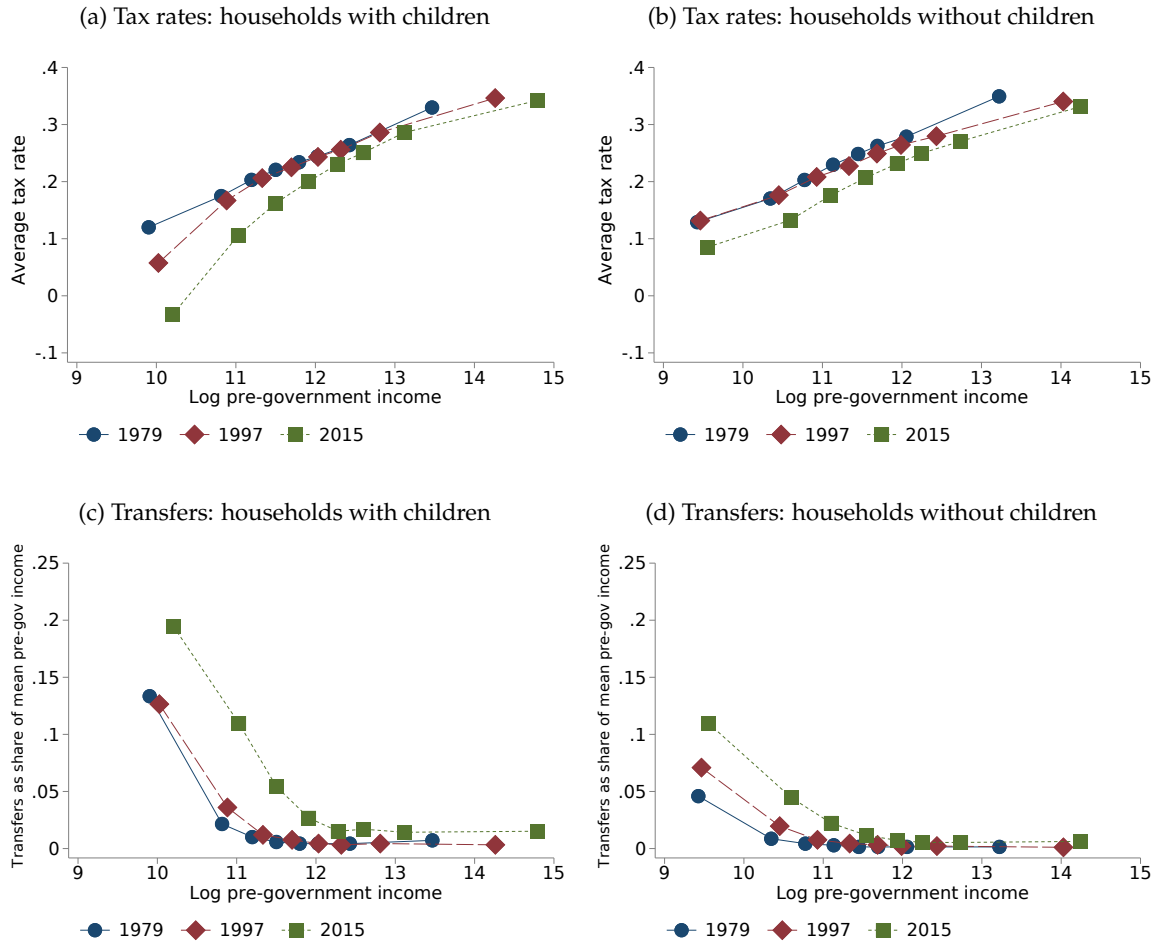
Data from the CBO contains information on average pre- and post-tax income, means-tested transfers, and taxes by income quintile and for the top 5%, 1%, 0.1%, and 0.01% of the income distribution for households with and without children from 1979-2019.[7] Figure 4 shows average tax rates (Panels (a) and (b)) and transfers as a share of mean household income (Panels (c) and (d)) by log pre-government income. From 1979 to 2015 average tax rates for households with children became more progressive. The lowest-income households with children had average tax rates a little over 10% in 1979. In 2015 it was around -5% due to more generous tax credits. Households without children, on the other hand, saw effectively no changes in tax progressivity. Panels (c) and (d) show the substantial expansion of means-tested transfers since 1979, though a greater change for households with children.

I now look to survey data from the CPS-ASEC to evaluate changes in means-tested transfers and tax credits by family structure. To account for underreporting of means-tested transfers in the CPS I utilize the CBO's regression-based procedure to impute transfers when possible (Habib, 2018).[8] I

[7]This data are used in the CBO report on the Distribution of Household Income, 2019. See www.cbo.gov/publication/58353 for the report and links to underlying data for researchers.

[8]The procedure first uses administrative data to set targets of transfer receipt reflecting the CPS sampling frame, estimates the probability of receipt for households in the CPS, and then imputes transfer receipt based on estimated probabilities until the targets are reached. Replication files provided by the CBO at

Figure 4: Average tax rates and transfers as a share of mean income by log income



Notes: This figure shows average tax rates by log pre-government income (top panels) and transfers as a share of mean pre-government income by log pre-government income (bottom panels) for households with children (left panels) and households without children (right panels). Data are from the CBO and used in the Distribution of Household Income, 2019 report.

calculate transfers and tax credits as a share of mean household income and take averages for each cohort by family structure.[9] Figure 5 shows income from means-tested transfers and tax credits as a share of mean household income by normalized household income bins.

In the first cohort, transfers were relatively low. Single parents in the lowest bin received about 12% of mean household income in transfers per year; married parents in the same income bin received about 7%. The second cohort saw a large expansion of means-tested transfers and tax credits. Adding up all benefits, single parents with the lowest incomes received almost 30% of

https://www.cbo.gov/publication/54234.

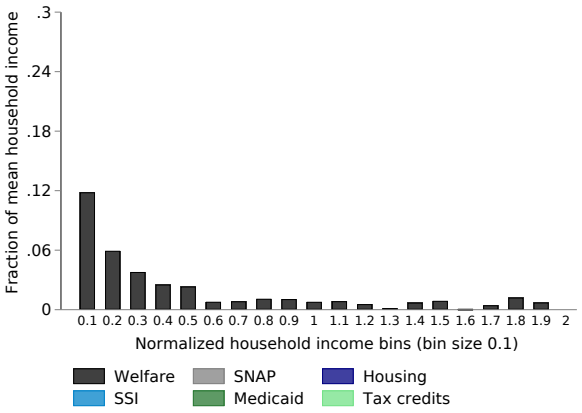
[9]For the first and second cohorts data is only available for 1967-1970 and 1979-1994, respectively, due to availability of transfers in the CPS-ASEC data and through CBO imputations.

mean household income in benefits; married parents 23%. In the final cohort, traditional welfare like AFDC was replaced with Temporary Assistance for Needy Families (TANF), which lowered benefits and instituted time limits and work requirements. Medicaid and SNAP, formerly Food Stamps, saw expanded eligibility and increased participation which made up for the decline in AFDC/TANF usage. Married parents, and families with higher incomes than in prior cohorts, saw increases in benefits from Medicaid and tax credits. Much of the expansion of benefits in the third period went to relatively higher-income families compared to in the second period.

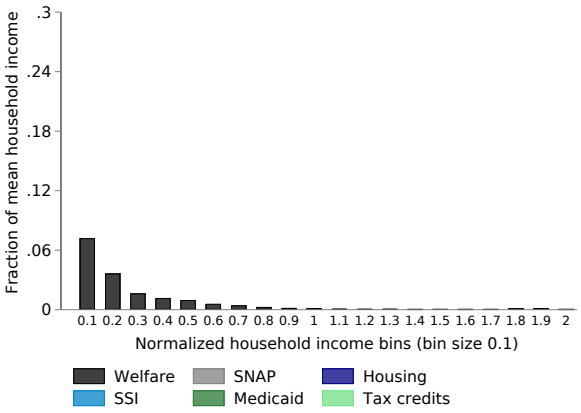
Summing up, means-tested transfers and tax credits in the United States have undergone considerable reforms since the mid-1960s. First, the generosity of means-tested transfers was greatly expanded with additions of Medicaid, Food Stamps, and SSI, adding to existing programs like AFDC. In particular, benefits for single parents increased substantially. Second, with the introductions of the EITC in 1975 and CTC in 1997 plus several expansions to both, tax credits have become more generous across cohorts. Lastly, recent reforms in the 1990s onward led to greater eligibility and benefits for families higher up the income distribution, particularly for families with married parents. These reforms entailed greater emphasis on expanded tax credits for the lowest-income families versus means-tested transfers. My findings coincide with those in Splinter (2020) and Auten and Splinter (2023), who show that redistribution in the United States has risen markedly since the 1960s for both transfers and tax credits, and also with Hoynes and Schanzenbach (2018), who finds much of the recent gains in social safety net spending for children went to relatively better-off families compared to prior cohorts. In the next section I present trends in parental investments.

Figure 5: Transfers and tax credits as share of mean household income by family structure

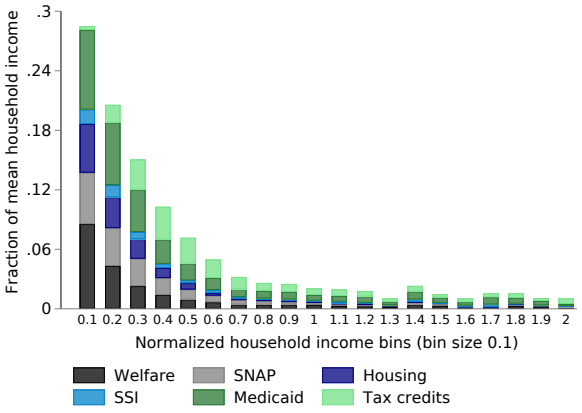
(a) Single parents, 1967-1970



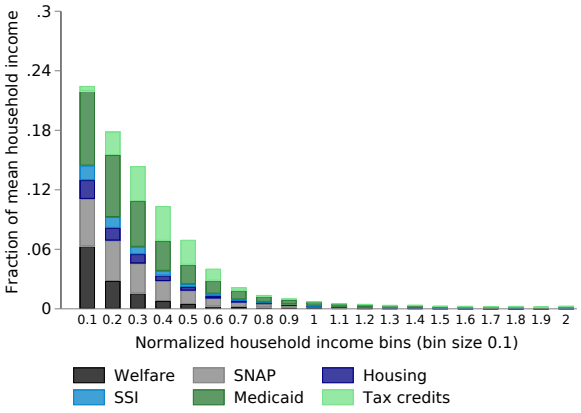
(b) Married parents, 1967-1970



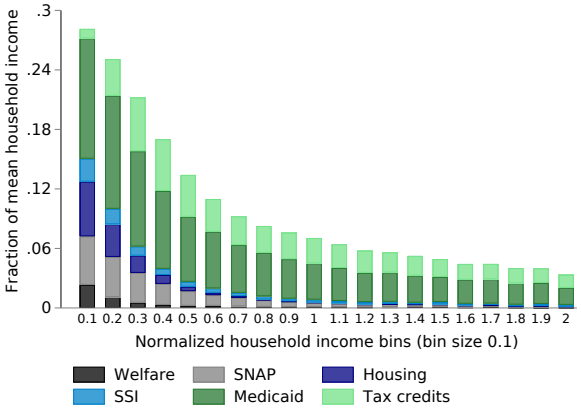
(c) Single parents, 1979-1994



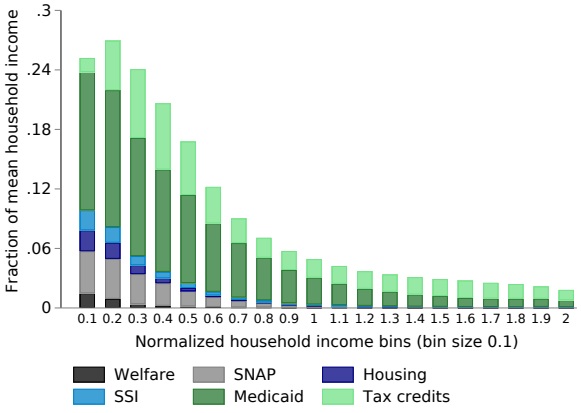
(d) Married parents, 1979-1994



(e) Single parents, 1995-2018



(f) Married parents, 1995-2018



Notes: This figure shows transfers and tax credits as a share of mean household income by normalized household income bins of size 0.1. Data from CPS-ASEC with CBO imputations of means-tested transfers.

2.2 Trends in parental investments

In this section I document growing inequalities in parental human capital investments, analyzing differences in time investments, public education funding, and private education expenditures across families and over time.

2.2.1 Time investments

I draw on two data sets for time investments: the Panel Study of Income Dynamics Child Development Supplement (PSID-CDS) and the American Heritage Time-Use Study (AHTUS). Each data set offers different benefits and drawbacks. The PSID-CDS has detailed household information for children and parents, and collects information for both parents' time investments for a family unit compared to time diaries for individuals, as in the AHTUS. One drawback of the PSID-CDS is the limited number of years it covers, as my sample only has data for 1997 and 2002. A major benefit of the AHTUS, on the other hand is that data goes back to 1965 and has been used to document changes in time investments over time.

Differences in investments by parent human capital

Starting with the PSID-CDS data, I focus on time investments as defined in Caucutt et al. (2020), which includes all activities where children are actively engaging with their parents. These include academic investment activities, health investment activities, play, arts and crafts with household children, sports, talk and listen, eating, socializing, religious activities, volunteering, and other activities.[10]

Table 1: Weekly hours in time investment by parent education and family structure

	All	Less than HS	High school	Some college	College+
Single parents	17.68	16.85	16.24	19.11	19.27
Married parents	32.72	25.92	31.96	31.40	35.47
Total	28.28	21.02	26.37	27.43	33.40

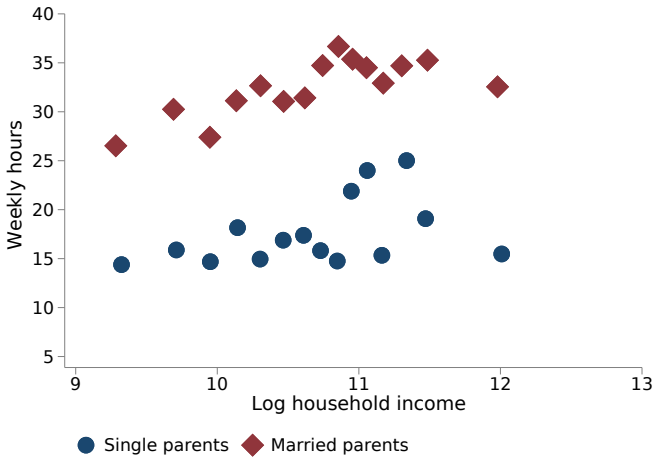
Notes: This table shows average weekly hours in time investment by parent education and family structure in the PSID-CDS 1997, 2002 samples. Activities constituting time investments include academic investment activities, health investment activities, play, arts and crafts with household children, sports, talk and listen, eating, socializing, religious activities, volunteering, and other activities.

Table 1 reports average weekly hours in time investments by family structure and parents' highest education level. First, the results indicate that married parents spend almost twice as much time actively engaging with their children than single parents, on average 33 hours per week versus 18 hours per week. Second, there are positive gradients in investments for parental education.

[10] See Section B of the appendix for their latest working paper.

College-educated married parents spend almost 20 more hours a week in time investment than single parents with less than a high school degree.

Figure 6: Weekly hours in time investment by log income



Notes: This figures shows binned scatter plots of weekly hours in time investment by log household income and family structure in the PSID-CDS 1997, 2002 samples. Activities constituting time investments include academic investment activities, health investment activities, play, arts and crafts with household children, sports, talk and listen, eating, socializing, religious activities, volunteering, and other activities.

A similar pattern emerges when looking at time investments by household income. Figure 6 shows binned scatter plots of weekly hours in time investment versus log household income. The relationship between income and investments is steeper for married parents than single parents, indicating single parents are more limited in their ability to invest more time in their children's human capital despite having higher incomes.

Growing gaps in time investments

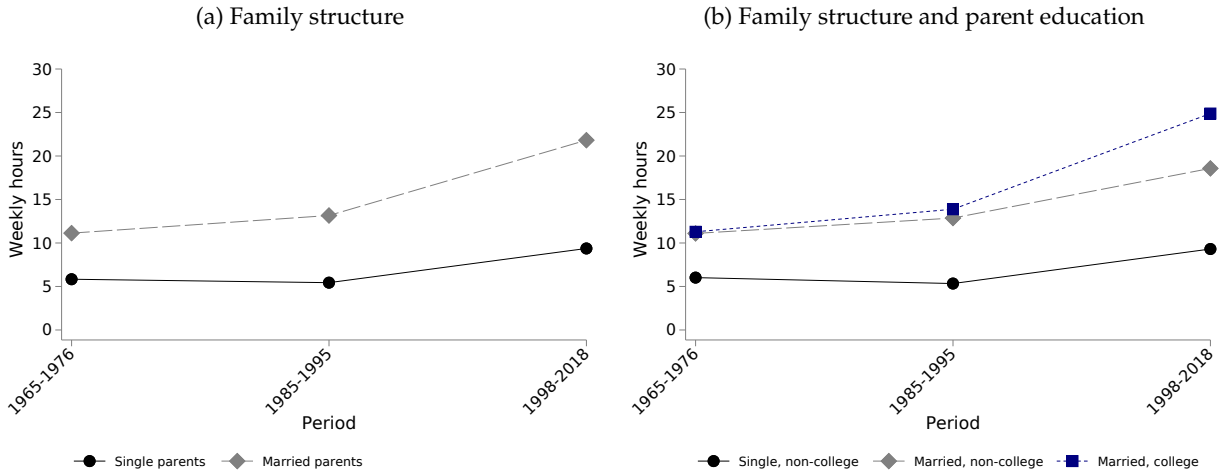
Turning to the AHTUS for trends over time, I evaluate average time investments from parents by family structure and whether they have a college education or not.[11] AHTUS data is not collected for parental units but for individuals, so to construct average hours for married parents I take the average time investment of individual parents who are married for each level of education and multiply by two. Due to smaller sample size, the time periods for this analysis do not line up exactly with the periods described in Section 2.1.[12] Time investments include child care, physical activities, and travel related to childcare.

The results are presented in Figure 7. Panel (a) shows average weekly hours in time investment by family structure. As with the PSID-CDS data, married parents spend roughly twice as much

[11]The AHTUS data has limited information on measures of parent human capital, such as no consistent data on household income across all survey years.

[12]My sample has data for 1965-1966, 1975-1976, 1985, 1992-1995, 1998-2000, 2003-2012, and 2018.

Figure 7: Weekly hours in active time with children by family structure and parent education



Notes: This figure shows average weekly hours in parental time investments over three periods by family structure in Panel (a) and by family structure and educational attainment Panel (b).

time actively engaging with their children, with the gap growing across periods. Panel (b) shows average weekly hours in time investment by family structure and highest parent education, either having a college degree or not.[13] The results show that over time the gap in time investments between single and married parents is driven by growing time investments for college-educated married parents. This is consistent with evidence that documents changing time-use patterns for highly educated parents (Guryan et al., 2008; Ramey and Ramey, 2010).

2.2.2 Education investments

Expenditures on education has grown considerably in the United States since 1947. As a share of personal income, total education expenditures rose from 4.9% in 1947-1970 to 7.1% in 1971-1994 and 7.9% in 1995-2018.[14] However, the amount of education funding children receive in the United States is highly dependent on parental resources. Parents with higher education and income spend a larger amount on their children's education compared to those with less. This holds for both private and public education, where local funding generated largely through property taxes drives variation in public education funding across communities. The United States is somewhat unique in how it funds public education with local funding being such a large component, resulting in a regressive funding system where neighborhoods and communities with higher incomes have more funding for public education per student on average.

[13] Due to small number of single parents with a college degree I do not show time investments for college-educated single parents.

[14] Data are from the US Census, US Federal Budget, Bureau of Economic Analysis, Tax Policy Center, and College Board. See Section A.3 for details.

First I document growing inequality in private education expenditures in the Consumer Expenditure Survey (CEX). Next, I show that public education funding is unequal across school districts using data on district-level expenditures and county characteristics. Due to limited data sources on education expenditures at the household and neighborhood levels before around 1990, the analysis here is limited to the past thirty years or so.

Growing gaps in private education expenditures

Here I analyze education expenditures in the Consumer Expenditure Survey (CEX) across households and over time. The sample covers 1990 to 2019. Table D2 reports summary statistics. My measure of education expenditures combines categories on childcare, schooling, lessons, and reading, and expenditures are adjusted to account for economies of scale in raising children.[15]

I group households by their level of resources with two measures: (1) number and highest education of parents and (2) total expenditure percentile groups. The first set are denoted by 1L, 2L, and 2H, where 1 refers to a single parent, 2 refers to two parents, L refers to less than college, and H college or above. Households of single parents with a college degree or more are excluded due to small sample sizes. The second set are denoted by 0-40p, 40-80p, and 80p+. The first group are those in the bottom 40 percent of households in terms of total expenditures, the second group in the middle 40 percent, and the last group are in the 80th percentile or above.[16]

Lastly, for cleaner comparisons across time, I separate the analysis by child and parent age. The two age groups are denoted as early and late childhood, which capture the bulk of expenditures before reaching college-age.

- Early childhood: households with children 0-7 years old, parents 24-42 years old
- Late childhood: households with children 12-18 years old, parents 36-53 years old

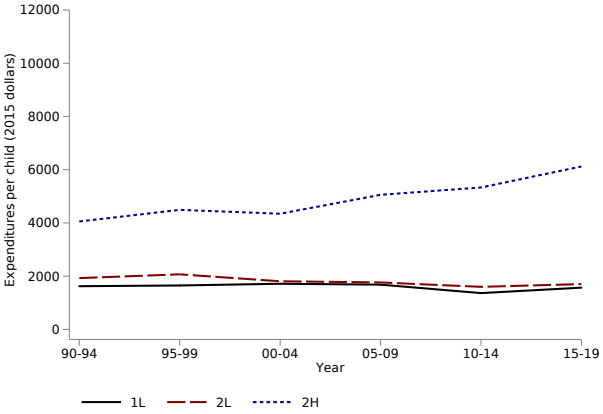
Figure 8 presents expenditures per child during early and late childhood for each resource group. Panels (a) and (c) have groups for number and highest education of parents and Panels (b) and (d) expenditure percentile groups. The top two figures are for early childhood and bottom two for late. In both early and late childhood, parents in the highest-resource groups, 2H and 80p+, are spending a growing amount compared to other households. Expenditures for the four lowest-resource groups are relatively flat or slightly decreasing from 1990 to 2019.

[15] Other studies on child investments include expenditures on all goods and services purchased for children (Carlos Córdoba and Ripoll, 2019; Schoonbroodt, 2018). This paper concerns education and related expenditures. See Section A.5 for descriptions of expenditure categories and adjustment process for number of children.

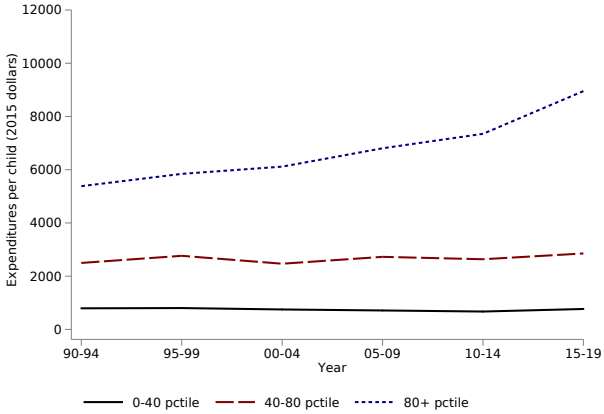
[16] Total expenditure percentiles are calculated each year among all households (with or without children) in the same age ranges for comparing expenditure investments (early and late). The idea behind grouping households by their total expenditure percentile rank is that total expenditure is a closer measure to permanent income than current income. The results similar using income percentiles.

Figure 8: Expenditures per child, early and late childhood

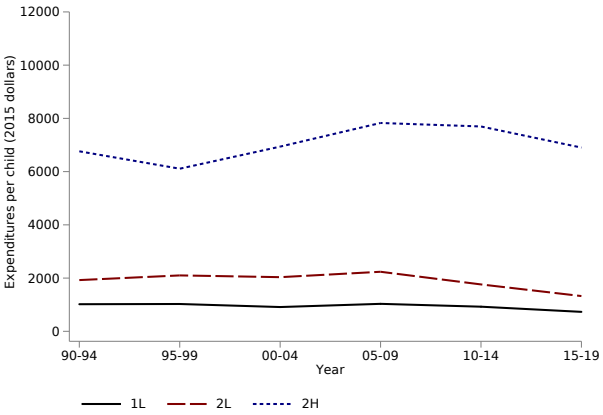
(a) Early: number and highest education of parents



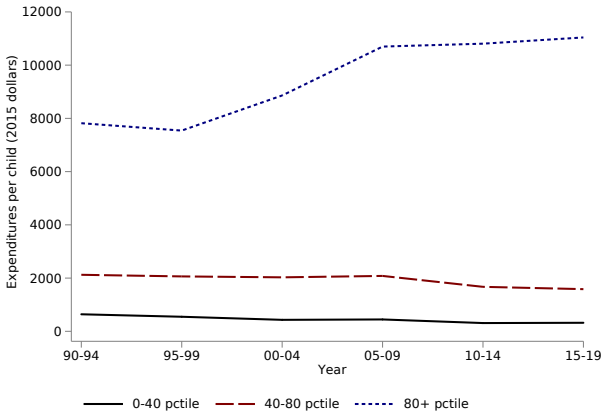
(b) Early: expenditure percentile groups



(c) Late: number and highest education of parents



(d) Late: expenditure percentile groups



Notes: This figure shows expenditures per child in 2015 dollars from the CEX adjusting for the number of children in the household by different family resource groupings. The number and highest education of parents has groups 1L, 2L, and 2H, corresponding to single parents with less than college education; married parents with less than college education; and married parents with a college education or more, respectively. Expenditure percentile groups are 0-40p, 40-80p, and 80p+, corresponding to households in the 0-40 percentile of total expenditures; 40-80 percentile of total expenditures; and 80th percentile and up, respectively. Early childhood sample refers to households with children 0-7 years old, parents 24-42 years old. Late childhood sample refers to households with children 12-18 years old, parents 36-53 years old.

Unequal public education funding

Public education funding in the United States has considerable local and state control. Compared to other countries, the federal government in the United States provides little direct funding for public education (Herrington, 2015). This decentralized system means that where parents live and raise their children is important for the resources and quality of public schools in the area. Empirical evidence indicates families that are able will move to more expensive neighborhoods for the

quality of schools (Goldstein and Hastings, 2019).

The data I use to evaluate district-level public education funding comes from three sources. Data on expenditures and district characteristics come from the Department of Education Common Core of Data (CCD). I use data from the US Census Small Area Income and Poverty Estimates (SAIPE) Program for county median household income and poverty rate to capture economic characteristics of the area. Lastly, I use publicly-available data on county share of single-parent families, share of college educated, and population density from Chetty et al. (2018).

I create binned scatter plots of log expenditures per student versus log county median household income, county share of college-educated, county share of single-parent families. Lastly, I create a binned scatter plot of the district child poverty rate versus the county share of single-parent families. All binned scatter plots control for year fixed effects, share of special education students, and highest grade offered. The results are shown in Figure 9.

The figures show that family resources at the community-level matter substantially for public education funding. Panels (a) and (b) highlight that counties with higher income and more college-educated adults spend considerably more on public schools than those with lower incomes and fewer college-educated adults, between 40 and 50 log points between top and bottom. Panels (c) and (d) show that a higher share of single-parent families is correlated with less public funding per student, driven by the positive relationship between single parenthood and child poverty.

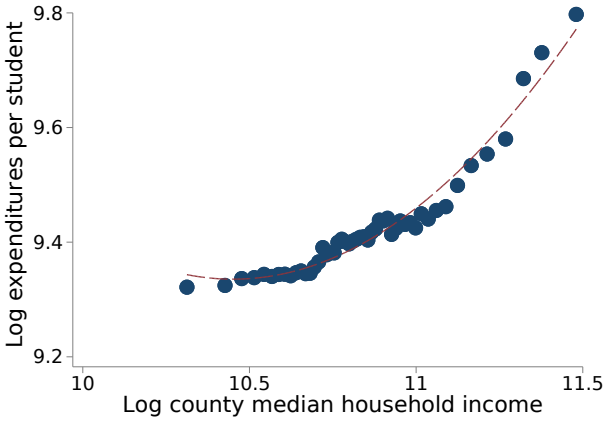
The key takeaway is that expenditure investment gaps have grown over the past thirty years between households of different levels of parental resources. In particular, those with the highest permanent income, captured by total expenditures, are spending both a greater level and share of expenditures on education. These results, including for time investments, build on empirical evidence of widening investments gaps and a greater importance of family characteristics for investments (Guryan et al., 2008; Blandin and Herrington, 2022; Belley and Lochner, 2007).

3 Model

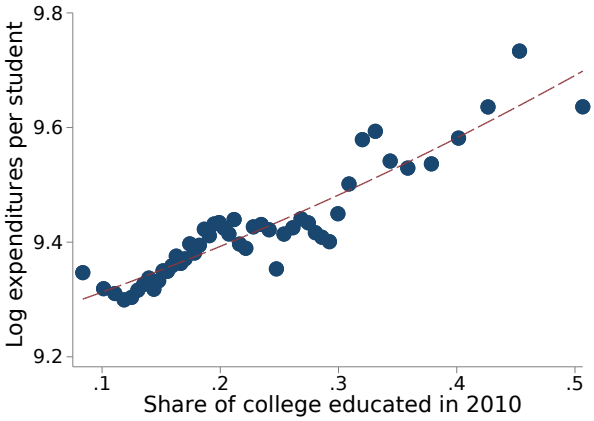
I present the model, characterize equilibrium investments, and discuss implications. The model is then used to quantify the importance of cross-cohort changes in family resources and trends in investments for inequality and intergenerational mobility.

Figure 9: District expenditures per student by county median household income and share of college-educated

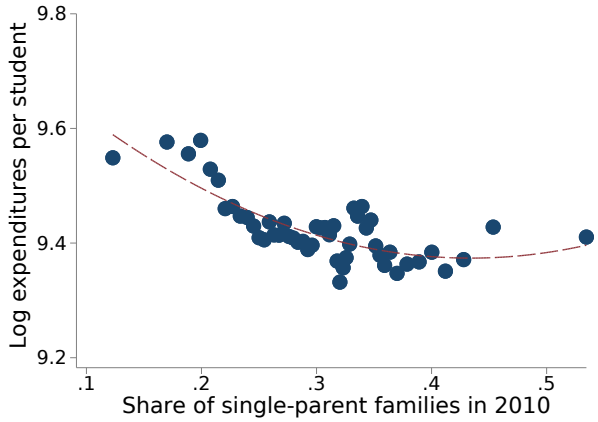
(a) Expenditures and county median household income



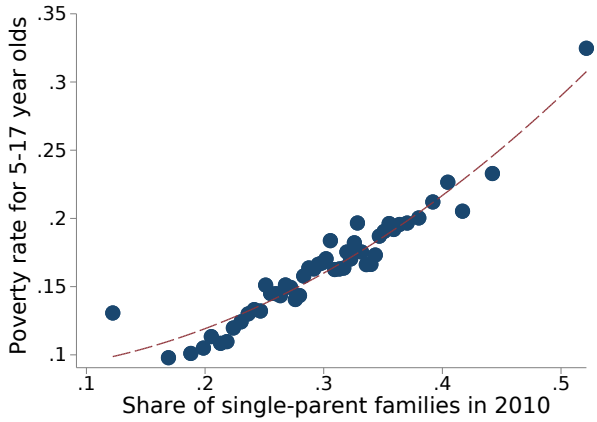
(b) Expenditures and share of college-educated (2010)



(c) Expenditures and share of single parents



(d) Child poverty rate and share of single parents



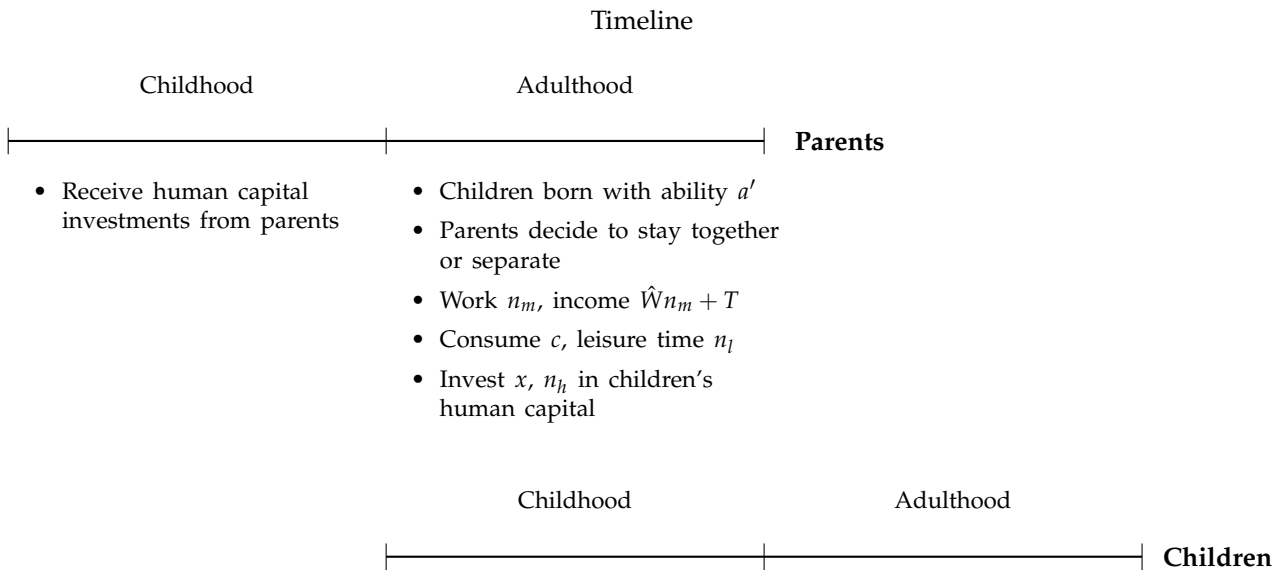
Notes: This figure shows binned scatter plots, controlling for year fixed effects and district share of special education students and highest grade offered, of the relationships between district-level public education expenditures per student, county median household income, share of college-educated residents, and share of single-parent families.

3.1 Environment

3.1.1 Overview

The economy is populated by a continuum of heterogeneous dynasties indexed by $i \in [0, 1]$. Time is discrete, indexed by $t = 0, 1, ...$, where each period is 24 years long. Agents live for two periods of life, one as children and one as parents, so dynasties are sequences of overlapping generations of parents and children. The timeline for dynasties in each period is described below.

Children are passive and receive human capital investments from their parents. Upon reaching



adulthood, new adults have children and then decide to separate or not, determining family structure and available time. Parents then allocate their time between market work, leisure, and time investments, and their expenditures between consumption and education investments.

3.1.2 Child ability and human capital production

Children are endowed with learning ability a_{it+1}, partially inherited from parents according to

$$\log(a_{it+1}) = \underbrace{\zeta \log(a_{it})}_{\substack{\text{Intergenerational} \\ \text{persistence}}} + \underbrace{(1-\zeta)\mu_a}_{\substack{\text{Mean} \\ \text{reversion}}} + \underbrace{\nu_{a_{it+1}}}_{\substack{\text{Ability} \\ \text{shock}}}.$$

The first term captures intergenerational persistence of ability across generations, where ζ is the degree of persistence; the second captures mean reversion; and the third is an iid ability shock.

Human capital is produced combining time ($n_{h_{it}}$) and education (x_{it}) investments via human capital production technology

$$h_{it+1} = H_t(x_{it}, n_{h_{it}}; a_{it+1}, h_{it}). \tag{1}$$

Child ability and parent human capital determine the productivity of human capital development, capturing intergenerational persistence not explained by economic behavior. Parent human capital captures the *human capital production efficiency* of the parents and also the *quality of the home or neighborhood environment*, similar to in Benabou (2002). A key assumption here is that parental human capital increases productivity not only in the labor market but also in the production of children's human capital, a notion going back to Becker (1965). Education can help parents better understand the most effective methods to achieve similar outcomes. Highly educated parents

might be better able to help navigate their children through the school system at various levels and assist with school work of greater complexity (Becker et al., 2018). Whichever the reason, children with highly educated parents are more likely to grow up in an environment conducive to human capital development. Human capital production technology can vary across cohorts[17].

3.1.3 Labor market productivity, wages, and income

Labor market productivity is characterized by parent human capital h_{it}, a permanent income shock ν_{it}, and technology parameter γ_t according to

$$h_{it}^{\gamma_t}\nu_{it}.$$

Permanent income shocks are iid drawn from a log normal distribution with mean one, $\nu_{it} \sim \log\mathcal{N}(\frac{-\sigma_\nu^2}{2}, \sigma_\nu^2)$. The technology parameter γ_t captures cohort-specific returns to human capital. Changes in γ_t represent skill-biased technical change (SBTC). An increase in γ_t disproportionately raises the productivity of high-human capital workers, raising the skewness of the distributions of wages and income.

Wages W_{it} are a combination of labor market productivity and the overall price of effective labor w_t, and capture the permanent component of income

$$\log(W_{it}) = \underbrace{\log(w_t)}_{\substack{\text{Overall price}\\ \text{of labor}}} + \underbrace{\gamma_t \log(h_{it}) + \log(\nu_{it})}_{\substack{\text{Efficiency units}\\ \text{of labor}}}. \tag{2}$$

Hours worked in the market are $n_{m_{it}}$, so a household's (pre-tax) income is $W_{it}n_{m_{it}}$.

3.1.4 Taxes

The government taxes income to finance transfers and tax credits in addition to non-valued government expenditures, totaling G_t. If $W_{it}n_{m_{it}}$ is pre-tax income, then $\hat{W}_{it}n_{m_{it}}$ is after-tax income, where $\hat{W}_{it}$ is the after-tax wage given by

$$\log(\hat{W}_{it}) = \underbrace{\log(\lambda_t(n_{it}))}_{\substack{\text{Governs}\\ \text{tax level}}} + \underbrace{(1-\tau_t(n_{it}))}_{\substack{\text{Governs}\\ \text{progressivity}}}\log(W_{it}). \tag{3}$$

The parameters $\lambda_t(n_{it})$ and $\tau_t(n_{it})$ govern the level and progressivity of taxes, respectively, and

[17]The relationship between parental human capital, human capital production efficiency, and the quality of the home or neighborhood environment can change over time due to changes in parenting styles and neighborhood effects from increasing neighborhood income segregation, that are not modeled here (Doepke and Zilibotti, 2017; Fogli and Guerrieri, 2019).

vary by family structure[18].

Income taxes are

$$[\underbrace{w_t h_{it}^{\gamma_t} \nu_{it}}_{\text{Pre-tax wage}} - \underbrace{\lambda_t (w_t h_{it}^{\gamma_t} \nu_{it})^{1-\tau_t}}_{\text{After-tax wage}}] n_{m_{it}}.$$

3.1.5 Means-tested transfers

The government provides mean-tested transfers T_{it} to lower-income families with children.

$$T_{it} = T_t(W_{it} n_{m_{it}}, n_{it})$$

Transfers decline with household pre-tax income, $W_{it} n_{m_{it}}$, and differ by family structure, which is captured by n_{it}. Two values determine a household's transfers: (1) guaranteed transfer amount, which is how much a family receives in transfers with zero income, and (2) the benefits reduction rate, which is how much transfers decline with income. These values can both vary between single and married parents.

3.1.6 Preferences

Parents have preferences over two objects: current utility u_{it} from consumption and leisure and their children's human capital h_{it+1}. Lifetime utility is a constant elasticity of substitution (CES) aggregator of u_{it} and h_{it+1}

$$\left[\left(u_{it} \right)^{\frac{\rho-1}{\rho}} + \beta \left(h_{it+1} \right)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \tag{4}$$

where β is captures the weight on children's human capital versus current utility and $\rho > 0$ is the elasticity of substitution between child human capital and current utility.

Current utility is a function of effective per-parent consumption and leisure

$$u_{it} = u\left(\frac{c_{it}}{e_c(n_{it})}, n_{l_{it}} \right) \tag{5}$$

where $e_c(n_{it})$ are economies of scale in consumption.

The non-separability of preferences implies parents internalize both their children's learning ability and their own human capital when allocating time and expenditures.

[18] Boerma and Karabarbounis (2021) use a similar tax function, which is a modified tax schedule on wages instead of income as in Benabou (2002) and Heathcote et al. (2017). Guner et al. (2014) estimate parameters for this class of tax functions and find they differ by family structure for the United States.

3.1.7 Family structure

After children are born, new parents make a discrete choice between staying together or separating after receiving a match quality (preference) shock ξ_{it}. The choice is over per-parent expected utility, taking expectations over permanent income shock ν_{it}

$$\max_{M,S} \left\{ \underbrace{(1/2)\mathbb{E}_\nu[V_t(h, 2\bar{n}, \nu, a')] + \xi}_{\text{M = married}}, \underbrace{\mathbb{E}_\nu[V_t(h, \bar{n}, \nu, a')]}_{\text{S = single}} \right\} \tag{6}$$

where V_t is the value function of a family. Preference shocks are drawn from a normal distribution $\xi \sim \mathcal{N}(\mu_{\xi t}, \sigma_{\xi t}|h)$ whose mean and standard deviation can change across cohorts. The change in distribution over time captures trends in unmodeled and non-economic reasons for the rise in single parenthood.[19] Taxes and transfers available for single and married parents affect family formation as the relative economic benefits of staying together or not differs. Preference shocks are correlated with parental human capital, motivated by the negative correlation between single parenthood and income in the data.[20] In each period dynasties are endowed with $2\bar{n}$ units of total parental time. Families with married parents have a time endowment of $n_{it} = 2\bar{n}$. If parents separate, total parental time is divided between custodial and non-custodial parents such that a family's time endowment is $n_{it} = \bar{n}$ and non-custodial parent's time endowment is $n_{it}^{nc} = \bar{n}$.

3.1.8 Parent's problem

Parents enter the decision stage with state vector $\{h_{it}, n_{it}, \nu_{it}, a_{it+1}\}$ and choose $\{n_{m_{it}}, n_{l_{it}}, n_{h_{it}}, c_{it}, x_{it}\}$ to solve the following problem

$$\begin{aligned} V_t(h_{it}, n_{it}, \nu_{it}, a_{it+1}) = \max_{\substack{n_{m_{it}}, n_{l_{it}}, n_{h_{it}} \\ c_{it}, x_{it}}} & \left[\left(u_{it}\right)^{\frac{\rho-1}{\rho}} + \beta \left(h_{it+1}\right)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \\ \text{s.t. } & n_{it} = n_{m_{it}} + n_{l_{it}} + n_{h_{it}} \\ & p_{ct} c_{it} + p_{xt} x_{it} = \hat{W}_{it} n_{m_{it}} + T_{it} \\ & u_{it} = u\left(\frac{c_{it}}{e_c(n_{it})}, n_{l_{it}}\right) \\ & h_{it+1} = H_t(x_{it}, n_{h_{it}}; a_{it+1}, h_{it}) \end{aligned} \tag{7}$$

[19] Ellwood and Jencks (2004) suggest single parenthood increased due to a combination of changes in contraceptive technology, evolving attitudes towards non-marital sex and births, and dramatic shifts in gender roles and expectations surrounding maternal employment coupled with declining economic opportunity for less-educated men. Moffitt (1998) finds a weakly positive relationship between the expansion of welfare during the 1960s and single parenthood.

[20] There is no child support or visitation for non-custodial parents; non-custodial parents solve a consumption-leisure problem independently and are not involved in the children's lives going forward. See Section B.1 for the non-custodial parents problem.

3.1.9 Sectoral production

There are two sectors, consumption (c) and education (x). Production technology in each sector is linear in efficiency units of labor. Output is given by $Y_{jt} = A_{jt}Z_{jt}$, where A_{jt} is productivity for sector j and Z_{jt} is total efficiency units of labor. The price for sector j goods and services is p_{jt}, and the overall price of effective labor is w_t, equalized across sectors due to labor mobility.

Taking prices as given, the firm's profit maximization problem in sector $j \in \{c, x\}$ is

$$\max_{Z_{jt}} \; p_{jt}A_{jt}Z_{jt} - w_t Z_{jt}$$

In equilibrium, sectoral prices are given by

$$p_{jt} = \frac{w_t}{A_{jt}} \implies \frac{p_{xt}}{p_{ct}} = \frac{A_{ct}}{A_{xt}}$$

Thus, if A_{ct} grows faster than A_{xt}, the relative price of education will rise over time.

3.1.10 Equilibrium

The formal definition of equilibrium is stated in Section B.3.

3.2 Equilibrium allocations

In this section I specify functional forms for current utility and human capital production technology and derive equilibrium allocations for investments in closed-form. I then show under household optimality how dynasty human capital evolves over time and the impact family resources, prices, policy, and technology have on dispersion and persistence of wages.

3.2.1 Functional forms

Current utility u_{it} is a Cobb-Douglas function of effective per-parent consumption $\frac{c_{it}}{e_c(n_{it})}$ and leisure $n_{l_{it}}$, given by

$$u_{it} = \left[\frac{c_{it}}{e_c(n_{it})}\right]^{\psi} n_{l_{it}}^{1-\psi}, \tag{8}$$

where ψ governs the importance of consumption relative to leisure and $e_c(n_{it})$ are economies of scale in consumption.

The technology for human capital production is

$$h_{it+1} = a_{it+1} h_{it}^{\eta_t} (x_{it})^{\phi} n_{h_{it}}^{1-\phi}, \tag{9}$$

where ϕ governs the importance of education investments relative to time investments and η_t is the elasticity of child's human capital with respect to parent's. When η_t is combined with parental human capital it forms parents' human capital production efficiency $h_{it}^{\eta_t}$.[21] While Cobb-Douglas technology with constant returns to scale is somewhat restrictive, it allows to maintain tractability and includes complementarities between investments.

3.2.2 Optimal investments

Building on Benabou (2002), this model has closed form solutions for parental investments, child human capital, and inequality. In this section I explore these analytical results and use them to derive intuition about the key mechanisms of the model. Throughout, I focus on the case $\rho > 1$ and $\psi > \phi$, which is consistent with the full calibrated version of the model below.

Denote relative expenditures of education to consumption as $\theta \equiv \frac{p_x x}{p_c c}$. Under household optimality, θ is given by

Relative expenditures

$$\log(\theta_{it}) = \Gamma + \underbrace{(\rho-1)\log(a_{it+1})}_{\text{Child ability}} + \underbrace{(\rho-1)\log(h_{it}^{\eta_t}) - (\psi-\phi)(\rho-1)\log(\hat{W}_{it})}_{\text{Parent human capital production efficiency and after-tax wage}} + \underbrace{\psi(\rho-1)\log(e_c(n_{it}))}_{\text{Economies of scale}} - \underbrace{\phi(\rho-1)\log(p_{xt})}_{\text{Price of education}} + \underbrace{\psi(\rho-1)\log(p_{ct})}_{\text{Price of consumption}} \tag{10}$$

This relation shows many of the trade-offs parents face when deciding between investments versus consumption and leisure. Because parents internalize their children's learning ability and their own human capital production efficiency, they will invest more if their children has high ability

[21] Human capital production efficiency also captures the quality of the home or neighborhood environment, i.e. how conducive the children's environment is to human capital development. Changes in η_t represent unmodeled changes in the mapping between a parent's human capital and the parent's human capital production efficiency. This includes factors like parenting quality, parenting styles, and neighborhood quality, all positively correlated with parent human capital (Reeves and Howard, 2013; Fogli and Guerrieri, 2019). Doepke and Zilibotti (2017) shows there have been broad changes towards more effective parenting styles since the 1960s, with greater uptake by highly educated parents. See Section D.2 for more discussion and empirical evidence on parenting styles. Trends at the neighborhood level indicate less diverse communities in terms of socioeconomic background due to an increase in income segregation (Reardon and Bischoff, 2011). Fogli and Guerrieri (2019) find that inequality and income segregation amplify each other because of local spillovers from neighborhood peer effects that change returns to education. Rising income segregation means that children are growing up in more unequal communities in terms of neighborhood and peer quality. Greater income segregation is correlated with lower mobility for an area Chetty et al. (2014). These effects combined steepen the relationship between parent human capital and human capital production efficiency. Human capital production efficiency, along with child ability, determine the productivity of human capital development.

and/or they have high human capital, all else equal. These two effects, the *child ability* and *human capital production efficiency* effects, work to offset substitution effects of after-tax wages and prices. This is consistent with parental investments in the data – parents with higher human capital tend to investment more in their children's development.

Equation 10 also highlights how tax progressivity affects parental investments. For instance, if there is an increase in tax progressivity such that after-tax wages are now higher than pre-tax wages due to a wage subsidy for lower-income families, then the substitution effect of after-tax wages will be larger, leading to less investment for parents in lower-income families. The main channel for this reduction in investments is through a lower relative return to time investments compared to market work. Agostinelli and Sorrenti (2022) find evidence that expansions of the EITC in the 1990s had unintended negative effects on child development. Their results indicate that higher returns to working from the expanded tax credit lead to greater labor supply and a decline in the amount and quality of time investments.[22]

Turning to education and time investments in Equations 11 and 12, tax progressivity and the generosity of means-tested transfers have important implications for parental investments. Since investments depend on total available family resources, which is the full value of parents' time priced at their after-tax wage plus the amount received in transfers, policy design directly affects how much parents invest by altering total family resources through transfers and taxes. First, transfers produce an income effect, leading to more investments if a family receives benefits. Second, after-tax wages produce both a substitution and income effect. Note that for time investments the substitution effect of after-tax wages is substantially higher than for education investments and more closely-tied to a family's wage. While the substitution effect of education prices is higher for education than for time investments, an increase in the price of education leads to almost uniform declines in investments across all families. Whichever effects dominate depends on the level of tax progressivity and shape of transfer functions for different family types. This suggests there should be more debate on how to design assistance programs for disadvantaged families to support child development (Agostinelli and Sorrenti, 2022).

[22] Kalil et al. (2022) also finds declines in parenting quality but no significant change in hours.

Education investments

$$\log(x_{it}) = \Lambda + \underbrace{(\rho-1)\log(a_{it+1})}_{\text{Child ability}} + \underbrace{(\rho-1)\log(h_{it}^{\eta_t})}_{\substack{\text{Human capital}\\ \text{production efficiency}}} - \underbrace{(\psi-\phi)(\rho-1)\log(\hat{W}_{it})}_{\text{After-tax wage}}$$
$$+ \underbrace{\log(\hat{W}_{it}n_{it}+T_{it})}_{\text{Total available resources}} + \underbrace{\psi(\rho-1)\log(e_c(n_{it}))}_{\text{Economies of scale}} - \underbrace{\log(\phi+\psi\theta_{it})}_{\substack{\text{Relative}\\ \text{expenditures}}} \tag{11}$$
$$- \underbrace{[1+\phi(\rho-1)]\log(p_{xt})}_{\text{Price of education}} + \underbrace{\psi(\rho-1)\log(p_{ct})}_{\text{Price of consumption}}$$

Time investments

$$\log(n_{h_{it}}) = \Sigma + \underbrace{(\rho-1)\log(a_{it+1})}_{\text{Child ability}} + \underbrace{(\rho-1)\log(h_{it}^{\eta_t})}_{\substack{\text{Human capital}\\ \text{production efficiency}}} - \underbrace{[1+(\psi-\phi)(\rho-1)]\log(\hat{W}_{it})}_{\text{After-tax wage}}$$
$$+ \underbrace{\log(\hat{W}_{it}n_{it}+T_{it})}_{\text{Total available resources}} + \underbrace{\psi(\rho-1)\log(e_c(n_{it}))}_{\text{Economies of scale}} - \underbrace{\log(\phi+\psi\theta_{it})}_{\substack{\text{Relative}\\ \text{expenditures}}} \tag{12}$$
$$- \underbrace{[\phi(\rho-1)]\log(p_{xt})}_{\text{Price of education}} + \underbrace{\psi(\rho-1)\log(p_{ct})}_{\text{Price of consumption}}$$

Further, single parenthood affects investments in two ways. First, due to economies of scale in consumption, married parents are able to allocate more resources towards investments as they do not need exactly double the amount of consumption as two single adults. This is reflected in relative expenditures in Equation 10 and for investments in Equations 11 and 12. Second, family structure results in lower total available resources for investments compared to married parents with similar attributes, constraining the level of investments significantly. Thus, if a dynasty experiences single parenthood it can have persistent effects for future generations. This coupled with the higher probability of single parenthood for those with lower human capital can result in poverty traps.

3.3 Implications for inequality and mobility

Taking optimal investments in Equations 11-12 and inputting into the human capital production function gives the law of motion for dynasty human capital in Equation 13. The evolution of human capital naturally depends on family heterogeneity and trade-offs discussed for relative expenditures and investments.

Law of motion for dynasty human capital

$$\begin{aligned}\log(h_{it+1}) = \Psi &+ \underbrace{\rho \log(a_{it+1})}_{\text{Child ability}} + \underbrace{\rho\eta_t \log(h_{it}) - [(\psi-\phi)\rho + (1-\psi)]\log(\hat{W}_{it})}_{\text{Parent human capital and after-tax wage}} \\ &+ \underbrace{\log(\hat{W}_{it} n_{it} + T_{it})}_{\text{Total available resources}} + \underbrace{\psi(\rho-1)\log(e_c(n_{it}))}_{\text{Economies of scale}} - \underbrace{\log(\phi + \psi\theta_{it}(\mathcal{S}_{it}))}_{\text{Relative expenditures}} \\ &- \underbrace{\phi\rho \log(p_{xt})}_{\text{Price of education}} + \underbrace{\psi(\rho-1)\log(p_{ct})}_{\text{Price of consumption}}\end{aligned} \tag{13}$$

where $\mathcal{S}_{it} = (\hat{W}_{it}, h_{it}^{\eta_t}, n_{it}, a_{it+1}; p_{xt}, p_{ct})$.

Importantly, Equation 13 demonstrates how family resources of previous cohorts – determined by family heterogeneity, prices, technology, and policy – impacts dispersion and intergenerational persistence of wages (i.e. the permanent component of income) for the next cohort through the mapping of human capital to wages.

Log wages for individuals in cohort $t+1$ are

$$\log(W_{it+1}) = \log(w_{t+1}) + \gamma_{t+1}\log(h_{it+1}) + \log(\nu_{it+1}),$$

with variance

$$\sigma^2_{Wt+1} = \gamma^2_{t+1}\boxed{\sigma^2_{ht+1}} + \sigma^2_\nu. \tag{14}$$

Taking the variance over Equation 13 gives the variance of log human capital

$$\begin{aligned}\sigma^2_{ht+1} = &\underbrace{\rho^2\sigma^2_a}_{\text{Variance of ability}} + \underbrace{\rho^2\eta_t^2\sigma^2_{ht} + [(\psi-\phi)\rho + (1-\psi)]^2\sigma^2_{\hat{W}t}}_{\text{Variance of parent human capital and after-tax wages}} \\ &+ \underbrace{\sigma^2_{(\hat{W}n+T)t} + \psi^2(\rho-1)^2\sigma^2_{e_c(n)t}}_{\text{Variance of total available resources and economies of scale}} + \underbrace{\sigma^2_{(\phi+\psi\theta)t}}_{\text{Relative expenditures}}\end{aligned} \tag{15}$$

Prior cohorts' distributions of human capital, after-tax wages, and total family resources are important for wage dispersion for subsequent cohorts. Family structure also plays a direct role through economies of scale, further amplifying investment differences between single and married parents. Note that the price of education only enters through the final term related to relative expenditures. Relative expenditures are small compared to ψ and ϕ, so the variance of $\log(\psi + \phi\theta_{it})$, and prices, is likely not a major driving force of inequality.

Lastly, taking the law of motion for dynasty human capital in Equation 13 and applying it to log wages gives the relationship between child and parent wages, shown in Equation 16. This relationship details how various factors affect intergenerational persistence. Note the importance of SBTC, a key driver of changes in persistence across cohorts like for inequality.

Relationship between child and parent wages

$$
\begin{aligned}
\log(W_{it+1}) = \Psi &+ \underbrace{\log(w_{t+1}) - \gamma_{t+1}\frac{\rho\eta_t}{\gamma_t}\log(w_t)}_{\text{Overall price of labor}} + \gamma_{t+1}\underbrace{\Big[\psi(\rho-1)\log(p_{ct}) - \phi\rho\log(p_{xt})\Big]}_{\text{Consumption and education prices}} \\
&+ \gamma_{t+1}\Big[\underbrace{\rho\log(a_{it+1})}_{\text{Ability}} + \underbrace{\psi(\rho-1)\log(e_c(n_{it}))}_{\text{Economies of scale}}\Big] \\
&+ \gamma_{t+1}\underbrace{\Big[\frac{\rho\eta_t}{\gamma_t}\log(W_{it}) - [(\psi-\phi)\rho + (1-\psi)]\log(\hat{W}_{it})\Big]}_{\text{Pre- and post-tax wages}} \\
&+ \gamma_{t+1}\Big[\underbrace{\log(\hat{W}_{it}n_{it} + T_{it})}_{\text{Total resources}} - \underbrace{\log(\phi + \psi\theta_{it}(\mathcal{S}_{it}))}_{\text{Relative expenditures}}\Big] \\
&+ \underbrace{\log(\nu_{it+1}) - \gamma_{t+1}\frac{\rho\eta_t}{\gamma_t}\log(\nu_{it})}_{\text{Permanent income shocks}}
\end{aligned}
\tag{16}
$$

where $\mathcal{S}_{it} = (\hat{W}_{it}, h_{it}^{\eta_t}, n_{it}, a_{it+1}; p_{xt}, p_{ct})$.

Equation 16 highlights how differently wages evolve for dynasties. Due to heterogeneity across families, including for policy treatment, the mapping from parent to child wages varies due to family characteristics, and in the aggregate, is influenced by factors that affect the distribution of family resources and trade-offs to parental investments versus working, consumption, and leisure. Mobility at different points of distribution can be affected by targeted policy. This implies a potentially important channel for affecting long-run inequality and intergenerational mobility by considering differential impacts of policy on parental investments across families. Specifically, policy can be targeted more effectively towards lower-income families to create the right incentives for greater investments.

4 Quantitative analysis

I first describe the parameterization of the model. Next I evaluate how well the model accounts for trends in family structure, parental investments, inequality, and mobility. Finally, I conduct counterfactual experiments for alternative scenarios of changes in family resources. The experiments quantify how changes in family resources and trade-offs to investments contributed to or mitigated the rise in income inequality and intergenerational persistence.

4.1 Parameterization

The parameterization of the model involves setting several parameters external to the model and then jointly calibrating remaining parameters to minimize the distance between simulated moments from the model and targeted moments from the data.

4.1.1 Parameters set outside the model

A model period is 24 years long with periods corresponding to (1) 1947-1970, (2) 1971-1994, and (3) 1995-2018. The available time per parent is $\bar{n} = 112$ hours, giving 224 total available hours for each set of parents.[23] Economies of scale $e_c(n)$ = 1.34 are set to the mean of estimated household equivalence scales for a family of two from Table 1 in Fernández-Villaverde and Krueger (2007).

Relative prices in the model are given by

$$\frac{p_{xt}}{p_{ct}} = \frac{A_{ct}}{A_{xt}}.$$

For relative sectoral productivity, $\frac{A_{ct}}{A_{xt}}$, I take the Personal Consumption Expenditures Price Index (PCEPI) for *Education services*, divide by the PCEPI for overall prices, and normalize such that relative productivity (i.e. relative prices) for 1947-1970 equal 1. I take averages for each period:

$$\left\{\frac{A_{ct}}{A_{xt}}\right\}_t = \{1, 1.51, 3.47\}.$$

Table 2: Tax progressivity parameters

Cohort	**Single parents**	**Married parents**	**Non-custodial parents**
1947-1970	0.05	0.08	0.07
1971-1994	0.06	0.10	0.07
1995-2018	0.13	0.15	0.07

To estimate tax parameters by family structure I draw on data from the CPS-ASEC as described in Section 2.1, using information on pre-tax income, tax liabilities at the federal and state level, payroll taxes, tax credits, and hours worked. The estimates come from regressions of log after-tax wages on log pre-tax wages for each family type in every year, and take averages of estimates for the three periods corresponding to the model. Since the CPS-ASEC data on taxes and tax credits is only available from 1991 onward, I impute back to 1960 by taking a similar estimate of tax progressivity from Feenberg et al. (2017) and assuming that tax progressivity starts deviating for households with children in the late 1980s.[24] The imputed values take estimates from the above

[23] Available time per parent is set to the number of hours parents are available in a week for work, leisure, and time investments (16 hours per day) allowing personal time of 8 hours per day.

[24] See Figure C1 in Section C.1.

regressions and follow the same path backward in time as the tax progressivity estimates from Feenberg et al. (2017). Estimates for $\tau_t(n)$ fed into the model are in Table 2.[25] Tax progressivity increased markedly for households with children in the final period with expansions of tax credits.

Transfers $T_{it} = T_t(W_{it}n_{m_{it}}, n_{it})$ take the following form

$$\begin{aligned} T_t(W_{it}n_{m_{it}}, n_{it}) &= G_t(n_{it}) && \text{if } G_t(n_{it}) - r_t(n_{it})W_{it}n_{m_{it}} > 0 \\ &= 0 && \text{if } G_t(n_{it}) - r_t(n_{it})W_{it}n_{m_{it}} \leq 0 \end{aligned}$$

$G_t(n_{it})$ is the guaranteed transfer amount and $r_t(n_{it})$ is the benefit reduction rate, both differing for single and married parents, and $W_{it}n_{m_{it}}$ is pre-tax income. If a family receives a positive transfer, their after-tax wage is $\hat{W}_{it} = \lambda_t(W_{it})^{1-\tau_t} - r_t W_{it}$ to incorporate the benefit reduction rate $r_t(n_{it})$. I estimate the guaranteed transfer amounts and benefit reduction rates using CPS-ASEC data as described in Section 2.1.3. First, I normalize household income and transfers by mean household income in each year then regress normalized transfers on normalized household income for each period. As the data corresponds to annual income and transfers, I divide normalized transfers by 4 = (6 years receiving benefits/24 year periods), as households who ever receive transfers participate in means-tested transfer programs for about six years over their lifetime on average (Pavetti, 1996). Estimated transfer functions are shown in Figure C3, which display the benefits families receive by normalized pre-tax and transfer household income.

4.1.2 Joint calibration of remaining parameters

Here I discuss joint calibration of the remaining parameters. There are seven parameters fixed across all cohorts $(\beta, \rho, \phi, \psi, \sigma_\nu, \sigma_a, \zeta)$, five parameters that vary across cohorts $(w_t, \gamma_t, \eta_t, \mu_{\xi t}, \varrho_t)$, and the mean and standard deviation of the initial distribution of parent human capital, assumed log normal (μ_{h0}, σ_{h0}). First I make distributional assumptions and then discuss joint calibration procedure.

Distributional assumptions

Initial distributions of human capital and ability correlated. I use a Gaussian copula to derive a joint distribution with dependence parameter r within the model.

$$\begin{bmatrix} h_{i0} \\ a_{i0} \end{bmatrix} \sim \log N(\boldsymbol{\mu_0}, \boldsymbol{\Sigma_0})$$

Process for generating the initial distributions of parent human capital and ability is the following

1. Draw two samples from from a standard normal distribution, $\{s^1_{i0}\}, \{s^2_{i0}\}$

[25] The parameters for the level of taxes by family structure $(\lambda_t(n))$ are set in the model such that total taxes as a share of income are 11.5 percent, which is the average of ratio personal current taxes to personal income from NIPA Table 2.1 from the Bureau of Economic Analysis.

2. Generate initial distribution of log ability such that $\log(a_{i0}) = \mu_a + \sigma_a s^1_{it}$

3. Initial human capital (correlated with ability) s.t. $\log(h_{i0}) = \mu_{h0} + \sigma_{h0} \cdot \left(\varrho_a s^1_{it} + \sqrt{1-\varrho_a^2} s^2_{it}\right)$

where (μ_a, σ_a) are the mean and standard deviation of log ability and (μ_{h0}, σ_{h0}) the mean and standard deviation of initial log human capital, to be estimated jointly.[26]

For the match quality preference shocks, I first set the standard deviation as half of the mean $\sigma_{\xi t} = (1/2)\mu_{\xi t}$. Match quality preference shocks for family formation are assumed correlated with human capital $\xi_{it} \sim N(\mu_{\xi t}, \sigma^2_{\xi t}|h)$ to capture the negative relationship between single parenthood and human capital. The dependence parameter is ϱ_t can vary across periods. The process for using a Gaussian copula to derive the joint distribution is

1. Standardize the distribution of log human capital, which is approximately normal, to have mean zero and standard deviation one $\log(\bar{h}_{it}) = (\log(h_{it}) - \mu_{ht})/\sigma_{ht}$

2. Draw sample from a standard normal distribution for all households $\epsilon_{it} \sim \mathcal{N}(0,1)$

3. Preference shocks are constructed as $\xi_{it} = \mu_{\xi t} + \sigma_{\xi t} \cdot \left(\varrho_t \log(\bar{h}_{it}) + \sqrt{1-\varrho_t^2}\epsilon_{it}\right)$

Ability shocks drawn from stationary distribution, $\nu_{a_{it+1}} \sim \mathcal{N}(0, (1-\zeta^2)\sigma_a^2)$. Learning ability is distributed log normal with mean equal to 1, such that $a_{it+1} \sim \log\mathcal{N}(\frac{-\sigma_a^2}{2}, \sigma_a)$. Permanent income shocks are drawn $\nu_{it} \sim \log\mathcal{N}(\frac{-\sigma_\nu^2}{2}, \sigma_\nu^2)$. In each period human capital is normalized to have the same mean.

Minimum distance estimation

Here I describe the joint calibration procedure for the remaining parameters: seven parameters that are fixed across cohorts $(\beta, \rho, \phi, \psi, \sigma_\nu, \sigma_a, \zeta)$, five time-varying parameters $(w_t, \gamma_t, \eta_t, \mu_{\xi t}, \varrho_t)$, and the mean and standard deviation of the initial distribution of parent human capital, assumed log normal (μ_{h0}, σ_{h0}). To estimate the remaining parameters I minimize the sum of squared percentage differences between simulated moments from the model and targeted moments from the data. The moments I target relate to single parenthood, the distribution of family income, and investments. When setting parameters I do not target investments by family structure. The targeted moments are chosen such that the model captures key aspects of single parenthood, the family income distribution, and investments for the United States during periods 1947-1970, 1971-1994, and 1995-2018.

Targeted moments for single parenthood are the average share of single-parent families and the correlation between (pre-tax and transfer) log household income in each period. The share of single-parent families is calculated using data from US Census Table FM-1 and is most closely

[26] Correlation = 0.3 from NLSY data on log wages and AFQT score.

related to $\mu_{\xi t}$, the mean of match quality preference shocks. The correlation of single parenthood with log household income comes from the CPS-ASEC and is most closely associated with ϱ_t, the dependence parameter for match quality preference shocks.

Moments for the distribution of family income are mean family income (weekly), Gini coefficient of family income, P95-P20 ratio of family income, the share of income variance due to permanent factors for 1971-1994, and the IGE of family income in 1971-1994 and 1995-2018.[27] I target mean family income in each period for mean log human capital in the initial period and the overall price of labor for the second and third periods. For the standard deviation of log human capital in the initial period and standard deviation of log ability I target the Gini coefficient for family income. For the returns to human capital for wages, captured by γ_t, I target the P95-P20 ratio for family income as increases in γ_t skew the income distribution. The standard deviation of permanent income shocks, σ_ν, determines the variation in the permanent component of income after reaching adulthood not due to human capital, so I target the estimated share of income variance due to permanent factors from Huggett et al. (2011), which corresponds most closely to the second period of my model. Lastly, for the intergenerational persistence of ability I target the IGE of family income in the second and third periods from Aaronson and Mazumder (2008), which correspond to their estimates for 1980 and 2000.

Table 3: Cohort-invariant parameters

Parameter	Description	Value
β	Weight on children's human capital in preferences	0.21
ρ	Elasticity of substitution between current utility and child human capital	2.29
ϕ	Importance of education investments for human capital production	0.18
ψ	Importance of consumption for current utility	0.34
σ_ν	Standard deviation of log permanent income shocks	0.46
σ_a	Standard deviation of log ability	0.15
ζ	Intergenerational persistence of ability	0.32

The moments targeted for investments and labor supply are aggregate relative expenditures of education versus consumption $\frac{\sum p_x x}{\sum p_c c}$, the elasticity of education expenditures to income, the ratio of mean time investments between the highest and lowest human capital quintile, average time investment share, and the average market hours share.[28] The parameter β is the weight on chil-

[27] The first three family income distribution moments are calculated from US Census data: Table F-5, Table F-4, and Table F-1, respectively. The share of income variance due to permanent factors for 1971-1994 comes from Huggett et al. (2011), who estimate the share of lifetime income variance attributed to permanent factors on data from 1969-2004. The IGE of family income for 1971-1994 and 1995-2018 cohorts are estimates of the IGE of family income for 1980 and 2000, respectively, from Table 1, Column (2) from Aaronson and Mazumder (2008).

[28] Aggregate relative expenditures are total public and private education expenditures divided by Personal Consumption Expenditures from the Bureau of Economic Analysis. See Section A.3 for details. The elasticity of education expenditures to income is an average of estimated public and private education expenditure elasticities. See Section C.1 under **Elasticity of education expenditures**. The ratio of mean time investments between the highest and lowest human capital quintile comes from the PSID-CDS but instead of human capital quintiles is calculated as the ratio of average time investments for college educated parents versus parents with less than a high school education. Average

dren's human capital in preferences so I target the ratio of education expenditures to consumption expenditures. The target moment for the elasticity of substitution between current utility and child human capital (ρ) is the ratio in average time investments for college-educated parents compared to parents with less than a high school degree (highest and lowest human capital quintiles in the model). Equation 12 indicates parents with higher human capital will spend more time on time investments if $\rho > 1$ (i.e. substitutes). The parameter ϕ captures the importance of education investments compared to time investments, $1 - \phi$, and I target the mean time investment share for families. Similarly, for ψ, the importance of consumption in current utility, I target the average market time share for families.

Table 4: Cohort-specific parameters

Parameter	Description	Cohort	Value
μ_{h0}	Mean and standard deviation of	1947-1970	4.41
σ_{h0}	log human capital for initial cohort		0.73
w_t	Overall price of effective labor	1947-1970	1.00
		1971-1994	0.98
		1995-2018	0.76
γ_t	Elasticity of human capital to wages	1947-1970	0.57
		1971-1994	0.69
		1995-2018	0.81
η_t	Elasticity of parent to child human capital	1947-1970	0.25
		1971-1994	0.35
		1995-2018	0.44
$\mu_{\xi t}$	Mean of match quality shocks	1947-1970	41.00
		1971-1994	36.00
		1995-2018	33.00
ϱ_t	Correlation coefficient for match quality shocks	1947-1970	0.44
		1971-1994	0.19
		1995-2018	0.23

The estimated parameter values are listed in Tables 3 and 4. There are a few worth noting. First, the elasticity of substitution ρ is estimated greater than one (2.29), indicating that current utility and child human capital are substitutes in parents' lifetime utility. This means that parents with higher human capital will invest more in their children's development compared to parents with lower human capital, as shown in the empirical evidence provided in Section 2.2. Second, $\psi > \phi$, which means consumption is more important for current utility than education investments are for human capital production. This means that an increase in wage subsidies for lower-income families will decrease time investments as there are greater returns to working while the par-

time investment share combines average time investment shares from the AHTUS for each cohort but adjusted up by 1.5 to roughly coincide with the broader set of activities that are included in time investments in the PSID-CDS. Average market hours share is the midpoint between the average share of work hours for parents in the PSID-CDS and CPS-ASEC.

ents' human capital production efficiency is unchanged. The opposite is true for higher-income families who receive no subsidy and higher progressive taxes. Lastly, the mean of match quality shocks and correlation for match quality shocks and human capital change over time to capture non-economic reasons for the rise of single parenthood and the spread further up the income distribution, as shown in Figure 2.

4.2 Comparing the model with the data

4.2.1 Targeted moments

The simulated moments from the model and targeted moments from the data are presented in Tables 5-7. The calibrated model does a good job hitting all the targets for single parenthood (Table 5), the family income distribution (Table 5), and investments (Table 7). While the calibration does not perfectly hit all the targeted moments, it captures salient features of the main objects of interest: single parenthood, investments, inequality and intergenerational mobility.

Table 5: Targeted family structure moments for calibration

Target	**Cohort**	**Data**	**Model**
Share of single-parent families	1947-1970	0.09	0.09
	1971-1994	0.20	0.20
	1995-2018	0.29	0.29
Correlation of single parenthood and log income	1947-1970	-0.43	-0.45
	1971-1994	-0.42	-0.44
	1995-2018	-0.42	-0.44

Notes: This table shows moments for family structure targeted in the joint calibration. The last two columns report the moments from the data and corresponding simulated moments from the Baseline model.

4.2.2 Untargeted moments

Here I discuss how the model performs matching untargeted moments from the data for single parenthood, parental investments, and inequality and intergenerational mobility.

Single parenthood

The model captures a key relationship in the data for single parenthood: high concentration of single parents for families with the lowest incomes. Figure C4 shows the share of single-parent families by normalized household income in the data and model for each cohort. The model is able to capture the spread of single parenthood across the distribution of income. For the second and third cohorts, single parenthood became more common amongst families with higher incomes compared to in cohort 1, though single parenthood is still heavily concentrated at the bottom of the income distribution.

Table 6: Targeted income distribution moments for calibration

Target	**Cohort**	**Data**	**Model**
Mean family income (weekly)	1947-1970	960	949
	1971-1994	1520	1525
	1995-2018	2000	2011
Gini coefficient for family income	1947-1970	0.36	0.36
	1971-1994	0.38	0.37
	1995-2018	0.44	0.41
P95-P20 ratio for family income	1947-1970	4.84	5.01
	1971-1994	5.64	5.69
	1995-2018	7.22	6.92
Share of income variance due to permanent factors	1947-1970	–	0.55
	1971-1994	0.61	0.59
	1995-2018	–	0.66
IGE of family income	1947-1970	–	–
	1971-1994	0.38	0.40
	1995-2018	0.55	0.51

Notes: This table shows moments for the family income distribution targeted in the joint calibration. The last two columns report the moments from the data and corresponding simulated moments from the Baseline model.

Table 7: Targeted investment and labor supply moments for calibration

Target	**Cohort**	**Data**	**Model**
Aggregate relative expenditures $\frac{\sum p_x x}{\sum p_c c}$	1947-1970	0.05	0.05
	1971-1994	0.08	0.07
	1995-2018	0.09	0.09
Elasticity of education expenditures to income	1947-1970	1.11	1.11
	1971-1994	1.19	1.15
	1995-2018	1.37	1.28
Ratio of mean time investments, high vs. low human capital quintiles	1947-1970	1.70	1.71
	1971-1994	1.70	1.78
	1995-2018	1.70	2.21
Average time investment share $\mathbb{E}\left[\frac{n_h}{n}\right]$	1947-1970	0.07	0.07
	1971-1994	0.10	0.10
	1995-2018	0.14	0.13
Average market hours share $\mathbb{E}\left[\frac{n_m}{n}\right]$	1947-1970	0.32	0.32
	1971-1994	0.32	0.31
	1995-2018	0.32	0.30

Notes: This table shows moments for parental investments targeted in the joint calibration. The last two columns report the moments from the data and corresponding simulated moments from the Baseline model.

Investments

Figures C5 and C6 show time and education investments, respectively, from the data and model. Investments in the model follow the same patterns as seen in the data. Figure C5 Panel (a) presents average weekly hours by log household income from the PSID-CDS for 1997, 2002. Panels (b) and (c) show the similar figures from the model for the 1971-1994 cohort and 1995-2018 cohort, respectively. The model generates a large gap between single and married parents and a positive gradient in time investments where parents with higher income spend more time with their children. Figure C6 shows education expenditures by log household income in the CEX with imputed public education expenditures from the CCD for 1990-2018.[29] High-income families spend much more than low-income families in both the data and model.

Inequality and mobility

Lastly, I review moments across the distribution of family income in the data and model and compare income quintile transition matrix for the middle cohort from the model to Chetty et al. (2014). The model generates inequality and mobility as seen from data on the distribution of family income and for estimates in the literature. The middle statistics in Table C2 show the model is able to capture inequality across other parts of the family income distribution such as the P95-P50, P50-P20, and P80-P20 percentile ratios, in addition to the Gini coefficient, P95-P20 ratio, and IGE of family income targeted in calibration. Table C3 shows income quintile transition matrices from Chetty et al. (2014) and the calibrated model. The model generates more persistence for the lowest income quintile than Chetty et al. (2014) but still captures the same features of low rates of upward mobility for children born in poorer households.

4.3 Counterfactual analysis

With the calibrated model I perform three exercises to quantify which changes in family resources either contributed to or mitigated the increases in inequality and declines in intergenerational mobility. The exercises consist of simulating counterfactual scenarios to see how parental investments and aggregate outcomes compare to those in the Baseline parameterized model.

First, taking all else as given, I limit the share of single-parent families to the average from 1950-1970 of 9 percent for all periods. Second, taking family structure as given from the Baseline model, I consider alternative scenarios (1) no SBTC, (2) the relative price of education equals 1 in all periods, and (3) no changes to taxes and transfers before the 1971-1994 period.[30] Third, I repeat the three alternative scenarios from the previous exercise but now allowing for endogenous family structure.

[29] For imputed public education spending I regress log district expenditures per student on log county median household income and use the estimates from the regression to predict public spending with log income.

[30] For counterfactual without SBTC I adjust the overall price of labor w_t so that the average family income is the same as in the Baseline model.

In each exercise I simulate the model starting from the same initial conditions as in the Baseline model, keeping child ability and permanent income shocks the same in all periods and for all families.[31] I simulate the model forward from initial conditions to compare model outcomes for adults in the most recent cohort we have data on (i.e. those born in 1971-1994 who are adults in 1995-2018). I then perform a similar analysis but on predicted outcomes for the next cohort (i.e. those born in 1995-2018 who will be adults in 2019-2042). To simulate the predicted outcomes, I use the calibrated parameters for the current cohort of adults, while normalizing the overall price of effective labor to $w_t = 1$. This allows for comparisons of predicted outcomes across different scenarios to be driven solely by changes affecting family resources: family structure, education prices, and taxes and transfers. The analysis reflects the path dependence of human capital, both at the dynasty level and for the entire distribution. Long-run outcomes depend on prior dynasty choices and the changing economic environment.

4.3.1 Driving forces of current inequality and mobility

The main results for family income for the most recent cohort of adults (those in the model raised in the second period 1971-1994) are presented in Table 8. This table shows the Gini coefficient, standard deviation of logs, and the IGE of family income for the Baseline and main counterfactual experiments. Each row reports measures of inequality and intergenerational mobility if, for instance in the second row of Table 8, the share of single-parent families was limited to 9% in all periods. A smaller number relative to the Baseline outcome indicates that without the change in family resources for a given row, inequality and/or persistence would have been lower. In other words, that specific change in family resources led to greater inequality and/or persistence. The bottom two portions of the tables report results under counterfactual scenarios (1) taking family structure as given from the Baseline scenario (i.e. fixed family structure), and (2) when allowing endogenous family structure.

If the share of single-parent families was limited to 9%, all else equal, the Gini coefficient of family income would decline from 0.412 to 0.382, standard deviation of log income from 0.786 to 0.717, and the IGE of income from 0.506 to 0.456. These are large differences. Inequality and persistence would be 7-9% and almost 10% lower, respectively, than in the Baseline model scenario. The change in the Gini coefficient from the initial to most recent cohort in the Baseline model was 0.055.[32] If the share of single-parent families was limited to 9% the increase would have been 0.025, indicating that the rise of single parenthood accounts for roughly 55% of the increase in Gini

[31] In the first scenario, limiting the share of single-parent families to 9% in all periods, parents are randomly assigned separation shocks that determine their family structure. The separation shocks are $\hat{\xi}_{it} \in \{0, 1\}$ and are correlated with human capital. See Section C.3 for details on the deriving the joint distribution of separation shocks and human capital.

[32] In the Baseline model, the Gini for each cohort is 0.357, 0.367, and 0.412; the standard deviation of log family income is 0.682, 0.711, and 0.786; and the IGE is 0.404 and 0.506. The change in Gini from third cohort to first is 0.412-0.357 = 0.055; for SD of log income is 0.786-0.682 = 0.104.

Table 8: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.412	0.786	0.506
Share of single parents 9%	0.382	0.717	0.456
Family structure fixed to Baseline			
No SBTC	0.365	0.685	0.356
Relative price of education = 1	0.410	0.781	0.500
Taxes and transfers pre-1971	0.414	0.815	0.551
Endogenous family structure			
No SBTC	0.366	0.688	0.362
Relative price of education = 1	0.410	0.781	0.501
Taxes and transfers pre-1971	0.401	0.784	0.517

This table shows the Gini coefficient, standard deviation of logs, and IGE of family income under the Baseline and counterfactual scenarios.

index. For the standard deviation of log family income, the growth of single parenthood accounts for 66% of the increase. Part of the difference for inequality measures compared to Baseline can be attributed to time constraints – more two-parent families translates to higher family income as two parents can provide greater market work hours. A lower share of single parents brings up the bottom of the income distribution given the high concentration of single parents amongst lower-income families. The other part is due to the impact of increasing single parenthood on investments and the distribution of human capital.

The most significant driving force of rising inequality and intergenerational persistence is SBTC. SBTC disproportionately increases wages for parents with high human capital. The results are largely unchanged when either taking family structure as given (middle portion of Table 8) or allowing endogenous family formation (bottom portion of Table 8). Without SBTC, the Gini coefficient would be 11% lower compared to the Baseline outcome, going from 0.412 to 0.365 in the counterfactual. SBTC thus accounts for about 86% of the increase in the Gini coefficient from the initial cohort to third. The SD of log income would be 12.9% lower without SBTC at 0.685 compared to 0.786 in the Baseline model, accounting for roughly 97% of the increase since the initial cohort, keeping all else equal. Without SBTC the IGE would be almost 30% lower at 0.356 compared to 0.506. The IGE in the Baseline outcome rises from 0.404 to 0.506 from the second to third cohort and from 0.339 to 0.356 in the counterfactual without SBTC. There would be significantly more mobility if returns to skill did not increase as SBTC amplifies differences in human capital and parental investments.

Rising relative prices for education, on the other hand, have only a small impact on inequality

and intergenerational mobility. As discussed later in this section, all families see similar declines in investments when the relative price of education rises. Further, the effect of education prices on inequality and intergenerational mobility are almost identical with fixed family structure and endogenous family structure as both the counterfactual share of single-parent families and correlation between single parenthood and log income are roughly the same as in the Baseline model.

Turning to the effects of policy changes, expansions of transfers and tax credits ahead of the 1971-1994 cohort differ by whether family structure is fixed or endogenous. When family structure is taken as given from the Baseline model, if taxes and transfers had not been expanded after the first cohort inequality and intergenerational persistence would both be higher. Thus, policy changes in the 1960s helped mitigate the rise of inequality and intergenerational persistence driven mostly by SBTC and single parenthood. Without changes to taxes and transfers ahead of the second cohort, the IGE of income would be 0.551 compared to 0.506 in the Baseline outcome, indicating substantially greater intergenerational persistence.[33] When family structure is endogenous, policy changes after the initial cohort have different implications for inequality and persistence. Without the expansion of benefits to tax credits and transfers, inequality by both measures would have been lower than in the Baseline. Conversely, the IGE would be higher. As I discuss in more detail shortly, this last result is due to the lack of assistance for low-income single-parent families without expansions to means-tested transfers and tax credits.

Next, I discuss how investments and endogenous family formation in each counterfactual leads to the results for inequality and mobility just presented. Table 9 presents average time investments for the total population, bottom income decile, bottom income quartile, and the top income quartile. Table 10 reports the share of single-parent families and correlation between single parenthood and log family income for counterfactual experiments with endogenous family structure.

Part of the reason why inequality and intergenerational persistence would be lower if the share of single-parent families had not risen is because children growing up in low-income families would receive significantly more investment than in the Baseline scenario. This is due to the high concentration of single parents among low-income families, as seen in the data. Less investment leads to lower child human capital, which then raises the likelihood of becoming a single parent and having lower income as an adult. The difference in time investments for children in low-income families is shown in Table 9. Children in the lowest income quartile and decile would receive almost three hours more in time investment per week on average if the share of single-parent families had not risen, 13.69 hours in Baseline versus 16.81 in the counterfactual.

SBTC, however, did not lead to substantially greater difference in time investments for high- ver-

[33] Section D.3.3 presents similar tables to Table 8 but when changes to taxes and transfers are evaluated separately. Table D23 shows that almost all of the difference in the IGE is due to the expansion of transfers in the 1960s ahead of the second period.

Table 9: Average time investments overall and by income quartile across scenarios: Baseline model and counterfactuals

	Overall	**Bottom decile**	**Bottom quartile**	**Top quartile**
Baseline	20.92	13.69	16.29	24.56
Share of single parents 9%	22.29	16.81	19.19	24.95
Family structure fixed to Baseline				
No SBTC	23.32	15.25	18.53	27.09
Relative price of education = 1	22.73	14.92	17.74	26.64
Taxes and transfers pre-1971	20.65	12.82	15.52	24.52
Endogenous family structure				
No SBTC	23.37	15.21	18.50	27.16
Relative price of education = 1	22.74	14.90	17.68	26.62
Taxes and transfers pre-1971	21.14	14.10	16.62	24.60

Notes: This table shows average time investments for all families, families in the bottom income decile, families in the bottom income quartile, and families in the top income quartile for the Baseline model and counterfactuals.

sus low-income families. Although the increase in the returns to market work leads to lower average time investment in the Baseline outcome compared to the counterfactual without SBTC (as shown in Table 9), the ratio of average hours in time investments between families in the highest income quartile compared to in the lowest income quartile is smaller when there is no SBTC (27.09/18.53 = 1.46) compared to in the Baseline (24.56/16.29 = 1.51). In other words, the importance of family characteristics for investments went up slightly with greater returns to skill in the labor market, contributing to higher inequality and more persistence across generations.

Higher relative price of education leads to parents spending more time at work and expenditures on consumption as the effective return to investments falls. Due to complementarities of investments in human capital production, an increase in the relative price of education lowers the return to both time *and* education investments. The percentage difference in investments between the Baseline outcome and counterfactual is roughly the same for all families, albeit slightly greater for lower-income families. Families in the lowest income decile and quartile invest 9% more time on average in the counterfactual relative to Baseline where families in the highest quartile invest 8.5% more. This difference leads to small changes in inequality and persistence in the counterfactual. The results are similar with fixed family structure and endogenous family structure as the share of single-parent families is 20% in both the Baseline and counterfactual with the same correlation between single parenthood and log income as shown in Table 10.

The expansion of benefits resulted in fewer hours at work and more hours in time investment for

Table 10: Share of single-parents for counterfactual scenarios with endogenous family structure

	Share of single-parent families	**Correlation with log income**
Baseline	0.20	0.44
No SBTC	0.20	0.50
Relative price of education = 1	0.20	0.44
Taxes and transfers pre-1971	0.16	0.42

Notes: This table reports the share of single-parent families and correlation between single parenthood and log family income (pre-tax and transfer) in the Baseline scenario and counterfactuals with endogenous family structure.

parents in lower-income families when family structure is fixed from the Baseline outcome. Table 9 highlights this result. Without the expansion of benefits, average time investments would be 7% lower for families in the first income decile (12.82 versus 13.69 hours) and 5% lower for families in the first quartile (15.52 versus 16.29 hours) compared to Baseline. More non-labor income produces an income effect where parents can spend more time actively engaging with their children. When family structure is endogenous, the expansion of benefits led to greater rates of single parenthood and increased time investments. As shown in Table 10, without changes to taxes and transfers, the share of single-parent families in the second cohort would have been 16% compared to 20% in the Baseline scenario. As a result, family income inequality is lower as fewer families are time constrained with only one parent, raising market work hours and family income for lower-income families. However, without the expansion of benefits, the IGE of family income would be higher than in the Baseline model as families headed by single parents have fewer resources for investments compared to the Baseline, as shown in 11. Despite the expansion of benefits leading to more single-parent families, the alternative would leave children in single-parent families with fewer resources for investments and greater persistence at the bottom of the income distribution.

Table 11: Average time investments for families in bottom decile of income distribution by family structure: Baseline model and counterfactuals where taxes and transfers were not expanded

	All	**Married parents**	**Single parents**
Baseline	13.69	21.10	10.26
Family structure fixed to Baseline	12.82	19.88	9.53
Endogenous family formation	14.10	19.82	9.72

Notes: This table shows average time investments for families in the bottom income decile by family structure for the Baseline model and counterfactuals with no expansion of taxes and transfers after initial cohort.

To separate the effects of changes in family resources on investments/human capital compared to returns to human capital, market hours, and receipt of transfers, I feed in combinations of sequences from counterfactual scenarios while keeping all other sequences the same as in the Base-

line scenario. Household and government budget constraints and market clearing will not hold. This exercise will demonstrate how much underlying differences in investments and the distribution of human capital contributed to rising inequality and declining mobility compared to other sources. As the rise in single parenthood and SBTC contributed most to inequality and persistence, I do three exercises to calculate the Gini, SD of log income, and IGE of income for counterfactual distributions of income. First, I create a counterfactual distribution of family income where investments and human capital are from the counterfactual where the share of single-parent families is limited to 9% and all else is from the Baseline outcome. Second, I create counterfactual family income using data from the Baseline outcome except where the returns to human capital γ_t is held at its initial value. Finally, I use investments and human capital from the counterfactual where there is no SBTC and all else is from the Baseline outcome to construct the distribution of family income. The results are in Table 12, which presents analogous statistics to Table 8.

Table 12: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.412	0.786	0.506
Share of single parents 9% full counterfactual	0.382	0.717	0.456
Counterfactual human capital	0.404	0.766	0.379
Counterfactual work hours and transfers	0.392	0.738	0.387
No SBTC full counterfactual	0.365	0.685	0.356
Counterfactual returns to skill	0.368	0.698	0.371
Counterfactual human capital	0.412	0.785	0.507
Counterfactual work hours and transfers	0.410	0.775	0.493

Taking sequences of investments and human capital from the counterfactual where the share of single-parent families is limited to 9%, the Gini coefficient would be 0.404, lower than 0.412 in the Baseline and higher than 0.382 in the full counterfactual. This indicates that of the difference between Baseline and full counterfactual, 27 percent is due to the distribution of human capital while the remainder is due to how the increase in single parenthood impacts work hours and transfers. This translates to 15% of the change in Gini from the first to third cohort driven by differences in investments/human capital between the Baseline model and counterfactual. The SD of log income with counterfactual human capital would be 0.766, compared to 0.717 in the full counterfactual and 0.786 in the Baseline scenario. The impact of the rise in single parenthood on human capital accounts for 29% of the difference from Baseline and 19% of the increase in the SD of log income. The IGE when investments and human capital are taken from the counterfactual (0.379) is significantly lower than in the Baseline (0.506) and even lower than in the full counterfactual (0.456).

Most of the increase in inequality driven by SBTC is due to the change in returns to skill and not the underlying distribution of human capital. For the counterfactual distribution of income constructed with allocations from the Baseline model but keeping the returns to skill the same as in the initial period, the Gini coefficient would be 0.368 compared to 0.365 in the full counterfactual and 0.412 in the Baseline. The SD of log income would be 0.698 compared to 0.685 in the full counterfactual and 0.786. The IGE would be 0.371 compared to 0.356 in the full counterfactual and 0.506 in the Baseline. On the other hand, when income is constructed with counterfactual investments and human capital but all else is from the Baseline scenario, inequality and persistence are effectively unchanged compared to the Baseline model.

Lastly, I turn to the impact of changes in family resources on pre-tax wages, which in my framework captures the permanent component of income. Focusing only on family income may mask changes in the underlying distribution of the returns to permanent skills and attributes, as the level of market hours, and thus family income, is so dependent on family structure.

Table 13 shows how much family structure, education prices, and policy changes contributed to or mitigated the increase in inequality and intergenerational persistence of wages. Values can be positive or negative, indicating whether a specific scenario contributed to or mitigated the rise in inequality or intergenerational persistence. Note that this table does not show results related to SBTC. By taking SBTC as given in this part of the analysis, I can directly compare changes in the distribution of wages across counterfactual scenarios because each has the exact same distribution of wages in the second period, including for the Baseline model.

I calculate the change in Gini coefficient, standard deviation of logs, and IGE of wages from the previous period for the Baseline model (Δ) and for each counterfactual c (Δ_c). The top row shows Δ for each statistic. For instance, the Gini of wages increased by 0.05 from period 2 to period 3 in the Baseline model. The remaining values show how much the change in each statistic in the Baseline model can be attributed to trends in family structure, education prices, or policy. For each counterfactual c, the share attributed to the corresponding change in family resources is calculated as

$$\text{Share of } \Delta \text{ due to } c = 1 - \frac{\Delta_c}{\Delta}$$

For example, in the counterfactual keeping the share of single-parent families to 9%, the change in Gini coefficient from period 2 to period 3 was .037, and in the Baseline model it was 0.047. The share of Δ for the Gini of wages due to the increase in single parenthood is $1 - \frac{0.037}{0.047} = 0.214$. Thus, the increase in the share of single-parent families contributed to 21% of the overall change in the Gini coefficient of wages. Further, the rise of single parenthood contributed to almost 25 percent of the increase in the standard deviation of log wages, but a more modest contribution of around 4 percent of the increase in the IGE of wages.

Table 13: Percent contributions to inequality and mobility due to trends in family resources

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.05	0.10	0.11
Share of Δ due to family structure	21.37	24.83	4.11
Family structure fixed to Baseline			
Share of Δ due to education prices	2.08	1.89	1.20
Share of Δ due to tax and transfer changes 1971	-6.00	-8.50	-20.36
Endogenous family formation			
Share of Δ due to education prices	0.68	0.69	1.66
Share of Δ due to tax and transfer changes 1971	4.77	5.54	-9.21

Education prices had a minimal effect on inequality and mobility, both with fixed or endogenous family structure, contributing 2 percent or less of the changes in dispersion and persistence. The expansion of transfers for the second cohort, taking family structure as given, helped mitigate the rise in both inequality and intergenerational persistence, helping reduce inequality by 6-8.5 percent and persistence by about 20 percent of the increases since the prior cohort. With endogenous family structure, changes in transfers contributed to about 5 percent of the increase in inequality but mitigated the rise in persistence by about 9 percent. This is due to how family structure changed because of more generous transfers available to single parents. The increase in generosity of means-tested transfers led to more single parents, which increased inequality, but the generosity of transfers helped lower-income families better invest in their children's development, reducing persistence.

4.3.2 Implications of changes in family resources for the next cohort

Here I briefly discuss results for predicted outcomes of the next cohort. Table 14 shows that single parenthood had a significant impact on the predicted growth in inequality and particularly for intergenerational persistence. This table measures the long-run contributions from changes in family resources, where 1971-1994 is still the reference point. The increase in single parenthood contributed to 25 percent of the increase in the Gini coefficient of wages, 29 percent to the increase in the standard deviation of log wages, and 15 percent to the IGE of wages since 1971-1994.

Figure 10 highlights why. This figure shows the distribution of log wages in the Baseline model grouping dynasties by the family structure they grew up in during children. The blue group corresponds to all families; orange is those who grew up with married parents; magenta are those who grew up in single parent families; and the small gold group are those who grew up in a household with two generations of single parents (a subset of those who grew up with single parents). Panel (a) shows the distribution of log wages for the prior period (cohort raised in 1971-1994) and Panel

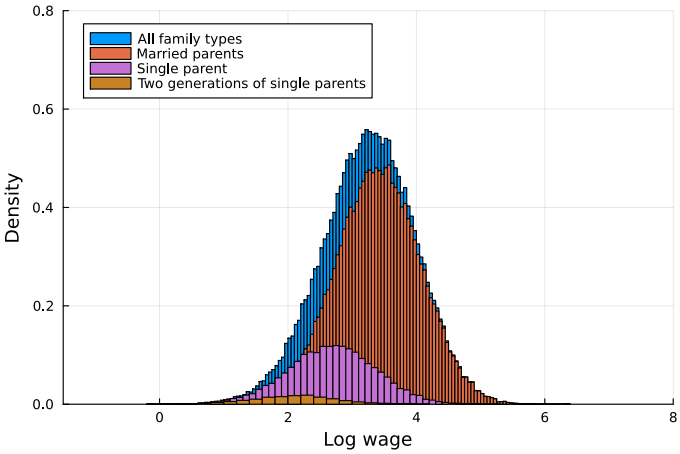
(b) shows the predicted distribution for the next period (cohort raised in 1995-2018). Looking from Panel (a) to Panel (b), the increase in single parenthood is heavily concentrated among low-wage families. In fact, it appears that the distributions of wages for those who grew up with married parents and those who grew up with a single parent are moving farther apart. This subtle bifurcation of the distribution of wages is what drives the increase in persistence: children who grew up in single-parent households become single parents themselves, leading to poverty traps.

Table 14: Share of changes in inequality and mobility due to trends in family resources

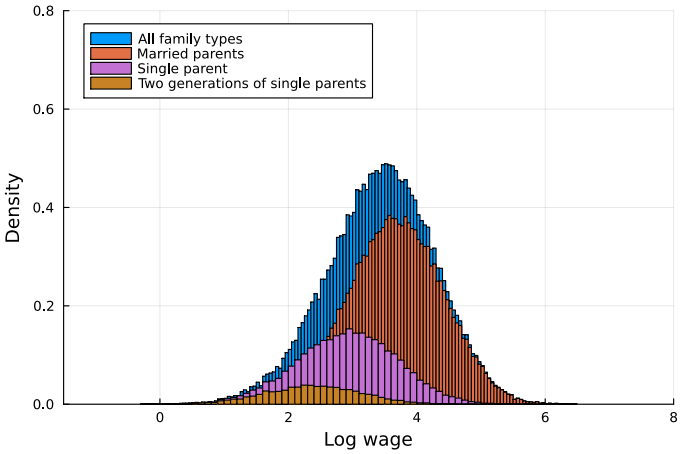
	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.09	0.21	0.27
Share of Δ due to family structure	25.49	29.45	15.26
Family structure fixed to Baseline			
Share of Δ due to education prices	5.90	5.38	3.98
Share of Δ due to tax and transfer changes 1971	-5.27	-6.20	-8.19
Share of Δ due to tax and transfer changes 1995	1.30	3.50	4.13
Endogenous family formation			
Share of Δ due to education prices	4.91	4.31	4.00
Share of Δ due to tax and transfer changes 1971	5.51	5.57	1.57
Share of Δ due to tax and transfer changes 1995	-0.16	-0.42	0.28

Figure 10: Distribution of log wages by family structure during childhood

(a) Cohort born in 1971-1994



(b) Cohort born in 1995-2018



5 Conclusion

In this paper I evaluate how cross-cohort changes in family resources and parental investments affected inequality and intergenerational mobility. First, I document changes in family resources and trends in parental investments over the past several decades in the United States. I then develop a dynastic model of parental human capital investment to analyze how different changes in family resources and trade-offs to investments impact inequality and intergenerational mobility. The key innovation of my model is that it includes important factors for family resources that are often overlooked: family structure, education prices, and taxes and transfers. An important feature of the model is that tax and transfer policies vary by family structure. This variation in policy treatment generates different trade-offs for parents. Not only does it influence the decision for parents to separate or not, but affects the relative costs and benefits of allocating time and expenditures to investments versus working, consumption, and leisure. Lastly, I bring the model to the data and quantify how much changes in family resources contributed to or mitigated the rise in inequality and intergenerational persistence. Single parenthood had a large impact on growing inequality and declining intergenerational mobility of family income and wages. For policy effects, expansions to means-tested transfer programs helped mitigate the increases in inequality and persistence driven by SBTC and rising single parenthood.

My paper makes three contributions. First, I develop a model that incorporates family structure, education prices, and income assistance programs into a unified framework, and provide some of the first estimates of the impact of the rise in single parenthood on overall inequality and intergenerational mobility. I find that the rise of single parenthood contributed to 20-25 percent of the increase in inequality and about 4 percent of the increase in intergenerational persistence of wages. Second, I document empirical trends on changing family resources and parental investments. Family resources devoted to children's development have changed dramatically over the last 50 years, altering the trade-offs parents face when allocating their resources towards their children's development. For investments, I find that positive investment gradients for parents with higher education, income, and who are married steepened. Parents with greater resources are spending increasingly more time and expenditures on their children's development. Third, I present evidence of the effects of policy changes on parental investments and the implications for inequality and mobility. Taxes and transfers offer differing trade-offs for parents highlighting the importance of considering parental investments when designing assistance programs.

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A Data details

A.1 Current Population Survey

The Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) is a nationally-representative survey containing information on demographic characteristics, household income, family structure, taxes, and transfers. I start with CPS data provided by Integrated Public Use Microdata Series (Flood et al., 2023). I use information on family characteristics, marital status, income, hours worked, taxes, and transfers.

To account for underreporting of means-tested transfers in the CPS I utilize the CBO's regression-based procedure to impute transfers when possible (Habib, 2018). The procedure first uses administrative data to set targets of transfer receipt reflecting the CPS sampling frame, estimates the probability of receipt for households in the CPS, and then imputes transfer receipt based on estimated probabilities until the targets from the administrative data are reached. Replication files provided by the CBO at https://www.cbo.gov/.

A.2 Time investments

A.2.1 PSID-CDS

Data provided by Joseph Mullins as used in Caucutt et al. (2020). Activities constituting time investments include academic investment activities, health investment activities, play, arts and crafts with household children, sports, talk and listen, eating, socializing, religious activities, volunteering, and other activities.

A.2.2 AHTUS

I start with replication files from Blandin and Herrington (2022), who draw data from AHTUS data provided by Integrated Public Use Microdata Series, and then I add data for 2018 from https://www.ahtusdata.org/ahtus/ (Fisher et al., 2023).

A.3 Aggregate education expenditures

Education expenditures in aggregate come from numerous sources. I start with total public and private education expenditures, which come from sources listed below

- Public education expenditures come from the US Census, including Historical Statistics of the United States, Statistical Abstract of the United States, Annual Survey of State and Local Government Finance, and the US Federal Budget
- Private education expenditures are Personal Consumption Expenditures on Education from the Bureau of Economic Analysis

Public education direct spending is divided between local, state, and federal sources

- Local: spending is mostly for preK-12, some for community college, libraries
- State: spending is mostly for higher education institutions and student grants
  - Expenditures for higher education does not remove state charges for tuition and other fees that individuals and households pay, so I manually remove. About 40% of higher education spending was state charges in 2018, up from 30% in 1977. I impute linearly backward to 1947. State charges come from Tax Policy Center and Urban Institute who draw data from US Census Bureau Annual Survey of State and Local Government Finances.
  - Add State Higher Education Grants from the US College Board Trends in Student Aid 2022 for 1970-2018.
- Federal: spending for higher education (not including grants or loans) is largely for R&D to universities so not included. Add Federal Undergraduate Grants from the US College Board Trends in Student Aid 2022 for 1970-2018. Excludes Veterans and Military Grants.

For share of education expenditures divide by Personal Income, which comes from the Bureau of Economic Analysis.

A.4 District-level funding and county characteristics

Public preK-12 education funding
Department of Education Common Core of Data (CCD) school district data

- Funding: expenditures per student
- Characteristics: student poverty rate, special education students, highest grade offered

US Census Small Area Income and Poverty Estimates (SAIPE)

- County median household income and poverty rate

Neighborhood Characteristics by County from Chetty et al. (2018)

- Data accessed through Opportunity Insights, https://opportunityinsights.org/data/. Select years for county characteristics: share of single-parent families (1990, 2000, 2010), share of college+ educated (2000, 2010), population density (2000, 2010).

Sample

- About 288,000 district-year observations for 1995-2018

Department of Education Common Core of Data (CCD) accessed through Education Data Portal, Urban Institute, https://educationdata.urban.org/documentation/.

A.5 Expenditure categories in the CEX

To account for differences in economies of scale in raising children, The adjustment process is as follows: let χ be either expenditures per child $\frac{p_x x}{Nkids}$. I regress $\log(\chi)$ on indicator variables for the number of children I_k, and a set of household variables Z (log total income, log total expenditures, parent education, and number of parents at home).

$$\log(\chi) = \sum_{k=1}^{K} \varphi_k I_k + \Omega Z + \epsilon$$

Adjusted measures of investment are

$$\hat{\chi} = \exp\Big(\log(\chi) - \sum_{k=1}^{K} \hat{\varphi}_k I_k \Big)$$

Childcare
Universal Classificatin Codes (UCC)

1. Babysitting and child care: 340210
2. Babysitting and child care in your own home: 340211
3. Babysitting and child care in someone else's home: 340212
4. Day care centers, nursery, and preschools: 670310

Schooling
Universal Classificatin Codes (UCC)

1. Tuition and student loans: 670110 670210 670410 005520 670901
2. Education supplies: 660110 660210 660410 660900 660901 660902 660000
3. Education services: 670903
4. Other school expenses including rentals: 670902
5. Housing while attending school; food or board at school; school lunches: 210310 190901 790430

Lessons
Universal Classificatin Codes (UCC)

1. Fees for recreational lessons or other instructions: 620310

Reading
Universal Classificatin Codes (UCC)

1. Books thru book clubs Books not thru book clubs: 590220 590230

2. Newspapers, magazines, newsletters subscriptions: 590310 590111 590211 590900
3. Newspapers, magazines, newsletters non-subscriptions: 590410 590110 590210 590112 590212
4. Encyclopedia and other sets of reference books: 660310
5. Digital book readers: 690118

B Appendix: Model

B.1 Non-custodial parents problem

$$
\begin{aligned}
V_t^a(h_{it}, n_{it}^{nc}, \nu_{it}) = \max_{c_{it}^{nc}, n_{m_{it}}^{nc}, n_{l_{it}}^{nc}} \quad & u(c_{it}^{nc}, n_{l_{it}}^{nc}) \\
\text{s.t.} \quad & p_{ct} c_{it}^{nc} = \lambda_t^{nc} (w_t h_{it}^{\gamma_t} \nu_{it})^{1-\tau_t^{nc}} n_{m_{it}}^{nc} \\
& n_{it}^{nc} = n_{m_{it}}^{nc} + n_{l_{it}}^{nc}
\end{aligned}
$$

B.2 Government budget and market clearing

Taxes and government expenditures

$$
G_t = \int \left(w_t h_{it}^{\gamma_t} \nu_{it} - \lambda_t(n_{it}) [w_t h_{it}^{\gamma_t} \nu_{it}]^{1-\tau_t(n_{it})} \right) n_{m_{it}} + \left(w_t h_{it}^{\gamma_t} \nu_{it} - \lambda_t^{nc} [w_t h_{it}^{\gamma_t} \nu_{it}]^{1-\tau_t^{nc}} \right) n_{m_{it}}^{nc} \, di
$$

Transfers

$$
\int T_{it} \, di \leq G_t
$$

Market clearing

Total output	$p_{ct} Y_{ct} + p_{xt} Y_{xt} + G_t = \int w_t h_{it}^{\gamma_t} \nu_{it} [n_{m_{it}} + n_{m_{it}}^a] + T_{it} \, di$
Consumption	$Y_{ct} = \int [c_{it} + c_{it}^a] \, di$
Education	$Y_{xt} = \int x_{it} \, di$

B.3 Equilibrium

Given

- Tax and transfer systems
- Initial human capital and ability $\{h_{i0}, a_{i0}\}_i$
- Technology and sectoral productivity $\{H_t(\cdot), \gamma_t, A_{ct}, A_{xt}\}_t$
- Distributions of shocks for permanent income, ability, and parent match quality

a competitive equilibrium is household parental time $\{n_{it}, n_{it}^{nc}\}$, household allocations $\{c_{it}, x_{it}, n_{m_{it}}, n_{l_{it}}, n_{h_{it}}\}_{i,t}$, $\{c_{it}^{nc}, n_{m_{it}}^{nc}, n_{l_{it}}^{nc}\}_{i,t}$, firm allocations $\{Z_{ct}, Z_{xt}\}_t$, and prices $\{w_t, p_{ct}, p_{xt}\}_t$ such that:

1. Given prices, parents maximize lifetime utility
2. Given prices, firms maximize profits

3. Government budgets balance

4. Markets clear

B.4 Optimal consumption and leisure

Consumption

$$\log(c_{it}) = \log(\psi\phi) + \underbrace{\log(\hat{W}_{it}n_{it} + T_{it})}_{\text{Total available resources}} - \underbrace{\log(p_{ct})}_{\substack{\text{Price of} \\ \text{consumption}}} - \underbrace{\log(\phi + \psi\theta_{it})}_{\substack{\text{Relative} \\ \text{expenditures}}}$$

Leisure

$$\log(n_{l_{it}}) = \log([1-\psi]\phi) + \underbrace{\log(\hat{W}_{it}n_{it} + T_{it})}_{\text{Total available resources}} - \underbrace{\log(\hat{W}_{it})}_{\substack{\text{After-tax} \\ \text{wage}}} - \underbrace{\log(\phi + \psi\theta_{it})}_{\substack{\text{Relative} \\ \text{expenditures}}}$$

C Appendix: Quantitative analysis

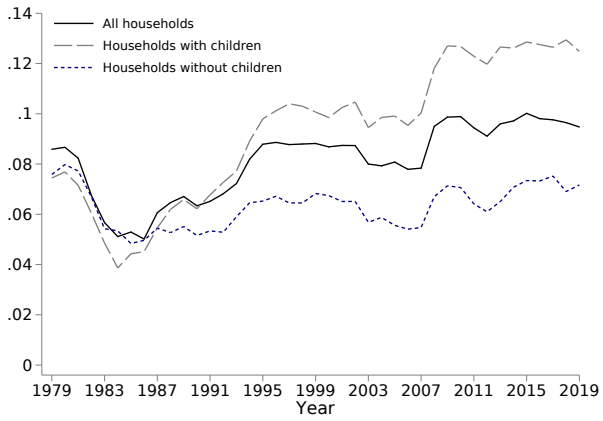
C.1 Calibration

Tax progressivity

Regress log after-tax income on log pre-tax income (CBO data is for income not wages)

$$\log(\hat{y}_{it}) = \log(\lambda_t) + (1 - \tau_t)\log(y_{it})$$

Figure C1: Progressivity measures of income taxes



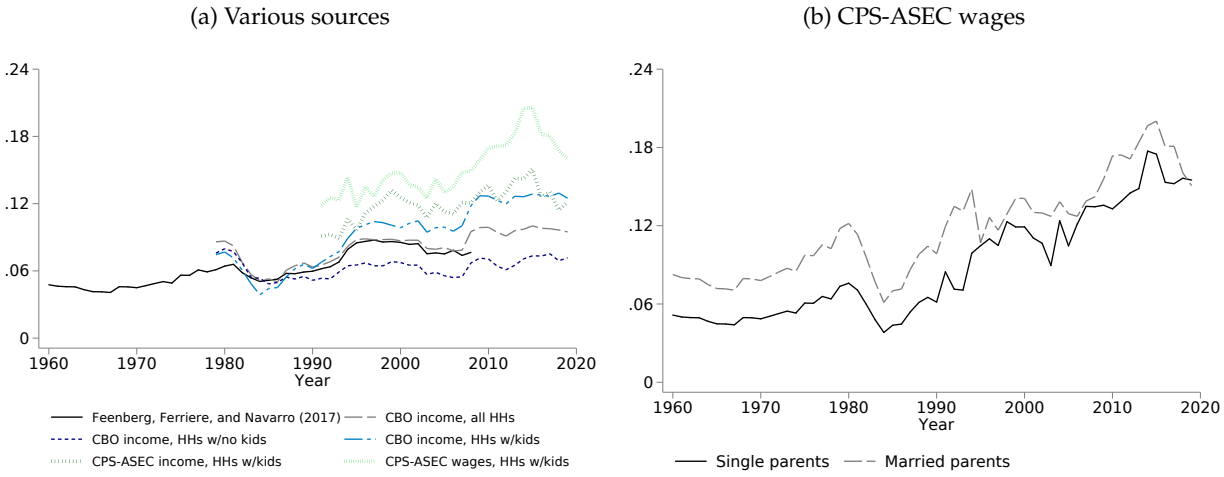
Source: Congressional Budget Office (CBO) - *The Distribution of Household Income, 2019* Data Files

- Regress log after-tax wages on log pre-tax wages in CPS-ASEC

$$\log(\hat{W}_{it}) = \log(\lambda_t(n_{it})) + (1 - \tau_t(n_{it}))\log(W_{it})$$

- Impute measures back to 1960
  - Assumption: progressivity for households with children starts to deviate in late 1980s

Figure C2: Measures of tax progressivity

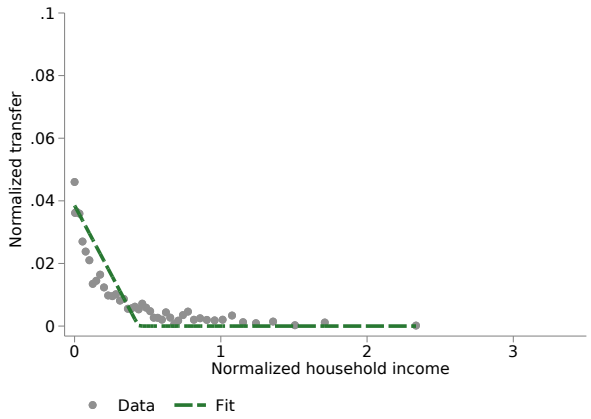


Source: CBO; CPS-ASEC; Feenberg, Ferriere, and Navarro (2017)
Note: Wage progressivity measures in panel (b) imputed for 1960-1990

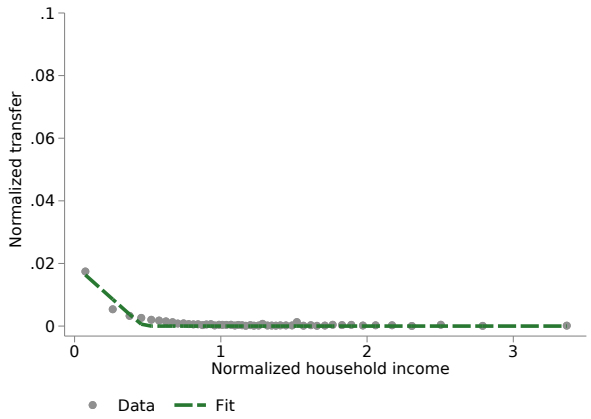
Transfer functions

Figure C3: Transfer functions

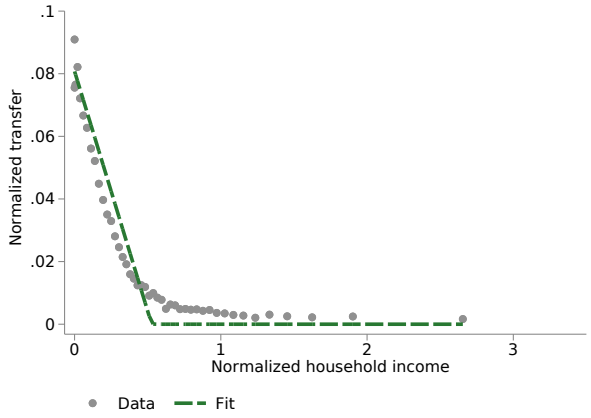
(a) Single parents, 1947-1970



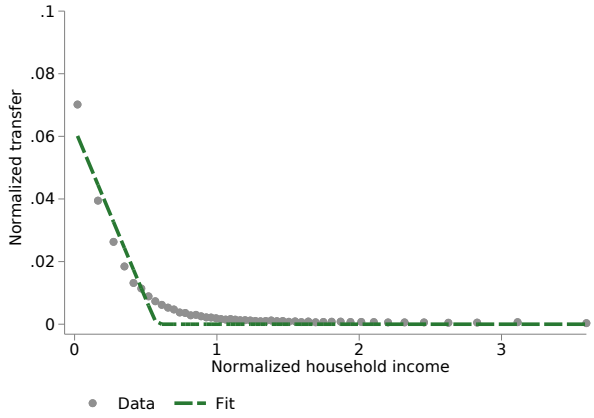
(b) Married parents, 1947-1970



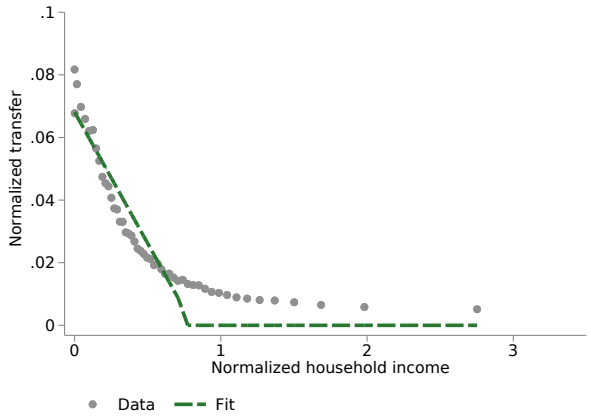
(c) Single parents, 1971-1994



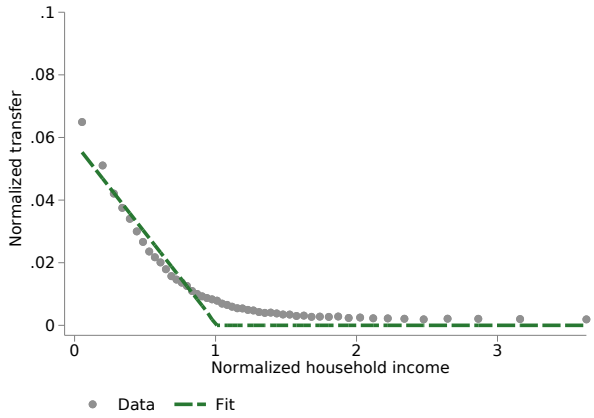
(d) Married parents, 1971-1994



(e) Single parents, 1995-2018



(f) Married parents, 1995-2018



Income elasticity of education expenditures

Estimates from the literature of the elasticity of income to education expenditures have a wide range. The elasticity of public education funding is generally found to be at or below one, ranging from the low end of about 0.50 to about 1 at the top. Results from numerous studies on the income elasticity of public education spending are reported in Table C1. The bulk of these studies find an estimate in the range [0.7,1.0]. Further, while most of the papers concern data for 1970 and earlier, those covering 1970-1990s do not indicate any significant change in estimates. In particular, Fernandez and Rogerson (1997) find estimates for periods 1950-1970 and 1970-1990 to be roughly the same between 0.9 and 1. Given the range of estimates, I choose a midpoint of 0.85 as the income elasticity of public education spending.

The income elasticity of private education has been estimated to be higher than for public education and above 1. Kim (1988) finds an elasticity of 1.34 for private education expenditures for 1958-1982. For higher education only, Campbell and Siegel (1967) report an income elasticity of 1.2 for 1919-1964 while Lehr and Newton (1978) report an estimate of 1.88 for 1960-1974. In more recent decades, using the replication files of Aguiar and Bils (2015) who estimate demand elasticities of various goods in the CEX correcting for measurement error, the elasticity for education and domestic services (i.e. childcare) combined is 1.52 (1.56 for education, 1.48 for domestic services) for 1980-1994 and 1.88 (1.95 for education, 1.79 for domestic services) for 1995-2010. The results from the CEX following the procedure in Aguiar and Bils (2015) indicates an increase in the elasticity for education and childcare from the 1980s to 2000s. The income elasticities of private education and childcare expenditures for each cohort used in calibration are 1.34, 1.52, and 1.88.

The income elasticity targets for η_t are averages of income elasticities for public and private expenditures on education. Assuming the public education elasticity remains stable at 0.85, I target 1.10, 1.19, and 1.37.

Table C1: Estimates of income elasticity for public primary and secondary education funding

Paper	Description	Sample	Period	Estimate
Fabricant (1952)	Cross section, state public education expenditures on per capita income	US	1938-1942	0.78
Brazer (1959)	Cross section, city public education expenditures on median family income	US	1949-1953	0.73
Hirsch (1961)	Time series, public education expenditures on per capita income	US	1900-1958	1.09
Hirsch (1961)	Cross section, public education expenditures on district per pupil property value	St. Louis	1951-1955	0.59
Barlow (1970)	Cross section, public education expenditures on personal income per pupil	Michigan	1960	0.64
Bradford and Oates (1974)	Cross section, public education expenditures on district median family income	New Jersey	1960	0.65
Feldstein (1975)	Cross section, expenditures per pupil on median family income	Massachusetts	1970	0.48
	Pooled years		1965,1970	0.64
	Corrected by Bergstrom, Rubinfeld, and Shapiro (1982)		1970	0.76
Inman (1975)	Cross section, expenditures per pupil on district median family income	Long Island	1970	0.61
Ladd (1975)	Cross section, expenditures per pupil on median family income	Boston	1970	0.46
	Corrected by Bergstrom, Rubinfeld, and Shapiro (1982)		1970	0.70
Peterson (1975)	Cross section, expenditures per pupil on median family income	CA, MI, NJ, NY, KC	1970	0.84-1.35
Lovell (1978)	Cross section, expenditures per pupil on median family income	Connecticut	1970	0.65
Perkins (1977)	Cross section, public education expenditures on median family income	Massachusetts	1969-1970	1.02-1.07
Bergstrom, Rubinfeld, and Shapiro (1982)	Survey, desire for more public education expenditures on family income	Michigan	1978	0.83
Romer, Rosenthal, and Munley (1992)	Outcomes of school district voting referenda on district mean family income	New York	1974-1975	0.98
Poterba (1997)	Cross section, state education spending per child on per capita income and demographics	US	1961-1991	0.78
Fernández and Rogerson (1997)	Pooled cross section, state-level spending per student on permanent income	US	1970-1990	0.87-1.05
			1950-1970	0.94-1.03
Cohen-Zada and Justman (2003)	Cross section, cities with pop. over 25,000	US	1990	0.70-0.90
	Sensitivity analysis		1990	0.64-1.03
	Control for Tiebout sorting		1990	0.83-1.13

Minimum distance estimation

The calibration procedure is as follows

1. Select initial guess for parameters
2. Simulate the model
3. Compare simulated data moments to targeted moments from the data
4. Update parameters
5. Repeat steps 2-4 until squared residuals between simulated and target moments minimized

C.2 Model fit

Table C2: Inequality and intergenerational mobility of family income

	1947-1970		1971-1994		1995-2018	
Statistic	Data	Model	Data	Model	Data	Model
P95-P50	2.45	2.83	2.73	2.84	3.28	3.49
P50-P20	1.97	1.77	2.06	2.00	2.20	1.98
P80-P20	3.09	3.03	3.48	3.47	4.09	3.91

Notes: Moments for Gini and percentile ratios are calculated from US Census Tables F-1, F-4, and F-5.

Table C3: Income quintile transition matrices, data and model

(a) 1980-82 birth cohort, Chetty et al. (2014) Table II

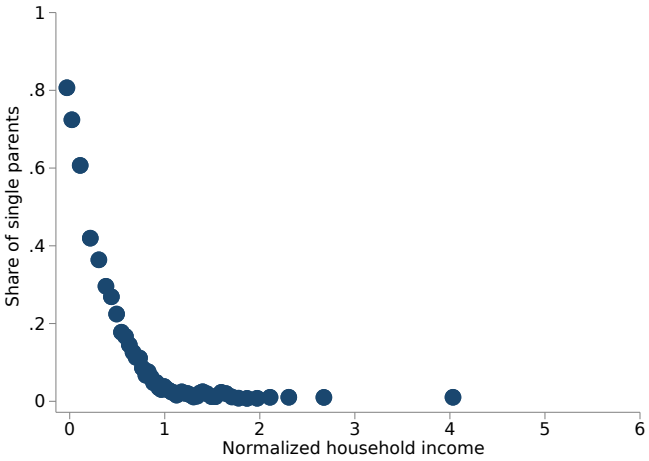
Child	Parent quintile				
quintile	1	2	3	4	5
1	33.7	24.2	17.8	13.4	10.9
2	28.0	24.2	19.8	16.0	11.9
3	18.4	21.7	22.1	20.9	17.0
4	12.3	17.6	22.0	24.4	23.6
5	7.5	12.3	18.3	25.4	36.5

(b) 1971-1994 model cohort

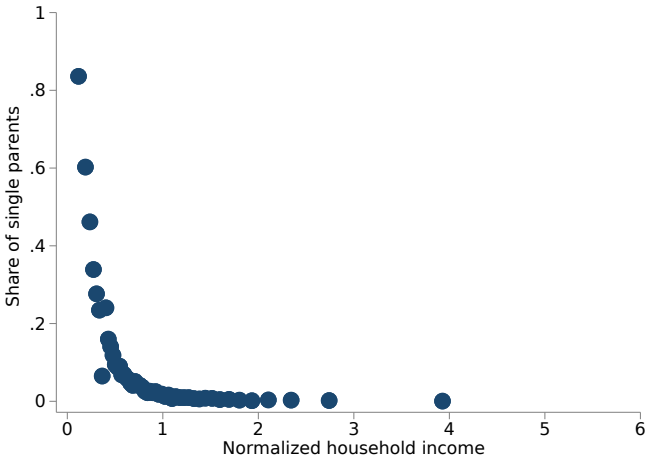
Child	Parent quintile				
quintile	1	2	3	4	5
1	44.2	23.5	15.9	10.6	5.9
2	24.3	24.5	21.2	17.6	12.6
3	16.4	22.0	22.1	21.6	17.8
4	10.2	17.9	22.2	24.2	25.5
5	4.9	12.1	18.7	26.0	38.3

Figure C4: Share of single parents by normalized household income

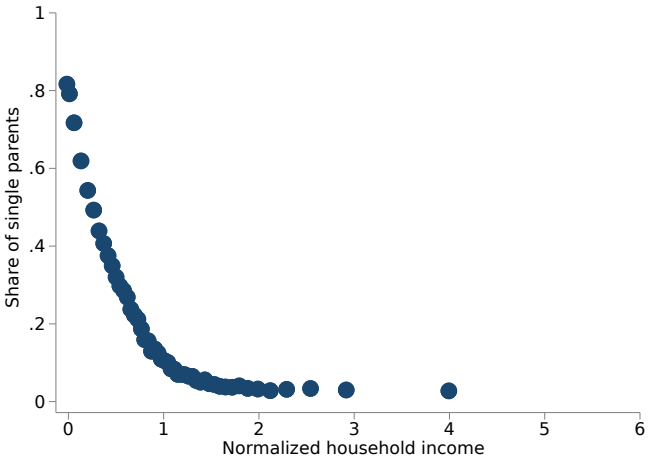
(a) 1967-1970 (CPS-ASEC)



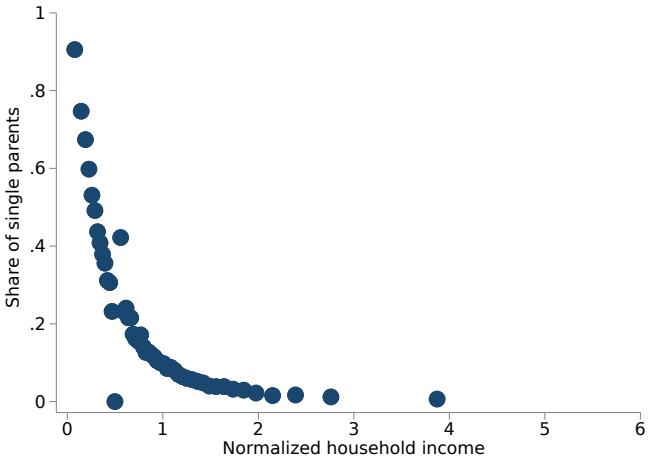
(b) 1947-1970 cohort (model)



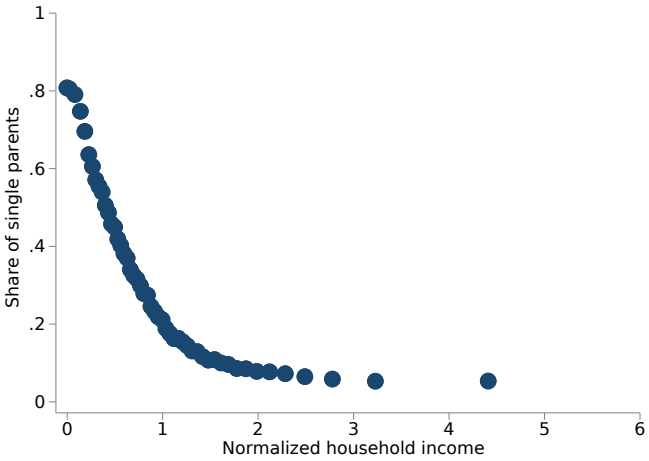
(c) 1971-1994 (CPS-ASEC)



(d) 1971-1994 cohort (model)



(e) 1995-2018 (CPS-ASEC)



(f) 1995-2018 cohort (model)

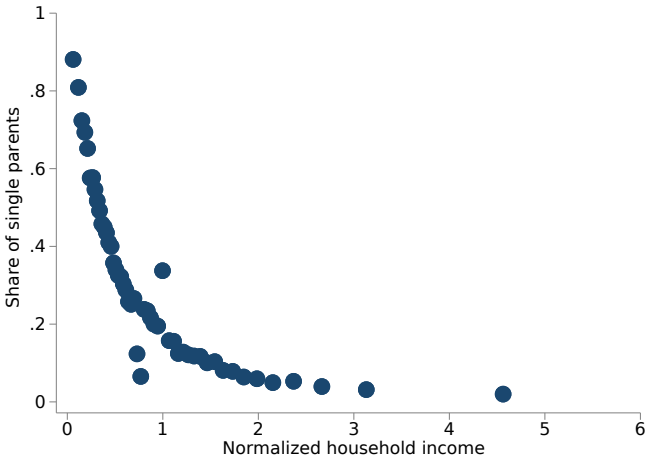
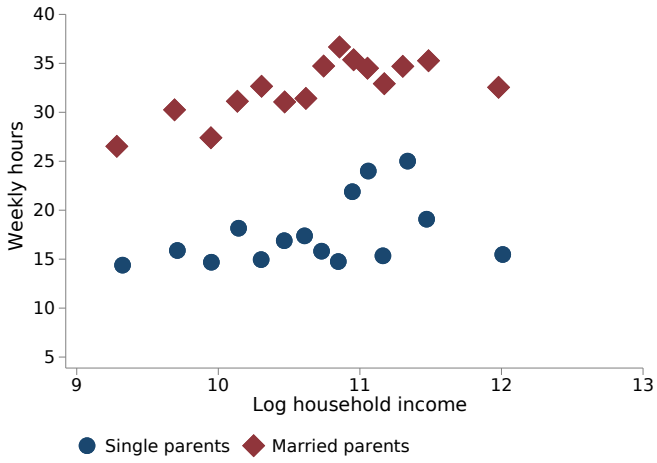
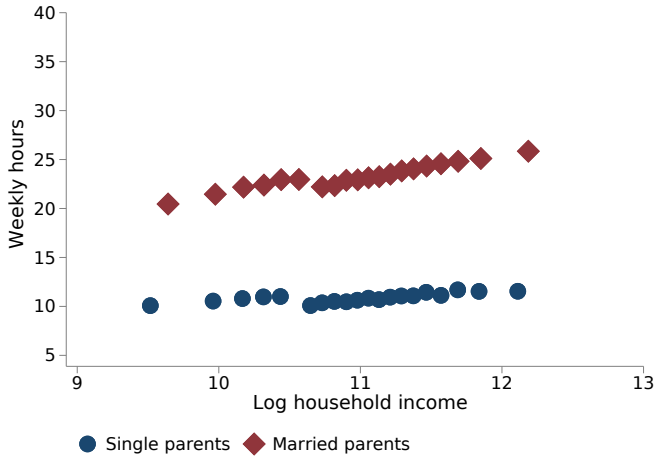


Figure C5: Time investments by log income, data and model

(a) 1997,2002 (PSID-CDS)



(b) 1971-1994 cohort (model)



(c) 1995-2018 cohort (model)

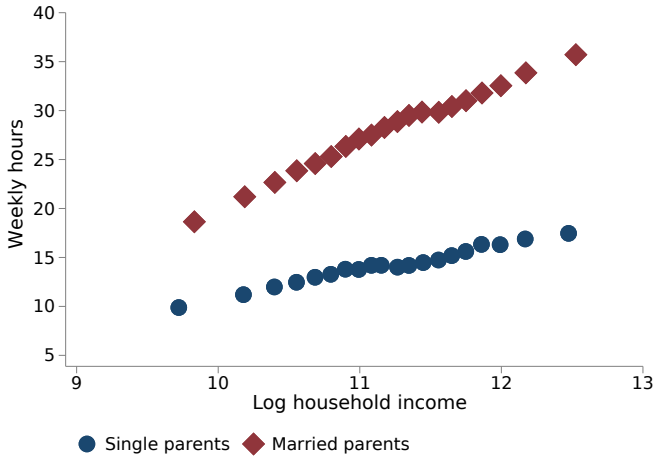
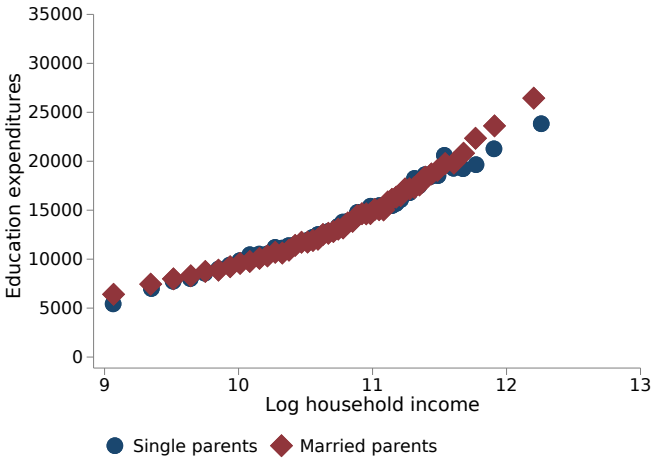
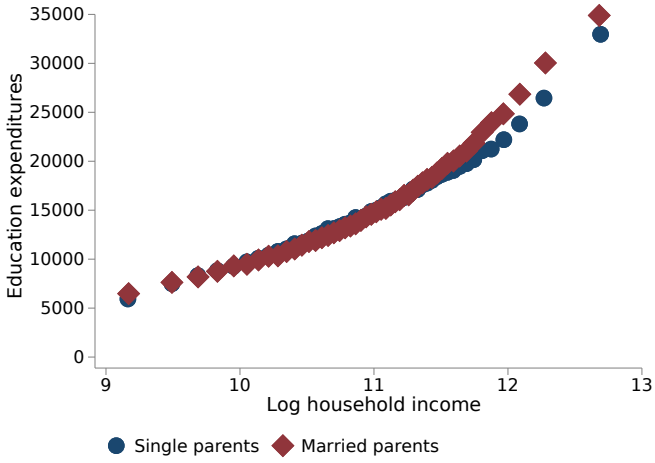


Figure C6: Education investments by log income, data and model

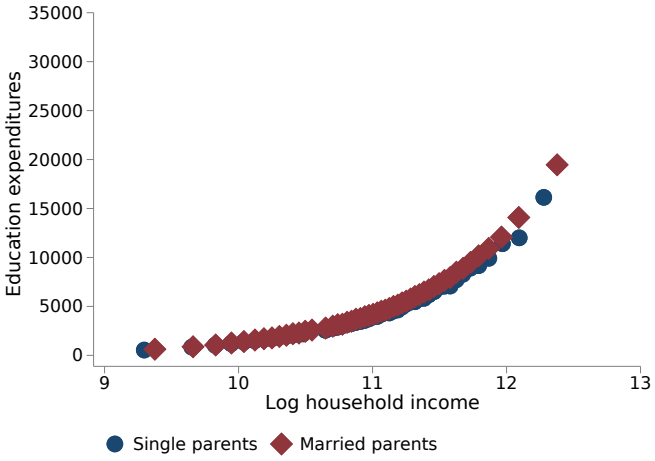
(a) 1990-1994 (CEX and CCD)



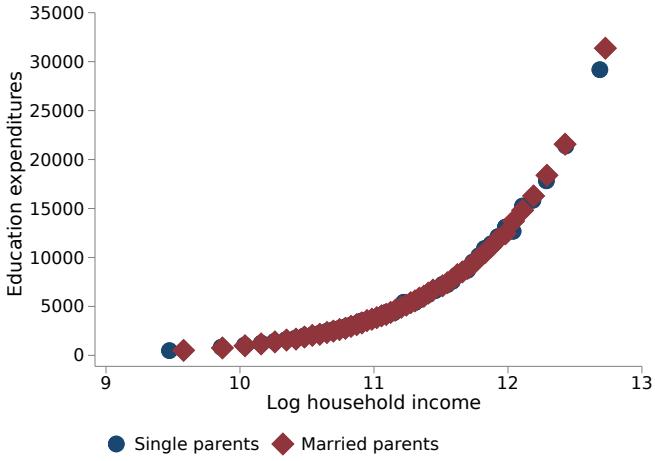
(b) 1995-2018 (CEX and CCD)



(c) 1971-1994 cohort (model)



(d) 1995-2018 cohort (model)



C.3 Counterfactual limiting share of single-parent families

For the counterfactual exercises where the share of single-parent families is limited to 9%, separations are random but correlated with human capital. Similarly to how the match quality preference shocks for parents staying together are constructed, separation shocks $\hat{\xi}_{it} \in \{0, 1\}$ are constructed in a similar way

- Use Gaussian copula to derive joint distribution
- Dependence parameter $\hat{\varrho}_t$
- Marginal success probability for each cohort is share of married families $1 - \pi_t$ from the data
- $\hat{\varrho}_t$ is calibrated so that the model matches the correlation between log income and single parenthood as in the baseline calibration with endogenous family formation. When calibrating $\hat{\varrho}_t$, the marginal success probability (i.e. share of single-parent families) in each period is taken from the data.

    1. Standardize the distribution of log human capital, which is approximately normal, to have mean zero and standard deviation one $\log(\bar{h}_{it}) = (\log(h_{it}) - \mu_{ht})/\sigma_{ht}$
    2. Draw sample from a standard normal distribution for all households $s^1_{it} \sim \mathcal{N}(0, 1)$
    3. Construct *correlated* random draws as $s^2_{it} = \left(\varrho_t \log(\bar{h}_{it}) + \sqrt{1 - \varrho_t^2} s^1_{it}\right)$
    4. Evaluate the cumulative probability for a standard normal at s^2_{it} to generate values from a uniform distribution in $s^3_{it} \in [0, 1]$
    5. If the uniform correlated draws s^3_{it} are greater than or equal to the marginal success probability (share of married-parents families) then the parents stay together ($\hat{\xi}_{it} = 0$); if less than the marginal success probability then parents separate ($\hat{\xi}_{it} = 1$)

$\hat{\varrho}_t$ is calibrated so that the correlation between single parenthood and log income is the same as in the Baseline model[34].

[34]Changes in the dependence parameter between shocks affecting parent separations (i.e. $\hat{\xi}_{it}$ and ξ_{it} with endogenous separations), reflect the spread of single parenthood to parents with higher educations and incomes, despite continued high rates of single parenthood for low income families across cohorts.

D Additional figures and tables

D.1 Trends in parental investments

D.1.1 Public education

Table D1: Log district expenditures per student and county median household income

	(1)	(2)	(3)	(4)
Quintile 2	0.023***	0.017***	0.021***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)
Quintile 3	0.062***	0.054***	0.047***	0.046***
	(0.002)	(0.002)	(0.003)	(0.003)
Quintile 4	0.105***	0.089***	0.088***	0.087***
	(0.002)	(0.003)	(0.003)	(0.003)
Quintile 5	0.203***	0.177***	0.127***	0.129***
	(0.002)	(0.003)	(0.004)	(0.004)
Constant	9.121***	8.909***	9.140***	8.998***
	(0.003)	(0.025)	(0.003)	(0.019)
Year FE	Yes	Yes	Yes	Yes
District controls	No	Yes	No	Yes
District FE	No	No	Yes	Yes
Observations	288,227	288,227	288,227	288,227

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1995-2018; County poverty is the overall county poverty rate, District controls include share of school-age population (ages 5–17) in poverty, share of special education students, and highest grade offered.

D.1.2 Education expenditures in the CEX

Figure D3 shows expenditure shares during early and late childhood. While growing gaps in the level of expenditures is somewhat expected given changes in average household income in these groups, these two figures indicate that not only are households with more resources spending a growing level of expenditures on investments, but also a growing share of their expenditures. In particular, 2H and 80p+ households in early childhood have both increased their expenditure shares since 1990-1994. As early investments are often the most influential on development, these results highlight large and growing gaps in investments at a crucial stage. For lower-resource households, expenditure shares are slightly declining or flat over time.

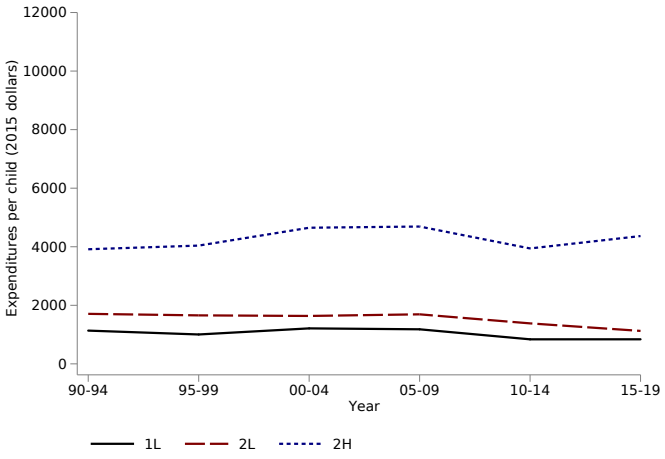
Table D2: Summary statistics of CEX sample

Observations	301,254
Households	90,138
Mean household income	72,891
HS or below	35.8
Some college	30.1
College or more	34.1
Percent married	69.2
Average age of household head	40.1
Average age of youngest child	7.4
Average age of oldest child	10.7
Average number of children	1.9
White	62.8
Black	13.3
Hispanic	17.2
Asian	5.2
Native American	0.8
Multi-racial/Other	0.9

Income and expenditures are deflated using CPI-U-RS with base year 2015.

Figure D1: Expenditures per child, mid childhood

(a) Number and highest education of parents



(b) Expenditure percentile groups

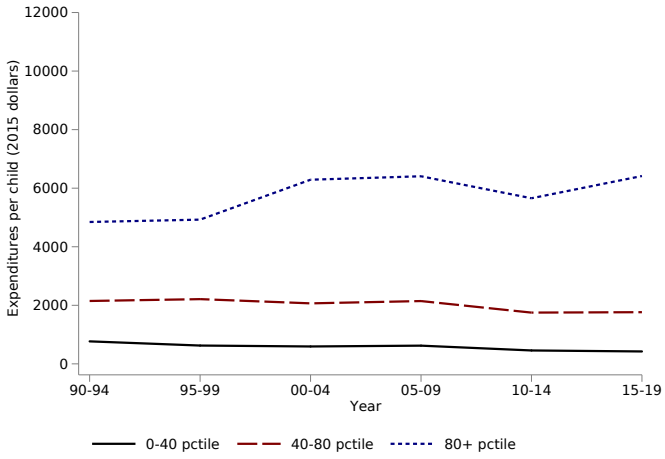
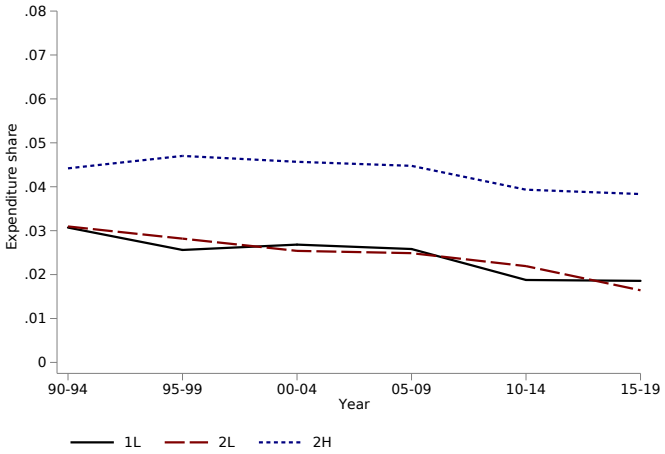


Figure D2: Expenditure shares, mid childhood

(a) Number and highest education of parents



(b) Expenditure percentile groups

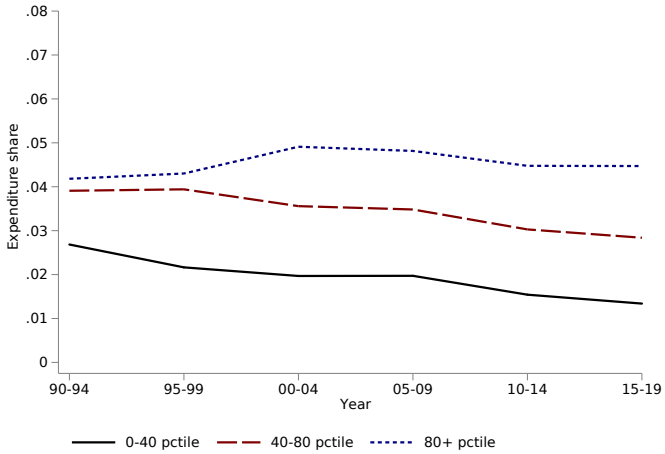


Table D3: Expenditures in early childhood, 1995-1999 and 2015-2019

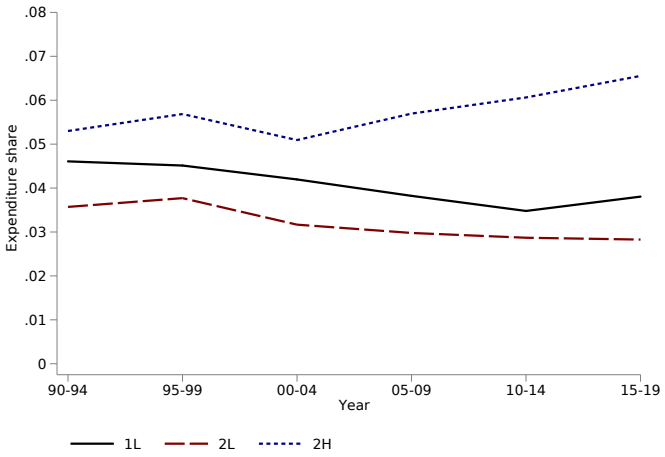
Group	**Expenditures per child**			**Expenditure shares**		
	1995-1999	2015-2019	Change	1995-1999	2015-2019	Change
1L	1,652	1,569	-83	0.045	0.038	-0.007
2L	2,070	1,702	-367	0.038	0.028	-0.009
2H	4,492	6,123	+1,631	0.057	0.066	+0.009
0-40p	802	768	-34	0.031	0.026	-0.005
40-80p	2,766	2,854	+88	0.054	0.050	-0.004
80p+	5,844	8,952	+3,108	0.056	0.077	+0.021

Table D4: Expenditures in late childhood, 1995-1999 and 2015-2019

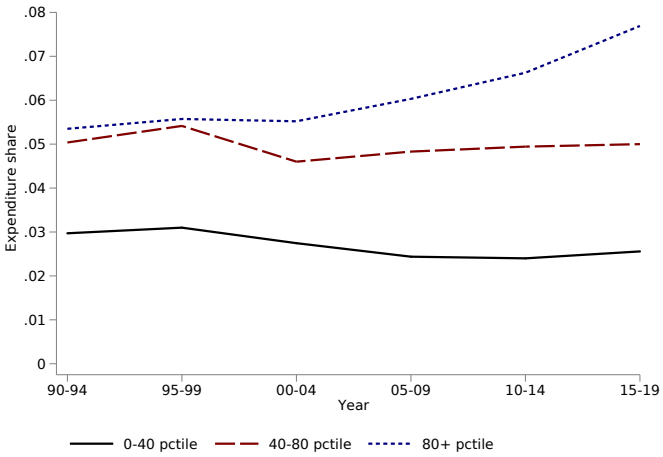
Group	**Expenditures per child**			**Expenditure shares**		
	1995-1999	2015-2019	Change	1995-1999	2015-2019	Change
1L	1,026	731	-295	0.022	0.014	-0.008
2L	2,101	1,325	-776	0.028	0.017	-0.011
2H	6,109	6,904	+794	0.057	0.047	-0.010
0-40p	547	321	-226	0.018	0.010	-0.009
40-80p	2,036	1,584	-478	0.034	0.024	-0.010
80p+	7,541	11,041	+3,500	0.058	0.065	+0.007

Figure D3: Expenditure shares, early and late childhood

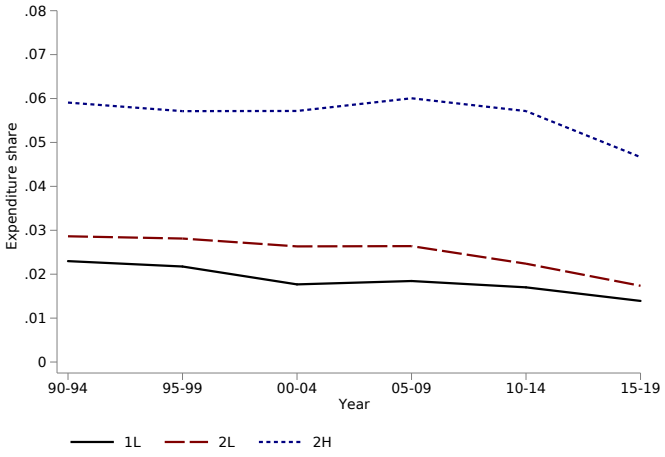
(a) Early: number and highest education of parents



(b) Early: expenditure percentile groups



(c) Late: number and highest education of parents



(d) Late: expenditure percentile groups

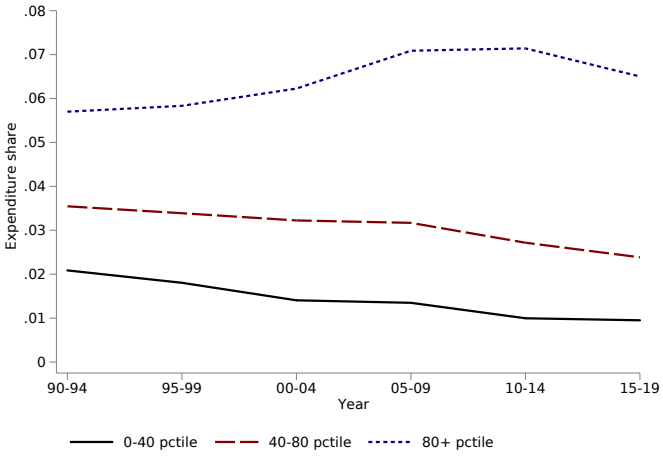


Table D5: Expenditures per child and expenditure shares by resource groups and over time

	Early childhood		**Late childhood**	
	Expenditure shares	Expenditures per child	Expenditure shares	Expenditures per child
40-80p	0.023***	1735.728***	0.011***	958.659***
	(0.002)	(132.878)	(0.002)	(264.810)
80p+	0.023***	4550.220***	0.031***	5869.408***
	(0.002)	(162.308)	(0.002)	(320.832)
2L	-0.015***	-478.767***	0.000	142.535
	(0.002)	(146.384)	(0.002)	(275.053)
2H	-0.002	718.087***	0.021***	2485.591***
	(0.002)	(167.599)	(0.002)	(333.755)
05-09	-0.008***	-91.567	-0.004**	-26.927
	(0.002)	(171.896)	(0.002)	(302.314)
15-19	-0.009***	-252.573	-0.007***	-153.972
	(0.002)	(173.124)	(0.002)	(315.681)
40-80p × 05-09	-0.001	-163.941	0.001	-79.515
	(0.002)	(184.494)	(0.002)	(360.795)
40-80p × 15-19	-0.002	-260.252	-0.001	-544.602
	(0.002)	(188.063)	(0.002)	(377.715)
80p+ × 05-09	0.008***	676.325***	0.016***	2702.036***
	(0.003)	(223.262)	(0.003)	(441.539)
80p+ × 15-19	0.022***	2600.245***	0.012***	2598.063***
	(0.003)	(226.602)	(0.003)	(471.206)
2L × 05-09	0.001	-143.801	-0.001	-238.946
	(0.002)	(204.178)	(0.002)	(372.428)
2L × 15-19	-0.001	-103.233	-0.002	-295.794
	(0.003)	(210.846)	(0.002)	(393.237)
2H × 05-09	0.005*	380.155*	-0.002	390.311
	(0.003)	(229.218)	(0.003)	(448.721)
2H × 15-19	0.009***	786.780***	-0.007**	155.905
	(0.003)	(228.448)	(0.003)	(461.500)
Constant	0.038***	938.166***	0.016***	314.186
	(0.001)	(121.523)	(0.001)	(229.180)

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

D.2 Human capital production efficiency: parenting styles

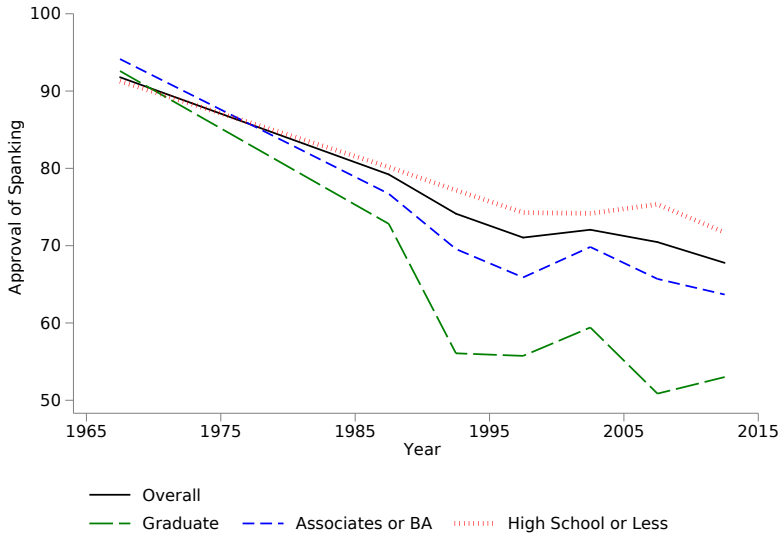
As discussed in Doepke and Zilibotti (2017), there have been long-standing trends in average parenting styles in the United States since the 1960s. Here I show empirical evidence suggesting these trends in parenting styles improve parents' human capital production efficiency. The greater uptake of more effective parenting styles by parents with higher education steepens the relationship between parent human capital and human capital production efficiency across families.

There are four common parenting styles

1. Uninvolved/neglecting: neither supportive or strict
2. Authoritarian: not supportive but strict
3. Permissive: supportive but not strict
4. Authoritative: supportive and strict

Since the 1960 has been decline in authoritarian parenting and a rise in authoritative parenting

Figure D4: Decline in authoritarian parenting: fall in approval of spanking



Notes: Data come from replication files for Doepke and Zilibotti (2017): General Social Survey (GSS, 1986–2014) and "Study of Political Violence Attitudes, Personal Experiences with Violence, Emotional Reactions to Assassination and Violence in the Media, 1968" (ICPSR Study No. 7354).

This societal change in parenting occurred mostly with parents with higher education. As discussed in Section C.4 of the Supplemental Material to Doepke and Zilibotti (2017), "for both mothers and fathers, authoritarian and neglecting parenting is most prevalent for those with the lowest education level (up to high school), and authoritative parenting is most common among parents

with advanced degrees (master, Ph.D., or professional degree)."

Next I show that parenting style impacts educational outcomes with NLSY data from the replication files of Doepke and Zilibotti (2017). I regress child high school GPA and an indicator for having a BA degree on parents' education interacted with parenting style, controlling for household income and demographic variables. Authoritative and permissive styles have positive effects on educational outcomes.

Table D6: Effects of parent education and parenting styles on high school GPA and probability of BA degree

	HS GPA		BA Degree	
Mother's years of education	0.016***	0.017***	0.018***	0.020***
	(0.006)	(0.006)	(0.004)	(0.004)
Father's years of education	0.028***	0.024***	0.025***	0.024***
	(0.005)	(0.005)	(0.003)	(0.003)
Authoritarian × Mother's years of education	-0.001	-0.000	0.003	0.003
	(0.004)	(0.004)	(0.002)	(0.002)
Permissive × Mother's years of education	0.006*	0.008**	0.005**	0.006***
	(0.003)	(0.003)	(0.002)	(0.002)
Authoritative × Mother's years of education	0.008**	0.010***	0.006***	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)
Authoritarian × Father's years of education	0.006*	0.005*	0.002	0.002
	(0.003)	(0.003)	(0.002)	(0.002)
Permissive × Father's years of education	0.012***	0.011***	0.007***	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)
Authoritative × Father's years of education	0.012***	0.013***	0.007***	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)
Household income	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	No	Yes
N	2721	2710	3840	3826

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure D5: Estimated impact of parent education and parenting styles on high school GPA

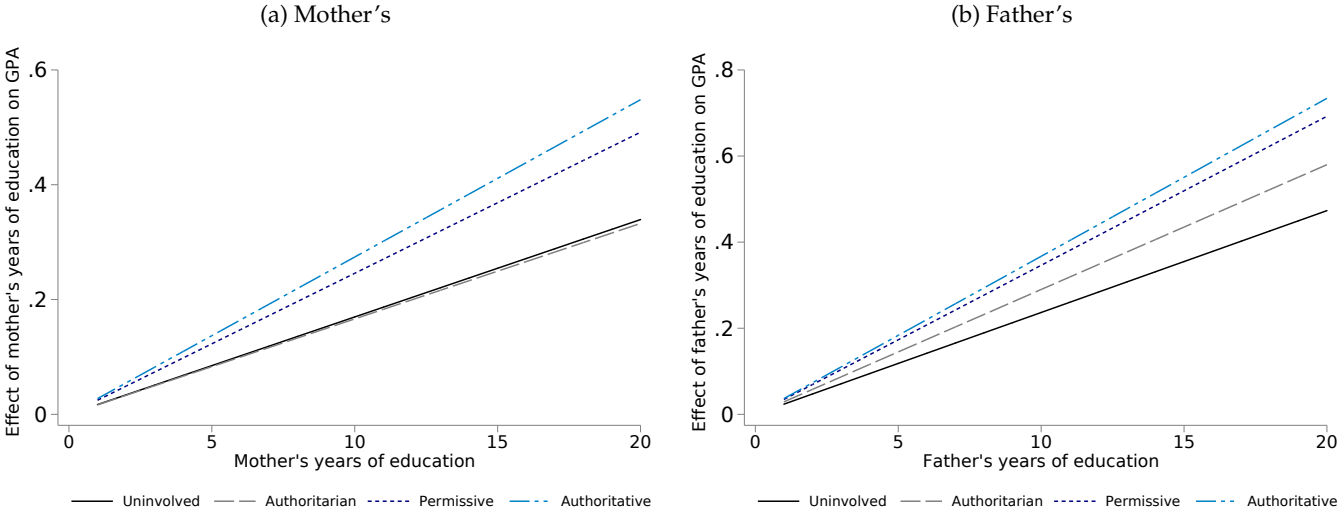
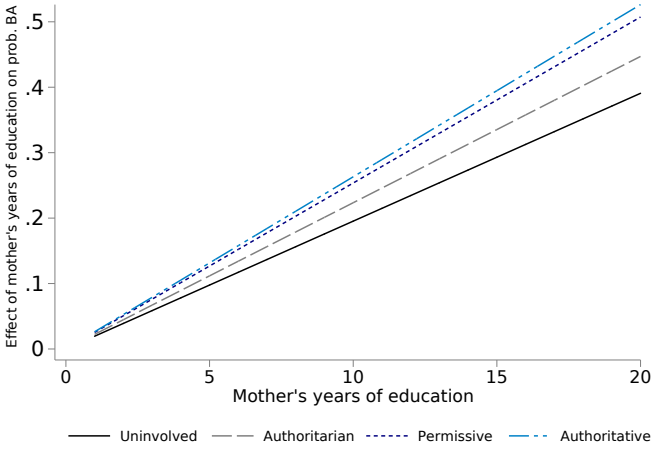
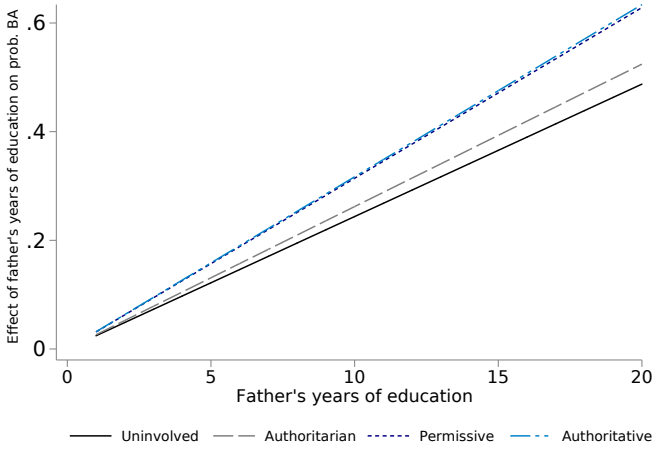


Figure D6: Estimated impact of parent education and parenting styles on probability of BA degree

(a) Mother's



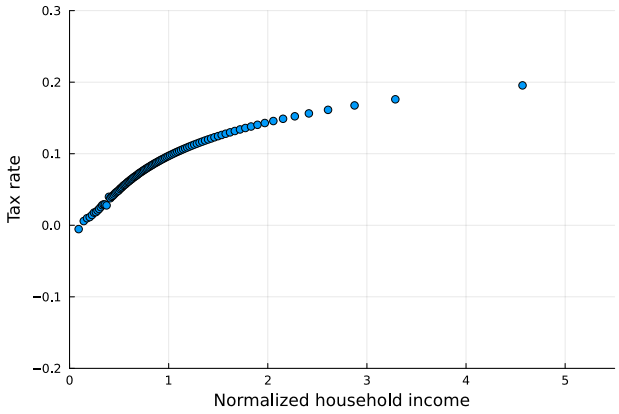
(b) Father's



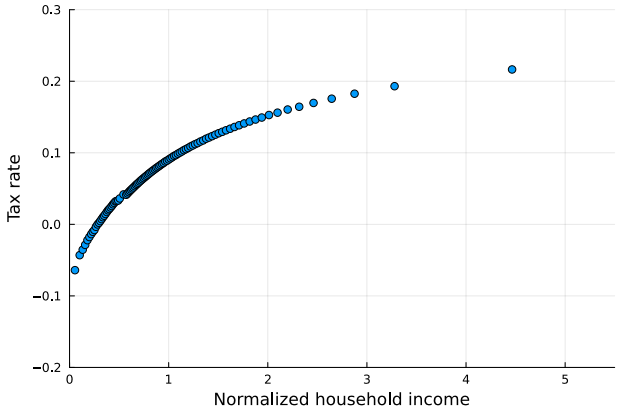
D.3 Quantitative analysis

Figure D7: Tax rates

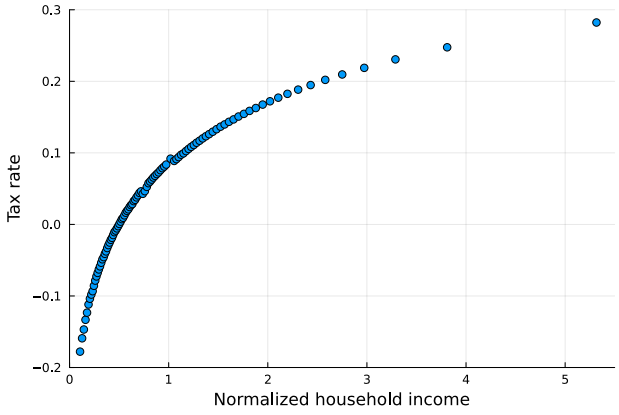
(a) Cohort 1



(b) Cohort 2



(c) Cohort 3



D.3.1 Investments

Cohort 2

Table D7: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	20.92	16.29	20.41	22.41	24.56
Share of single parents 9%	22.29	19.19	21.72	23.31	24.95
No SBTC	23.32	18.53	22.62	25.03	27.09
Relative price of education = 1	22.73	17.74	22.20	24.34	26.64
Taxes and transfers pre-1971	20.65	15.52	20.12	22.43	24.52

Table D8: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	20.92	16.29	20.41	22.41	24.56
Share of single parents 9%	22.29	19.19	21.72	23.31	24.95
No SBTC	23.37	18.50	22.70	25.13	27.16
Relative price of education = 1	22.74	17.68	22.29	24.38	26.62
Taxes and transfers pre-1971	21.14	16.62	20.66	22.67	24.60

Table D9: Average time investments for families in lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Married parents**	**Single parents**
Baseline	13.69	21.10	10.26
Share of single parents 9%	16.81	21.14	10.30
No SBTC	15.25	24.29	11.56
Relative price of education = 1	14.92	23.01	11.19
Taxes and transfers pre-1971	12.82	19.88	9.53

Table D10: Average time investments for families in lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Married parents**	**Single parents**
Baseline	13.69	21.10	10.26
Share of single parents 9%	16.81	21.14	10.30
No SBTC	15.21	24.13	11.55
Relative price of education = 1	14.90	22.91	11.13
Taxes and transfers pre-1971	14.10	19.82	9.72

Table D11: Average education investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	97.92	30.02	64.35	102.36	194.96
Share of single parents 9%	104.25	34.55	70.71	108.94	202.80
No SBTC	192.34	64.57	132.79	203.66	368.34
Relative price of education = 1	106.34	32.69	69.95	111.20	211.52
Taxes and transfers pre-1971	98.15	30.38	63.89	101.84	196.50

Table D12: Average education investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	97.92	30.02	64.35	102.36	194.96
Share of single parents 9%	104.25	34.55	70.71	108.94	202.80
No SBTC	193.02	64.48	132.94	204.34	370.32
Relative price of education = 1	106.34	32.50	70.13	111.52	211.21
Taxes and transfers pre-1971	100.10	32.42	65.93	103.73	198.34

Table D13: Average education investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Married parents**	**Single parents**
Baseline	19.40	22.53	17.95
Share of single parents 9%	23.03	25.09	19.93
No SBTC	42.87	50.64	39.71
Relative price of education = 1	21.16	24.58	19.58
Taxes and transfers pre-1971	18.85	21.94	17.42

Table D14: Average education investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed endogenous structure

	All	**Married parents**	**Single parents**
Baseline	19.40	22.53	17.95
Share of single parents 9%	23.03	25.09	19.93
No SBTC	42.67	50.12	39.61
Relative price of education = 1	21.09	24.42	19.52
Taxes and transfers pre-1971	20.54	22.93	18.72

Cohort 3

Table D15: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	24.46	15.90	23.02	26.98	31.95
Share of single parents 9%	27.56	21.31	26.83	29.18	32.91
No SBTC	30.41	19.99	29.53	33.57	38.54
Relative price of education = 1	31.03	20.49	29.20	34.39	40.05
Taxes and transfers pre-1971	24.05	15.57	22.06	26.75	31.80
Taxes and transfers pre-1995	24.48	16.63	22.79	26.70	31.79

Table D16: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	24.46	15.90	23.02	26.98	31.95
Share of single parents 9%	27.56	21.31	26.83	29.18	32.91
No SBTC	30.40	19.80	29.40	33.61	38.80
Relative price of education = 1	31.04	20.40	29.36	34.36	40.06
Taxes and transfers pre-1971	24.83	17.15	23.20	27.22	31.75
Taxes and transfers pre-1995	24.16	16.02	22.62	26.47	31.52

Table D17: Average education investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	130.03	31.86	72.53	129.49	286.23
Share of single parents 9%	146.27	43.20	88.31	147.79	305.79
No SBTC	525.50	162.47	333.94	546.22	1059.35
Relative price of education = 1	163.99	41.19	92.69	164.08	358.00
Taxes and transfers pre-1971	132.32	28.28	71.18	130.23	299.60
Taxes and transfers pre-1995	131.61	29.40	71.05	130.97	295.05

Table D18: Average education investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	130.03	31.86	72.53	129.49	286.23
Share of single parents 9%	146.27	43.20	88.31	147.79	305.79
No SBTC	530.43	161.63	333.82	550.49	1075.79
Relative price of education = 1	164.11	40.90	93.04	164.19	358.30
Taxes and transfers pre-1971	135.15	31.65	76.35	133.69	298.90
Taxes and transfers pre-1995	130.12	28.40	70.38	130.28	291.41

Table D19: Average education investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Married parents**	**Single parents**
Baseline	19.06	21.26	18.34
Share of single parents 9%	27.71	28.94	25.18
No SBTC	105.15	119.24	101.77
Relative price of education = 1	24.84	27.83	23.87
Taxes and transfers pre-1971	16.05	17.61	15.51
Taxes and transfers pre-1995	17.51	19.18	16.97

Table D20: Average education investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Married parents**	**Single parents**
Baseline	19.06	21.26	18.34
Share of single parents 9%	27.71	28.94	25.18
No SBTC	104.79	119.18	101.54
Relative price of education = 1	24.69	27.45	23.77
Taxes and transfers pre-1971	18.21	19.97	17.31
Taxes and transfers pre-1995	16.42	19.17	15.80

D.3.2 Counterfactual investments and human capital

Table D21: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.412	0.786	0.506
Share of single parents 9% full counterfactual	0.382	0.717	0.456
Counterfactual human capital	0.404	0.766	0.379
Counterfactual work hours and transfers	0.392	0.738	0.387
No SBTC full counterfactual	0.365	0.685	0.356
Counterfactual returns to skill	0.368	0.698	0.371
Counterfactual human capital	0.412	0.785	0.507
Counterfactual work hours and transfers	0.410	0.775	0.493
Relative price of education = 1 full counterfactual	0.410	0.781	0.500
Counterfactual human capital	0.412	0.784	0.505
Counterfactual work hours and transfers	0.411	0.783	0.501
Taxes and transfers pre-1971 full counterfactual	0.414	0.815	0.551
Counterfactual human capital	0.415	0.792	0.525
Counterfactual work hours and transfers	0.412	0.808	0.530

Table D22: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.412	0.786	0.506
Share of single parents 9% full counterfactual	0.382	0.717	0.456
Counterfactual human capital	0.404	0.766	0.379
Counterfactual work hours and transfers	0.392	0.738	0.387
No SBTC full counterfactual	0.366	0.688	0.362
Counterfactual returns to skill	0.368	0.698	0.371
Counterfactual human capital	0.413	0.785	0.384
Counterfactual work hours and transfers	0.412	0.777	0.370
Relative price of education = 1 full counterfactual	0.410	0.781	0.501
Counterfactual human capital	0.413	0.784	0.379
Counterfactual work hours and transfers	0.412	0.780	0.377
Taxes and transfers pre-1971 full counterfactual	0.401	0.784	0.517
Counterfactual human capital	0.411	0.780	0.387
Counterfactual work hours and transfers	0.404	0.788	0.385

D.3.3 Tax progressivity versus generosity of transfers

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Table D23: Inequality and intergenerational mobility of family income: tax and transfer counterfactual experiments with fixed family structure

	Gini of income	SD log income	IGE of income
Baseline	0.412	0.786	0.506
Taxes and transfers pre-1971	0.414	0.815	0.551
Taxes pre-1971	0.414	0.794	0.509
Transfers pre-1971	0.413	0.809	0.549

Table D24: Inequality and intergenerational mobility of family income: tax and transfer counterfactual experiments with endogenous family structure

	Gini of income	SD log income	IGE of income
Baseline	0.412	0.786	0.506
Taxes and transfers pre-1971	0.401	0.784	0.517
Taxes pre-1971	0.412	0.791	0.508
Transfers pre-1971	0.404	0.787	0.524

Table D25: Inequality and intergenerational mobility of wages: tax and transfer counterfactual experiments with fixed family structure

	Gini of wages	SD log wages	IGE of wages
Baseline	0.381	0.726	0.459
Taxes and transfers pre-1971	0.384	0.735	0.481
Taxes pre-1971	0.381	0.725	0.457
Transfers pre-1971	0.384	0.735	0.481

Table D26: Inequality and intergenerational mobility of wages: tax and transfer counterfactual experiments with endogenous family structure

	Gini of wages	SD log wages	IGE of wages
Baseline	0.381	0.726	0.459
Taxes and transfers pre-1971	0.379	0.720	0.469
Taxes pre-1971	0.381	0.725	0.464
Transfers pre-1971	0.380	0.723	0.466

Table D27: Share of changes in inequality and mobility due to changes in taxes and transfers, fixed family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.05	0.10	0.11
Share of Δ due to tax and transfer changes 1971	-6.00	-8.50	-20.36
Share of Δ due to tax changes 1971	0.35	0.57	1.26
Share of Δ due to transfer changes 1971	-6.12	-8.76	-20.82

Table D28: Share of changes in inequality and mobility due to changes in taxes and transfers, endogenous family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.05	0.10	0.11
Share of Δ due to tax and transfer changes 1971	4.77	5.54	-9.21
Share of Δ due to tax changes 1971	0.92	0.48	-4.59
Share of Δ due to transfer changes 1971	2.75	3.14	-6.35

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Table D29: Inequality and intergenerational mobility of family income: tax and transfer counterfactual experiments with fixed family structure

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.451	0.875	0.651
Taxes and transfers pre-1971	0.457	0.918	0.680
Taxes pre-1971	0.453	0.885	0.650
Transfers pre-1971	0.456	0.912	0.681

Table D30: Inequality and intergenerational mobility of family income: tax and transfer counterfactual experiments with endogenous family structure

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.451	0.875	0.651
Taxes and transfers pre-1971	0.440	0.880	0.648
Taxes pre-1971	0.450	0.881	0.647
Transfers pre-1971	0.443	0.883	0.656

Table D31: Inequality and intergenerational mobility of wages: tax and transfer counterfactual experiments with fixed family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Baseline	0.429	0.836	0.620
Taxes and transfers pre-1971	0.434	0.849	0.642
Taxes and transfers pre-1995	0.427	0.828	0.609
Taxes pre-1971	0.428	0.833	0.615
Taxes pre-1995	0.428	0.834	0.617
Transfers pre-1971	0.434	0.851	0.645
Transfers pre-1995	0.428	0.831	0.613

Table D32: Inequality and intergenerational mobility of wages: tax and transfer counterfactual experiments with endogenous family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Baseline	0.429	0.836	0.620
Taxes and transfers pre-1971	0.424	0.824	0.616
Taxes and transfers pre-1995	0.429	0.837	0.619
Taxes pre-1971	0.427	0.832	0.614
Taxes pre-1995	0.427	0.830	0.609
Transfers pre-1971	0.426	0.832	0.625
Transfers pre-1995	0.432	0.846	0.635

Table D33: Share of changes in inequality and mobility due to changes in taxes and transfers, fixed family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.09	0.21	0.27
Share of Δ due to tax and transfer changes 1971	-5.27	-6.20	-8.19
Share of Δ due to tax and transfer changes 1995	1.30	3.50	4.13
Share of Δ due to tax changes 1971	0.60	1.31	1.80
Share of Δ due to tax changes 1995	0.29	0.73	1.10
Share of Δ due to transfer changes 1971	-5.51	-7.01	-9.13
Share of Δ due to transfer changes 1995	0.89	2.51	2.68

Table D34: Share of changes in inequality and mobility due to changes in taxes and transfers, endogenous family structure

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.09	0.21	0.27
Share of Δ due to tax and transfer changes 1971	5.51	5.57	1.57
Share of Δ due to tax and transfer changes 1995	-0.16	-0.42	0.28
Share of Δ due to tax changes 1971	1.88	1.97	2.16
Share of Δ due to tax changes 1995	2.21	2.67	4.22
Share of Δ due to transfer changes 1971	2.43	1.88	-1.68
Share of Δ due to transfer changes 1995	-3.38	-4.94	-5.56

D.3.4 Effects of single parenthood combined with other changes

Cohort 3

Table D35: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals with share of single parents 9%

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.412	0.786	0.506
Share of single parents 9%	0.382	0.717	0.456
with no SBTC	0.334	0.619	0.311
with relative price of education = 1	0.381	0.714	0.452
with taxes and transfers pre-1971	0.382	0.736	0.496

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

Table D36: Inequality and intergenerational mobility of wages for the Baseline model and counterfactuals with share of single parents 9%

	Gini of wages	**SD log wages**	**IGE of wages**
Baseline	0.381	0.726	0.459
Share of single parents 9%	0.371	0.701	0.454
with no SBTC	0.319	0.589	0.308
with relative price of education = 1	0.370	0.699	0.453
with taxes and transfers pre-1971	0.373	0.708	0.473

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

Table D37: Share of changes in wage inequality and mobility due to trends in family resources for counterfactuals with share of single parents 9%

	Gini of wages	**SD log wages**	**IGE of wages**
Δ since 1971-1994	0.05	0.10	0.11
Share of Δ due to family structure	21.37	24.83	4.11
and education prices	23.26	26.21	4.94
and tax and transfer changes 1971	16.74	17.78	-13.52

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

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Table D38: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals with share of single parents 9%

	Gini of income	SD log income	IGE of income
Baseline	0.451	0.875	0.651
Share of single parents 9%	0.412	0.778	0.572
with no SBTC	0.350	0.650	0.381
with relative price of education = 1	0.405	0.765	0.557
with taxes and transfers pre-1971	0.415	0.807	0.602
with taxes and transfers pre-1995	0.415	0.796	0.569

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

Table D39: Inequality and intergenerational mobility of wages for the Baseline model and counterfactuals with share of single parents 9%

	Gini of wages	SD log wages	IGE of wages
Baseline	0.429	0.836	0.620
Share of single parents 9%	0.405	0.773	0.579
with no SBTC	0.338	0.629	0.394
with relative price of education = 1	0.399	0.763	0.569
with taxes and transfers pre-1971	0.409	0.786	0.601
with taxes and transfers pre-1995	0.405	0.771	0.575

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

Table D40: Share of changes in wage inequality and mobility due to trends in family resources for counterfactuals with share of single parents 9%

	Gini of wages	SD log wages	IGE of wages
Δ since 1971-1994	0.09	0.21	0.27
Share of Δ due to family structure	25.49	29.45	15.26
and education prices	31.64	34.42	19.11
and tax and transfer changes 1971	20.51	23.51	7.05
and tax and transfer changes 1995	25.52	30.39	16.71

Note: Bottom portion of table shows results for scenarios with share of single parents at 9% and additional changes in family resources included separately.

D.3.5 Implications of changes in family resources for the next cohort

Here I present full results for predicted outcomes of the next cohort. I use the model to quantify the long-run implications of prior changes in family resources across cohorts. I also include more recent changes to taxes and transfers following reforms in the 1990s. The motivation for this section is that changes in parental investments across families takes a generation to manifest for outcomes like inequality and intergenerational mobility, and may have different medium- and long-term effects.

I first present results for family income, comparing inequality and mobility under each counterfactual. Then I show which long-term trends and recent changes to family resources contributed to or mitigated the predicted changes in inequality and intergenerational mobility[35].

Table D41: Inequality and intergenerational mobility of family income for the Baseline model and counterfactuals

	Gini of income	**SD log income**	**IGE of income**
Baseline	0.451	0.875	0.651
Share of single parents 9%	0.412	0.778	0.572
Family structure fixed to Baseline			
No SBTC	0.387	0.738	0.468
Relative price of education = 1	0.445	0.862	0.637
Taxes and transfers pre-1971	0.457	0.918	0.680
Taxes and transfers pre-1995	0.455	0.891	0.639
Endogenous family structure			
No SBTC	0.391	0.742	0.477
Relative price of education = 1	0.446	0.864	0.641
Taxes and transfers pre-1971	0.440	0.880	0.648
Taxes and transfers pre-1995	0.458	0.906	0.653

Table D41 presents the Gini coefficient, standard deviation of logs, and IGE of family income predicted for the next cohort, continuing the Baseline and counterfactual scenarios from the previous section and including the new counterfactual where tax and transfer policy are not changed for the 1995-2018 period. In the Baseline model, inequality in family income grows compared to the previous cohort, with the Gini coefficient rising from 0.412 to 0.451 and the standard deviation of log income increasing from 0.786 to 0.875. Persistence increased substantially, from 0.506 to a staggering 0.651. This means that a 10 percent difference between two sets of parents' incomes leads to a 6.5 percent difference in their respective children's incomes.

[35]Outcomes for the next cohort are simulated using the calibrated technology parameters for the prior cohort, so the predicted changes in inequality and intergenerational mobility are absent increases in the returns to skill due to SBTC, which has been a key driver of these two trends. The results here are driven by inequality in parental resources and investments during 1995-2018.

If the share of single-parent families remained at 9% for all cohorts, both inequality and intergenerational persistence would be markedly lower. Relative to the Baseline outcome, the Gini coefficient would be 0.412 compared to 0.451, standard deviation of log income would be 0.778 compared to 0.875, and the IGE of income would be 0.572 compared to 0.651. Family structure thus had a significant impact on inequality and mobility, leading to greater dispersion and persistence in both the medium- and long-term. Only SBTC had more significant effect. The relative price of education, which rose rapidly during 1995-2018, did impact inequality and mobility, but again the effect was relatively minimal as families change investments similarly in response to price changes.

Table D42: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	24.46	15.90	23.02	26.98	31.95
Share of single parents 9%	27.56	21.31	26.83	29.18	32.91
No SBTC	30.41	19.99	29.53	33.57	38.54
Relative price of education = 1	31.03	20.49	29.20	34.39	40.05
Taxes and transfers pre-1971	24.05	15.57	22.06	26.75	31.80
Taxes and transfers pre-1995	24.48	16.63	22.79	26.70	31.79

Table D43: Average time investments overall and by income quartile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Quartile 1**	**Quartile 2**	**Quartile 3**	**Quartile 4**
Baseline	24.46	15.90	23.02	26.98	31.95
Share of single parents 9%	27.56	21.31	26.83	29.18	32.91
No SBTC	30.40	19.80	29.40	33.61	38.80
Relative price of education = 1	31.04	20.40	29.36	34.36	40.06
Taxes and transfers pre-1971	24.83	17.15	23.20	27.22	31.75
Taxes and transfers pre-1995	24.16	16.02	22.62	26.47	31.52

When taking family structure as given, tax and transfer changes in 1971-1994 and 1995-2018 mitigated the rise in inequality and intergenerational persistence driven by SBTC and single parenthood. Without both sets of expansions to the generosity of transfers and tax credits, there would be greater dispersion in family income and a more rigid economic landscape. While the Gini coefficient would be only slightly higher compared the Baseline outcome, the standard deviation of log income and IGE would both be almost 5 percent larger compared to the Baseline model. The IGE of income without any policy reforms would climb to 0.680. Thus, a 10 percent difference in income between two sets of parents leads to an expected 6.8 percent difference in their children's

incomes. The lack of support systems means every family is effectively on their own.

When family structure is endogenous, a different story emerges. Without the policy changes in 1971-1994 and 1995-2018, the share of single-parent families rises less than in the Baseline model. Recall from the previous section that in the absence of policy changes in 1971-1994, the share of single-parent families in the second period would be 16% instead of 20%. When simulating this counterfactual another period, the share would be 24% compared to 29% in the Baseline model. The two sets of policy changes led to more single parents, but in the long-run the standard deviation of log income and IGE of income are roughly the same. What differs is the Gini coefficient. In the Baseline model, the Gini coefficient predicted for the period is 0.451. In the counterfactual with endogenous family structure, it is be 0.440. Thus, while the distributions of income in both cases have similar width, the composition of the distributions are different. The lower share of single-parent families means that income is more evenly distributed compared to the Baseline model, so less concentration of incomes at different points of the distribution.

Table D44: Average time investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with fixed family structure

	All	**Married parents**	**Single parents**
Baseline	12.89	20.47	10.43
Share of single parents 9%	18.41	21.93	11.23
No SBTC	16.25	27.14	13.64
Relative price of education = 1	16.73	26.66	13.52
Taxes and transfers pre-1971	12.62	19.55	10.25
Taxes and transfers pre-1995	13.82	21.48	11.34

Table D45: Average time investments for lowest income decile across scenarios: Baseline, share of single-parents 9%, counterfactuals with endogenous family structure

	All	**Married parents**	**Single parents**
Baseline	12.89	20.47	10.43
Share of single parents 9%	18.41	21.93	11.23
No SBTC	16.10	27.29	13.57
Relative price of education = 1	16.76	26.44	13.53
Taxes and transfers pre-1971	13.84	20.37	10.51
Taxes and transfers pre-1995	13.05	21.98	11.04

Looking at results for the newly added counterfactual, taking family structure as given, the additional policy changes in the 1990s helped reduce income inequality but contributed modestly to increasing persistence. Recall that reforms in the 1990s involved expanding eligibility for transfers to families higher up the income distribution than in prior periods. Tax credits were expanded

several times, providing much greater wage subsidies for low-income families. But, there was little change in generosity of transfers for families at the bottom of the distribution. Thus, for the lowest-income families the substitution effect from expanded tax credits dominated the income effect from transfers. These parents spent more time at work at the cost of less time with their children. Tables D42 and D44 show that without the change in policy for the 1995-2018 period, parents in the lowest income quartile and decile have greater time investments, particularly for those in the bottom decile. With the expanded tax credits, time investments decline and work hours go up. One of the goals for reforms in the 1990s was to induce more employment. It appears to have worked, but at the detriment of children's development in the poorest families. On the flips side, parents from families with slightly higher incomes were now eligible to receive transfers, allowing for fewer hours at work and more time at home with their children. The decline in investments for families at the very bottom of the income distribution coupled with increases in investments for families towards the middle of the distribution leads to more dispersion in investments and greater persistence of outcomes for the next generation. This explains the result for policy changes in the 1990s with fixed family structure. Inequality goes down because parents from low-income families are working and earning more due to the expanded tax credits, but this translates to higher persistence due to more unequal investments.

Table D46: Share of single-parents for counterfactual scenarios with endogenous family structure

	Share of single-parent families	**Correlation with log income**
Baseline	0.29	0.44
No SBTC	0.29	0.52
Relative price of education = 1	0.29	0.44
Taxes and transfers pre-1971	0.24	0.42

With endogenous family structure, the changes to taxes and transfers in the 1990s led to a slightly lower share of single-parent families. Without the policy changes, the share of single-parent families in the third period would go from 29% in the Baseline model to 31% in the counterfactual. Absent the expansion of benefits, more parents separate, which would increase family income inequality. The net effect of expanded benefits in 1995-2018 with endogenous family structure is less inequality and lower intergenerational persistence of family income as slightly fewer parents separate due to more generous benefits for married parents with middle incomes.

The other changes in resources had smaller contributions to predicted inequality and mobility for the next cohort. Education prices, both with fixed and endogenous family structure, contributed to 4-6 percent of the increase in inequality and about 4 percent of the increase in persistence. Again, this result is due to similar changes in investments across families after price increases. Lower-income families are affected moderately more by higher prices, which results in the small effects on outcomes. The expansion of transfers in the second and third periods, taking family structure as given, helped mitigate the rise in both inequality and intergenerational persistence, reducing

inequality by 5-6 percent and persistence by about 8 percent. With endogenous family structure, these policy changes contributed to 5-6 percent of the increase in inequality and a little over 1.5 percent of the increase in persistence. This is due to how family structure changed because of more generous transfers available to single parents. The increase in generosity led to more single parents, which increased inequality due to greater dispersion in investments. Finally, the most recent policy changes are predicted to have small effects on the distribution of wages for the next cohort, despite larger effects for family income. While families with the lowest income and wages decreased investments due to more generous tax credits, the effect overall is small.