It Takes a Village: The Economics of Parenting with Neighborhood and Peer Effects*

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Abstract

During adolescence, peer interactions become increasingly central to children's development, whereas the direct influence of parents wanes. Nevertheless, parents can continue to exert leverage by shaping their children's peer groups. We construct and estimate a model of parenting with peer and neighborhood effects where parents intervene in peer formation and show that the model captures empirical patterns of skill accumulation, parenting style, and peer characteristics among US high school students. We find that interventions that move children to better neighborhoods lose impact when they are scaled up, because parents' equilibrium responses push against successful integration with the new peer group.

Keywords: Adolescents, Authoritarian Parenting, Homophily, Inequality, Moving-To-Opportunity, Parenting Style, Peer Effects, Skill Formation, Structural Estimation.

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I. Introduction

The most important influences on a child's development are their parents and their peers. The balance between these two factors shifts as children progress in age. When children enter adolescence, parents' ability to exert control over them wanes, while the influence of peers takes on greater significance (see, e.g., Erikson 1950, Steinberg and Silverberg 1986, Brown and Larson 2009, and Laursen and Veenstra 2021). However, parents can endeavor to shape how children choose their companions. They can select neighborhoods to live in and schools for their children to attend, and they can encourage their children to participate in activities and pursue hobbies that introduce them to particular peer groups. Alternatively, parents can take a more direct approach by urging their children to associate with specific peers or by prodding them to distance themselves from others.

In this paper, we investigate the determinants and consequences of parental interference in their children's peer relationships. Our study is based on insights drawn from the Add Health study, which tracks a cohort of students in the United States throughout their high school years. This data set encompasses details on students' academic performance, test results, and the socioeconomic attributes of their families. Importantly, it also offers comprehensive information on parental behavior and children's friendship networks. Our particular focus is on understanding parents' engagement in children's peer group formation. The data set includes a question that directly speaks to this issue: "Do your parents let you make your own decisions about the people you hang around with?" We designate a parent whose child responds with "No" as displaying an authoritarian approach to friendships—more succinctly, as authoritarian. Conversely, a parent whose child responds with "Yes" displays a nonauthoritarian parenting style.[1]

We interpret the choice to embrace an authoritarian parenting style through the lens of a theory where parents are motivated by the current and future well-being of their children and adapt their behavior to the characteristics of both their children and the surrounding community. Our exploration starts by documenting correlations between the parenting style chosen by parents and the peer environment their children face. We show that parents are more likely to interfere in their children's choice of friends when the academic proficiency of the peer

[1] We also construct an alternative measure of a latent parenting style based on children's responses to multiple questions. The notion of an authoritarian parenting style (stretching back to Baumrind 1967) is usually more general and covers many aspects of behavior; we use the shorthand "authoritarian" because we are specifically interested in the impact of parents on peer selection. Following Doepke and Zilibotti (2017), we do not attach a value judgement to the notion of authoritarian parenting, and simply use "authoritarian" to denote parents who restrict their children's choices.

group is lower and when inequality in proficiency is higher. Authoritarian parenting also appears to be effective: intervening in a child's peer relationships correlates with a subsequent enhancement in the average academic performance of the child's group of friends.

These correlations align with the perspective that parents' actions are purposeful responses to the environment their children face. To investigate the implications of this hypothesis, we develop a model that integrates dynamic skill formation in children (Cunha and Heckman 2007) with endogenous friendship networks (Agostinelli 2018) and a rational choice theory of parent-child interactions. Based on Doepke, Sorrenti, and Zilibotti (2019), our model incorporates a paternalistic component of parents' concern for their children: Parents are more concerned about the children's accumulation of skills than are the children themselves. This tension motivates parental interventions that can take two forms. First, parents can intervene in their child's selection of friends, that is, parents can adopt an authoritarian approach. Second, parents can invest time to directly support their children's skill development, such as assisting with homework. We construe such time investments as an aspect of an authoritative parenting style.[2] These two strategies are not mutually exclusive; parents can opt to combine elements of both authoritarian and authoritative parenting.

Children establish friendships through mutual agreement between potential friends. The utility derived from a friendship hinges on the characteristics of both the child and the friend, along with idiosyncratic match-specific shocks. Children under an authoritarian parenting style experience a welfare penalty if they befriend peers who are less academically proficient than they are. By prompting a more positive selection of friends, the authoritarian parenting style enhances the average academic proficiency of a child's peers. However, drawing on insights from the literature on child development, we take into account that an authoritarian parenting style might have other drawbacks. For example, interfering in the selection of friends could strain the parent-child relationship and leave the child less receptive to other parental interventions. As a result, parents are presented with a trade-off, the optimal solution of which hinges on the peer environment their children are exposed to. Influencing friendship choices is appealing in neighborhoods where social interactions might hinder rather than foster children's educational progress. In contrast, in affluent neighborhoods characterized by high academic achievement among potential peers, parents can give their children more independence and avoid the downsides of a strict parenting approach.

[2] Authoritative parenting typically involves active parental engagement, along with an emphasis on explaining the rationale behind parental viewpoints rather than merely demanding obedience, as seen in the authoritarian style (see Doepke and Zilibotti 2019 for an in-depth discussion of parenting styles from an economic standpoint).

We estimate the model using the indirect inference method and find a strong alignment between the model's predicted outcomes and the empirical correlations among child skills, peer attributes, and parenting style observed in the Add Health study. The primary sources of identification in the estimation are the within-school-grade and within-child panel variation in the makeup of peer groups. Although unobserved heterogeneity between families in their inclination toward an authoritarian approach could contribute to the cross-sectional correlation between parenting styles and peer achievement, panel regressions highlight parental responses to changes in the peer environment while controlling for time-invariant preference heterogeneity across families. The model also fits the observed variation in parenting styles across schools in affluent and disadvantaged neighborhoods well.

The estimated model implies a flexible interaction between different aspects of parenting style. In the case of nonauthoritarian parents, dedicating time to enhance the skills of the child serves as a substitute for the skills of the child's peers, aligning with the results in Agostinelli (2018). Consequently, parents increase their time investments when their children face an unfavorable peer environment. In contrast, the time investment made by authoritarian parents remains unaffected by the academic proficiency of their children's peers. These results indicate that parents view authoritative supportive time investments and authoritarian intervention in friendship selection as alternative strategies to respond to a challenging peer environment.

Having validated that parenting behavior can indeed be viewed as a rational response to variation in the environment, we investigate the model's implications for the consequences of policy interventions that aim to enhance opportunities for underprivileged children. Specifically, we examine a policy that relocates children from disadvantaged neighborhoods. Our model indicates that when children transition to neighborhoods with higher average academic achievement among children, they encounter two barriers to integration. The first is homophily bias, that is, children's tendency to associate with peers who are similar to them, particularly in terms of academic achievement. The second obstacle emerges from the responses of the parents within the host neighborhood.

Our counterfactual analysis demonstrates that the potency of both barriers hinges on the scale of the intervention. A policy that relocates only a few children generates substantial benefits for the moved children, while largely avoiding adverse effects on the children at the receiving school. However, as the scale of the policy expands to include more children, its effectiveness quickly declines. Homophily bias leads relocated children to cluster together and interact less with others. In addition, parents in the receiving neighborhood become prone to turn

authoritarian and discourage their children from befriending the less academically proficient new arrivals, counteracting successful integration of the two groups. In an extension, we also explore the possibility that some families in the host neighborhood decide to move away in response to the policy. This further reduces the benefits of the intervention. These findings underscore the importance of accounting for parental reactions when assessing the impacts of policies that aim to reshape peer effects.

Relationship to Literature

Our paper links different strands of the child development literature. The first is the literature on children's skill formation, notably James Heckman's recent work with different coauthors (e.g., Cunha and Heckman 2007; Cunha, Heckman, and Schennach 2010). This body of literature has provided a fresh perspective on the evolution of children's skills and attitudes, influenced by the inputs provided by parents and other sources.[3] Our primary contribution to this literature is the recognition that parents can choose alternative strategies (that is, parenting styles) to promote the acquisition of skills of their children.

The second strand of literature studies the importance of neighborhood effects. This literature shows that children who grew up in distressed areas tend to achieve lower outcomes and display less upward mobility than children from wealthier areas (e.g., Cutler and Glaeser 1997; Chetty et al. 2014). The importance of childhood exposure to neighborhoods is also supported by recent articles studying the effect of moving to better areas (see, e.g., Chetty, Hendren, and Katz 2016, Chetty and Hendren 2018a, 2018b, and Chyn 2018). In most existing empirical studies, the mechanism through which the benefits of residing in a more advantageous neighborhood are attained remains elusive. In this regard, our study serves as a complement to the theoretical literature on social interactions within neighborhoods (e.g., Brock and Durlauf 2001a, 2001b, 2002, and Durlauf and Ioannides 2010) and the empirical literature on peer effects in education.[4] Calvó-Armengol, Patacchini, and Zenou (2009) estimate a friendship

[3]Other important studies in this literature include Todd and Wolpin (2003), Heckman, Stixrud, and Urzua (2006), Cunha and Heckman (2008), Almlund et al. (2011), Dahl and Lochner (2012), Løken, Mogstad, and Wiswall (2012), Heckman, Pinto, and Savelyev (2013), Del Boca, Flinn, and Wiswall (2014), Agostinelli and Wiswall (2023), Agostinelli and Sorrenti (2022), Heckman, Humphries, and Veramendi (2018), Attanasio, Meghir, and Nix (2020), and Attanasio et al. (2020). For a review of the literature, see Heckman and Mosso (2014).

[4]Case and Katz (1991) is an early contribution to the study of the effect of neighborhood peers on youth behavior. Other studies of peer effects in education include Altonji and Mansfield (2018), Hoxby (2000), Zimmerman (2003), Sacerdote (2011), Arcidiacono et al. (2012), Carrell, Sacerdote, and West (2013), and Feld and Zölitz (2017). Blume et al. (2011, 2015) discuss identification problems in social interaction models.

network model using, as we do, the Add Health data.[5] List, Momeni, and Zenou (2019) documents large spillovers of programs targeting disadvantaged children on the cognitive and noncognitive skills of other local children. In line with our modeling approach, the evidence suggests that these spillovers operate through children's social networks. Angrist and Lang (2004) study the effect of a desegregation busing policy in the Boston area. They find that negative spillovers on the receiving community are small, although there are some negative effects on local black children who are more likely to interact with the moved children. These results are consistent with the findings of our counterfactual policy analysis. Two recent macroeconomic papers by Eckert and Kleineberg (2021) and Fogli and Guerrieri (2019) study the effect of neighborhoods on human capital and social mobility.

The third strand of related literature merges insights from child development psychology with the Beckerian tradition of family economics, as in our previous work in Doepke and Zilibotti (2017 and 2019), and Doepke, Sorrenti, and Zilibotti (2019). While the psychology literature treats parenting styles as inherent parental traits, this economics literature, as we do in this article, views them as deliberate choices made by parents to influence their children's behavior.[6] Strategic interaction between parents and children is also central in Del Boca et al. (2019), who focus on monetary incentives that parents provide for their children (related to Weinberg 2001), as opposed to interference with friend selection. Compared to this literature, the key innovation of this article is to consider how parenting choices interact with peer effects.

Finally, our research is related to the developmental psychology literature that studies the interaction between parents and peers.[7] Such interactions are prominent in studies exploring the influence of peers on antisocial behavior and juvenile crime. Patterson and Dishion (1985), Dishion et al. (1991), and Dishion and McMahon (1998) underscore the importance of parental discipline and monitoring practices to prevent deviant behavior among adolescents exposed to adverse peer environments. Their findings align with our theory, particularly in how an authoritarian parenting style can counteract negative peer influences within the educational sphere. Even authors who harbor skepticism about parental influence on adolescents, such

[5] Other studies on peer effects using the Add Health data set include Bifulco, Fletcher, and Ross (2011), Mele (2020), Olivetti, Patacchini, and Zenou (2020), Badev (2021), and Boucher et al. (2023).

[6] Earlier work on the economics of parenting includes Akabayashi (2006) and Lizzeri and Siniscalchi (2008), who emphasize informational frictions and learning. More recent studies include Patacchini and Zenou (2011), Zumbuehl, Dohmen, and Pfann (2020), Brenøe and Epper (2022), Cobb-Clark, Salamanca, and Zhu (2019), and Kim (2020).

[7] For instance, Brooks (2013) characterizes parenting as a "process of action and interaction between parent and child .... Society is a third dynamic force in the process. ... The child, the parent, and society all influence the process of parenting, and, in turn, are changed by it" (pp. 6–7).

as Harris (1998), acknowledge the effect parents can have on shaping their children's peer environments.

Section II describes the data and provides descriptive evidence. Section III develops a structural model of parent-child interactions with peer effects. Section IV describes the estimation. Section V uses the model for policy analysis. Section VI concludes. The Appendix contains additional details.

II. Parenting, Peers, and Skills in the Add Health Data

In this section, we describe the data and document the empirical correlations that motivate our structural model.

A. Data

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a nationally representative longitudinal survey of adolescents in the United States (Harris et al. 2009), which includes about 90,000 students in grades 7–12 from 132 schools in the year 1994–95. Our analysis focuses on the baseline survey (Wave I) and the 1996 follow-up (Wave II).

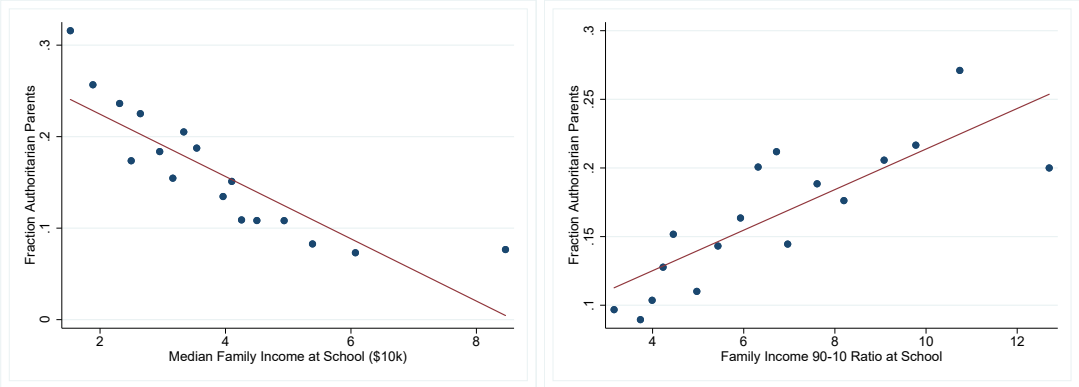
A subsample of students is selected for a home interview that includes questionnaires for both the students and their parents. The data set includes detailed information on family background, grades, and test scores. Importantly, for our research, the survey also asks questions about peers and parenting styles. Students are asked to nominate their best five male and best five female friends. Since students are observed repeatedly, we have information on how peer groups evolve over time. In addition, we can study how students' characteristics (including grades and test scores) affect peer group formation.

We are particularly interested in children's answers to the question: "Do your parents let you make your own decisions about the people you hang around with?" We classify a parent whose child answers "No" as behaving in an authoritarian fashion, whereas a parent of a child who answers "Yes" is labeled as nonauthoritarian. In our sample, 14 percent of parents are authoritarian according to this definition. To address concerns about measurement error, we construct alternative measures that rely on a larger set of questions in Add Health—see Section II.D.. Appendix Table A-1 provides descriptive statistics for the main variables used in our analysis.

B. Authoritarian Parenting Across Schools

In this section, we present correlational evidence that illustrates how parenting styles vary in response to the peer environments to which children are exposed. Our primary hypothesis is that motivated by the goal of enhancing their children's educational accomplishments, parents are more inclined to adopt an authoritarian parenting style when their children engage with academically low-achieving peers.

Figure 1: Authoritarian Parenting and Neighborhood Characteristics



The figure shows how the incidence of the authoritarian parenting style varies with within-school median family income (left panel) and inequality (right panel). Inequality is measured by the 90th–10th percentile ratio of within-school family income. The outcome variable represents our baseline measure of parenting style (see Section II.A.).

Figure 1 illustrates through binned scatter plots how authoritarian parenting varies across schools with distinct characteristics. The prevalence of parents adopting an authoritarian parenting style decreases with the median income at the school level (left panel) and increases with income inequality (right panel). As income is correlated with school achievement, this evidence suggests that parents are more likely to intervene in their children's choice of friends in less affluent and more unequal environments. The differences are substantial in magnitude. Transitioning from a neighborhood (school) with a median income of $20,000 to one with a median income of $60,000 or higher reduces the percentage of parents exhibiting authoritarian behavior from 26 percent to eight percent. Similarly, shifting from the three least unequal to the three most unequal categories more than doubles the proportion of authoritarian parents. Appendix Table A-2 shows that the same pattern emerges in multiple regressions that concurrently consider median income and income inequality, while accounting for parental and child characteristics.

Table 1: Authoritarian Parenting and Peer Environment within Schools

	(1)	(2)	(3)	(4)	(5)	(6)
	Authoritarian					
Mean GPA within Grade	-0.135***		-0.070*	-0.086**		-0.049
	(0.039)		(0.039)	(0.039)		(0.038)
SD GPA within Grade		0.389***	0.311***		0.291***	0.249***
		(0.078)	(0.081)		(0.090)	(0.089)
Mean Dependent Var.	0.138	0.138	0.138	0.138	0.138	0.138
Observations	13327	13327	13327	13327	13327	13327
Clusters	73	73	73	73	73	73
Controls	No	No	No	Yes	Yes	Yes
School F.E.	Yes	Yes	Yes	Yes	Yes	Yes

The table shows the effect of school-grade mean and standard deviation of the GPA on authoritarian parenting. The dependent variable is an indicator variable for authoritarian parenting at the individual level (see Section II.A.). The SD GPA is the standard deviation in GPA across pupils within school and grade. All regressions include school fixed effects. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

C. Authoritarian Parenting Within Schools and Families

Some of the correlations shown in Figure 1 could be driven by omitted variables at the school level, such as variation in parental characteristics other than family income. To address this concern, we exploit within-school variation in the peer environment across grades and within-child changes in the average characteristics of friends.

First, in the spirit of Hoxby (2000), we exploit sampling variation in the realization of grade composition within the same school. We measure the academic achievement of peers by the mean grade point average (GPA). Table 1 shows the results of regressing a dummy for our baseline measure of authoritarian parenting style on the mean and standard deviation of GPA among children in a specific school cohort. Parents tend to adopt an authoritarian approach when their children interact with peers who have lower and unequal academic achievements.

This finding is robust to accounting for family characteristics.[8] The association between parenting style and GPA inequality is more pronounced and robust compared to the correlation between parenting style and mean GPA. Our findings indicate that a one-standard-deviation increase (σ=0.08) in GPA inequality results in a rise in the prevalence of the authoritarian parenting style by around two (column 6) to three (column 2) percentage points. This difference is considerable, given that approximately 14 percent of parents are authoritarian in our sample.

While the regression results in Table 1 are interesting, a causal interpretation of the coefficients would not be warranted. For example, the proportion of parents adopting an authoritarian parenting style could influence the average academic achievement of the peer environment, raising a potential issue of reverse causality. To address this concern, the structural model we introduce below incorporates this feedback. We will use the correlation presented in Table 1 as target moments.

If the parenting style responds to the child's peer environment, we should expect changes in parenting style for a given child to track changes in the peer environment over time. To verify whether the data support this hypothesis, we use the longitudinal dimension of the saturated sample in Add Health, where we have access to repeated data on peer networks and parenting style.[9] Focusing on changes over time for individual children offers two key benefits. First, it alleviates concerns that cross-sectional variation in both the peer environment and parenting style could be influenced by unobserved family characteristics. Second, it addresses the concern about unobserved child-specific heterogeneity, such as time-invariant reporting bias of individual children regarding parenting style.

Table 2 shows that, for a given child, parents tend to adopt an authoritarian stance when there is a decline in either their own child's GPA or the GPA of their child's friends from one year to the next. We also consider the potential heterogeneity of these effects and ascertain that the parental reaction is more pronounced when their own child has lower grades. In the structural

[8] Among the family characteristics, we control for the mother's education. We use the information about mothers because, in most cases, they are the primary respondents in the survey. Notably, information about the partner's education is unavailable for roughly 35 percent of the families, and this absence of information cannot be assumed to occur randomly. Furthermore, when partner education information is available, it pertains to the current spouse or partner rather than the biological parent. Concerning the inequality metric, Appendix Table A-3 shows that the results remain robust when utilizing the Gini coefficient instead of the standard deviation of GPA. Appendix Table A-4 shows that we did not detect any significant gender-specific heterogeneity in these results.

[9] The saturated sample in Add Health is obtained by selecting a set of schools in Wave I where all students (rather than a subsample) are recruited for in-home interviews (Harris et al. 2013). Appendix Table A-1 provides the summary statistics for this sample. Note that, contrary to children, parents are interviewed only once, during the first wave of data collection.

Table 2: Authoritarian Parenting and Academic Achievement of Friends (Child Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Authoritarian Style					
Change in Peer GPA	-0.029**	-0.028**	-0.027**	-0.027**	-0.026**	-0.026**
	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.011)
Change in Child GPA		-0.017	-0.055***		-0.016	-0.054**
		(0.014)	(0.015)		(0.015)	(0.017)
Child GPA (t-1) × Change in Child GPA			0.012*			0.012
			(0.007)			(0.007)
Mean Dependent Variable	-0.036	-0.036	-0.036	-0.036	-0.036	-0.036
Observations	1489	1489	1489	1489	1489	1489
Clusters	10	10	10	10	10	10
Controls	Yes	Yes	Yes	Yes	Yes	Yes
School-Grade F.E.	No	No	No	Yes	Yes	Yes

The table shows the effect of changes in the average academic achievement (GPA) of peers and a child's own GPA on changes in authoritarian parenting. The dependent variable is the within-child longitudinal change in authoritarian parenting between the first and second waves of interviews (see Section II.A.). The change in peer GPA and the change in the child's GPA represent the longitudinal change between the first and second waves of interviews of the average GPA of peers and a child's GPA, respectively. Finally, the child's GPA ($t-1$) represents the GPA of a child during the first wave of interviews. The regressions are estimated with the saturated sample of Add Health schools, for which repeated information on peer networks and parenting style (based on the responses of the children) is available. Regression models in columns (4)-(6) also include school-grade fixed effects. The set of controls includes mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

model that we estimate below, we incorporate both cross-family and within-child regression coefficients as target moments.

Lastly, we study the correlation between authoritarian parenting and children's future peers. Table 3 documents a positive correlation between authoritarian parenting and the average GPA of peers in the following period. This correlation is statistically significant when we control for the own and peer GPAs in the current period. We will show that all conditional correlations in Table 3 align with the predictions of the structural model we formulate below.

D. Alternative Measures of Parenting Style and Parental Investments

Relying solely on children's responses to a single question within the Add Health data set introduces a potential measurement error, prompting us to address this issue using a range of approaches. We begin by creating an index for the authoritarian parenting style using multiple questions available in the Add Health data. In addition to the question about parents' influence on their children's social interactions, this index encompasses responses to the following three

Table 3: Authoritarian Parenting and Dynamics of the Academic Achievement of Peers

	(1)	(2)	(3)	(4)	(5)	(6)
	Next Period Peer GPA					
Authoritarian	0.023	0.033*	0.041**	0.034	0.039*	0.045**
	(0.038)	(0.016)	(0.014)	(0.039)	(0.021)	(0.017)
Peer GPA		0.510***	0.419***		0.460***	0.387***
		(0.059)	(0.045)		(0.076)	(0.059)
Child GPA			0.134***			0.120***
			(0.018)			(0.023)
Mean Dependent Var.	2.711	2.711	2.711	2.711	2.711	2.711
Observations	1941	1941	1941	1941	1941	1941
Clusters	10	10	10	10	10	10
Controls	No	No	No	Yes	Yes	Yes
School-Grade F.E.	Yes	Yes	Yes	Yes	Yes	Yes

The table shows the effect of being authoritarian, peers and a child's GPA on future peers' GPA. The dependent variable is the average GPA of peers in the second wave of interviews. The Peer GPA is the average GPA of peers in the first wave of interviews. The regressions are estimated with the saturated sample of Add Health schools, for which repeated information on peer networks and parenting style (based on the responses of the children) is available. All regressions include school-grade fixed effects. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

questions: "(1) Do your parents let you make your own decisions about the time you must be home on weekend nights?" (2) "Do your parents let you make your own decisions about what you wear?" (3) "Do your parents let you make your own decisions about what time you go to bed?" While not directly addressing friendships, these questions are closely related to peer selection; for instance, the curfew time imposes restrictions on the possibility of hanging around with certain types of peers. Following Driscoll, Russell, and Crockett (2008) and Shakya, Christakis, and Fowler (2012), we construct a composite index (Bartlett score) to measure a latent parenting style. This measure is highly correlated with our baseline measure. The results of the regressions presented in this section are robust to using the index measure of parenting style—see Appendix Tables A-5 and A-6.[10]

[10] A drawback of the index is that it does not provide information on the share of authoritarian parents among all families. For this reason, in order to include this information in our structural estimation, we measure the fraction of authoritarian parents in each neighborhood based on our baseline measure of authoritarian parenting, specifically, the binary variable indicating whether parents let their children make their own decisions about their own friends (see Section II.A.).

An additional concern arises from the possibility that children's responses might reflect subjective, and potentially biased, perceptions of their parents' actions. Regrettably, the Add Health survey lacks questions directed at parents about their involvement in their children's friend selection. To tackle this concern, we employ two approaches. First, we exploit the longitudinal dimension of the saturated sample of Add Health to run regressions in differences (see Table 2 above). These regressions absorb time-invariant individual heterogeneity that captures (among other things) child-specific reporting biases.

Second, we check the correlation between the child's answer to whether parents let them choose the people they hang around with a question asked to their parents, which unveils a broader authoritarian disposition (not confined to friends). In particular, parents are asked: "Of the following, which do you think is the most important thing for a boy/girl to learn?" We take the answer "be well-behaved" as indicative of an authoritarian parenting style.[11] Appendix Figure A-1 shows that the two measures of authoritarian parenting style are highly positively correlated at the school level. The correlation is also highly significant at the individual level. Parents stating that being well-behaved is the most important thing for a child to learn are 54 percent more likely (17 percent versus 11 percent) not to let their children make their own decisions about the people they hang around according to what their children report.

The same questions can be used to measure the other two basic parenting styles that are widely used in developmental psychology, namely, authoritative and permissive parenting. We construct these parenting styles following the approach of Doepke and Zilibotti (2017).[12] Appendix Figure A-2 shows that parents tend to be more permissive in wealthier and less unequal neighborhoods, while they lean toward being authoritative and authoritarian in poorer and more unequal neighborhoods. These findings mirror the results shown in Figure 1 for our more specific baseline measure of authoritarian parenting. Furthermore, these findings are consistent with the international evidence presented by Doepke and Zilibotti (2017) and Doepke, Sorrenti, and Zilibotti (2019). We conclude that, while this article specifically nar-

[11] In our theory, parenting style is not a fixed characteristic of parents; instead, it reflects a rational response to environmental features. Consequently, while certain parents who demonstrate an authoritarian parenting style concerning their children's companions might not display authoritarian traits in other areas (and conversely), we expect that different gauges of parenting style will exhibit substantial correlation. This is because exposure to a particular socioeconomic environment prompts parents to adjust their behavior across multiple dimensions.

[12] We use the answer parents give to the following question: "Of the following, which do you think is the most important thing for a boy/girl to learn? Be well-behaved, work hard, think for himself, help others, be popular." As already mentioned, we classify parents as authoritarian when they choose "be well-behaved." Parents are classified as authoritative when they choose "work hard" and as permissive when they choose "think for themselves." In the analysis, we exclude parents who choose either "think for himself" or "be popular." The result does not change significantly if we classify excluded parents as permissive.

rows down the concept of authoritarian parenting to meddling in friendship formation, our preferred measure can be seen as a constitutive component of a broader notion of authoritarian parenting style.

Another important element of our study is the intensive margin of the effort parents exert to directly foster their children's learning. To capture this aspect, we construct a metric for parental investment grounded in activities undertaken jointly by parents and their children. These activities encompass collaborative projects for school, discussions about attended events, or conversations about personal matters. To circumvent potential selection biases, we focus solely on activities involving the child and the mother, as the father's presence is often limited. We view these parental investments as a facet of an authoritative parenting style.

E. Taking Stock

The results of the reduced-form regressions presented in Tables 1, 2, and 3 align with a rational motive for parents to involve themselves in their children's peer selection. To advance beyond this correlation-based analysis, we move to a structural model. In this theoretical framework, in line with the findings presented in Tables 1 and 2, parents decide whether to interfere with their children's friend choices based on the current academic achievement of both their children and their potential peers. Conversely, given the peer environment, the choice of parenting style influences the child's future choice of friends, which is consistent with the results outlined in Table 3.

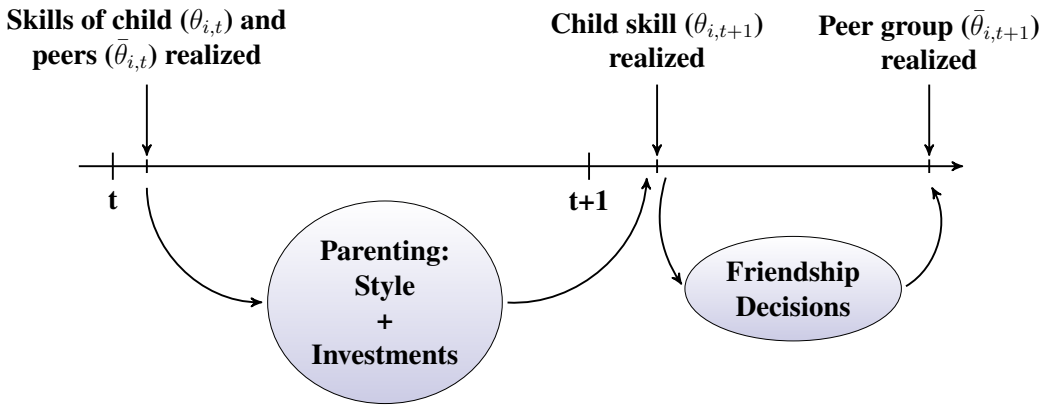
Within the dynamic model, the causality between the peer environment and parental decisions runs in both directions. By estimating the structural model, we can quantify these reciprocal relationships in a manner consistent with the conditional correlations outlined in Tables 1–3. Our framework also enables us to explore alternative factors that influence the observed correlations. For instance, some of the correlation between parenting style and a child's cognitive skills could reflect technological complementarities in the process of skill formation that are not directly identified from the data. Lastly, the model helps us to isolate how the effects of parental choices vary across economic environments and allows us to perform policy analysis through counterfactual scenarios.

III. A Model of Parents, Peers, and Skill Accumulation

The model economy comprises a set of neighborhoods indexed by n, each populated by families composed of a child and a parent. The focal point of the theory is the accumulation of

children's skills $\theta_{i,t}$, where i is the index of the child and t denotes time. We model the interaction between parents and children from $t = 1$ to $t = T$. In the empirical application, this interval corresponds to the four years of high school (grades 9–12), and thus $T = 4$.

Figure 2: Model Timing



The figure shows the timeline of the model. The child's skills at $t = 1$ are drawn from the initial distribution. The skills of the peers at $t = 1$ are determined by the peer environment (the distribution of children's skills at school and grade level) and by the random utility preferences without parental intervention. From period $t = 1$ onward, θ_t and $\bar{\theta}_t$ are endogenous state variables.

Each neighborhood n is characterized by a set $\mathcal{X}^n$ of children living in the neighborhood and by the initial ($t = 1$) skill distribution of these children. All children living in a given neighborhood attend the same school. Figure 2 outlines the timing of events within each period. At the beginning of period t, the child's skill level $\theta_{i,t}$ is realized. The child then forms friendships with some of the other children of the same age in the same school. The characteristics of these friends are summarized by the variable $\bar{\theta}_{i,t}$.

The parent can influence the child's skills and future peer connections through two avenues. First, she can engage in authoritative parenting investments $I_{i,t}$, which directly impact the child's skill formation. Second, the parent can select a parenting style $P_{i,t} \in \{0, 1\}$, where $P_{i,t} = 1$ indicates an authoritarian approach of interfering in the child's friendship decisions. The drive to interfere stems from a disagreement between parents and children about the balance between immediate enjoyment derived from friendships and the advantages of beneficial peer effects for future skill development. A child may prefer to hang out with "cool" kids who do not necessarily do well in school rather than associate with "nerdy" peers with a high GPA who can improve their school proficiency.

At the beginning of the next period, the child's updated skill $\theta_{i,t+1}$ is realized and a new group of friends with the average skill $\bar{\theta}_{i,t+1}$ is formed. This sequence of events repeats itself until the last year of high school, when the child enters adult life with skills $\theta_{i,T}$.

A. The Technology of Skill Formation

The distribution of children's skills in the first period is drawn from the distribution $F^n(\theta_{i,1})$, which we treat as an exogenous initial condition. By allowing this distribution to depend on the neighborhood n, we account for the possibility that the allocation of families to neighborhoods might not be random, resulting in a correlation between initial conditions and parents' inclination towards different parenting styles.

Subsequently, skills evolve as a result of family inputs and peer influences. For each child i, next period's skill level $\theta_{i,t+1}$ depends on the current skill level $\theta_{i,t}$, a summary statistic of the academic achievement of peers $\bar{\theta}_{i,t}$ (specifically, the average grades of peers), parental investments $I_{i,t}$, and the parent's choice of whether to interfere with the child's choice of peers $P_{i,t} \in \{0, 1\}$. We formalize the technology of skill formation as follows:

$$\theta_{i,t+1} = s(\theta_{i,t}, \bar{\theta}_{i,t}, I_{i,t}, P_{i,t}). \tag{1}$$

The direct effect of the parenting style $P_{i,t}$ in Equation (1) captures the impact of the quality of the parent-child relationship on skill accumulation. Although we refrain from imposing any constraint during estimation, we posit and subsequently verify empirically that authoritarian parenting has an adverse impact on skill acquisition. This effect could emanate either from conflict between parent and child or from time allocation: The time authoritarian parents invest in reprimanding their children regarding specific peers might not be available for more productive interactions. Nevertheless, from the parent's standpoint, the authoritarian parenting style might still be optimal as it affects the composition of the peer group, thereby reducing the influence of low-achieving friends on the child's learning.

B. The Parent's Decision Problem

To keep the model parsimonious, we limit attention to the choices and state variables that are part of our empirical analysis and omit other factors such as goods consumption. The individual state variables for a family are the child's skills $\theta_{i,t}$ and the characteristics of the child's peers $\bar{\theta}_{i,t}$. The aggregate state variable Θ_t^n for a family in neighborhood n is the distribution

of these individual states across families in the neighborhood:

$$\Theta_t^n = \left\{\theta_{j,t}, \bar{\theta}_{j,t}\right\}_{j \in \mathcal{X}^n}.$$

Families care about the aggregate state because the distribution of family characteristics in the neighborhood drives the evolution of the peer environment.

The parent decides the parenting style $P_{i,t}$ and the parental investments $I_{i,t}$, and the child chooses peers, that is, who to be friends with. The structure of preferences builds on Doepke and Zilibotti (2017) and Doepke, Sorrenti, and Zilibotti (2019). Notably, the parent's objectives combine facets of altruism and paternalism. Altruism signifies that the parent's utility takes into account the child's well-being, thus desiring the child to be happy. In contrast, paternalism involves the parent evaluating the child's choices and educational achievements based on the parent's own viewpoint. More precisely, the paternalistic parent attaches a higher priority to the child's skill development than does the child herself. The interaction between the conflicting forces of altruism and paternalism leads the parent to flexibly adjust their choices in response to the environment. The paternalistic motive elucidates why the parent might decide to interfere in the child's friendship decisions (contrary to the child's preferences), while the altruistic force explains why the parent would interfere only when the benefits of doing so considerably outweigh the child's loss of utility.

We represent the parent's preferences with a value function that summarizes utility at a point in time following the realization of the child's current skills and peer group. In period t, this value function is given by:

$$\begin{aligned} V_t^n(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta_t^n) = \max_{\{I_{i,t}(\xi_{i,t}), P_{i,t}(\xi_{i,t})\}} \Big\{ \mathbb{E}_t \Big[U^n(I_{i,t}, P_{i,t}, \xi_{i,t}) + \\ Z\left[\lambda \tilde{u}(\theta_{i,t}, P_{i,t}) + (1-\lambda) u(f_{i,t+1})\right] + B V_{t+1}^n(\theta_{i,t+1}, \bar{\theta}_{i,t+1}, \Theta_{t+1}^n) \Big] \Big\}. \end{aligned} \quad (2)$$

Here $U^n(\cdot)$ denotes the parent's period utility. Given that we abstract from other choices, such as consumption, the period utility solely captures the cost of exerting parental effort through the choice of $P_{i,t}$ and $I_{i,t}$. We allow the utility function to vary between neighborhoods, which can capture unobserved residential sorting based on parental preferences. Parents optimally choose $P_{i,t}$ and $I_{i,t}$ conditional on the realization of a vector of i.i.d. taste shocks $\xi_{i,t}$ that represent the parent's idiosyncratic preference over different parenting styles. The shocks ensure a smooth mapping of state variables to decision rules. We denote the vector of taste shocks among parents in neighborhood n at time t by Ξ_t^n, and there is also a vector of taste

shocks Φ^n_{t+1} for the children in the neighborhood which we will discuss in the following section. The expectation $\mathbb{E}_t$ in (2) is with regard to the realization of both shocks Ξ^n_t and Φ^n_{t+1}, which are the only sources of uncertainty in the model. The utility of the parent is affected by the preference shocks of other families in the neighborhood (in addition to her own taste shocks $\xi_{i,t}$) because these matter for the realization of the child's future friendship utility $f_{i,t+1}$ and peer characteristics $\bar{\theta}_{i,t+1}$ (as detailed below).

The parent also cares for the child, where Z is the weight attached to the child's welfare. The altruistic component, with a weight $1-\lambda$, comprises the utility $u(f_{i,t+1})$ that the child derives from the set of friendship that she forms and become active in period $t+1$.[13] The paternalistic component of parent preferences, with weight λ, is the parent's own evaluation of child's outcomes. The paternalistic utility $\tilde{u}(\theta_{i,t}, P_{i,t})$ is focused on the child's skills $\theta_{i,t}$, where we allow the parent's evaluation of the child's skill to interact with the parenting style $P_{i,t}$. Parental concern for their child's educational accomplishments reflects the desire to see the child succeed in her future life as an adult. At the same time, parents also care about a positive parent-child relationship, which hinges on the parenting style they adopt.

The optimization in (2) is subject to the skill acquisition technology (1) and to the law of motion of the aggregate state vector, which describes the evolution of the aggregate state vector as a function of the current state and the vector of preference shocks:

$$\Theta^n_{t+1} = \Gamma(\Theta^n_t, \Xi^n_t, \Phi^n_{t+1}).$$

The aggregate law of motion arises from the interactions between parents and children in a neighborhood. Parents behave atomistically, taking the aggregate law of motion as given.[14] The optimization is also subject to the determination of the child's friendship utility and future peer group, which depends on both the parent's and the child's choices.

The parent's continuation utility at the end of high school depends solely on the child's final skills θ_T (where $T=4$, corresponding to grade 12, the final year of high school):

$$V^n_T(\theta_{i,T}, \bar{\theta}_{i,T}, \Theta^n_T) = V_T(\theta_{i,T}). \tag{3}$$

[13] One could alternatively assume that the parents' altruistic component depends on the utility that the child gains from their existing friendships at time t, $u(f_{i,t})$. In this case, $u(f_{i,t+1})$ would still be part of the expression for V^n_t in Equation 2, albeit discounted by B. None of our conclusions hinge on this modeling choice.

[14] In principle, because there is a finite number of families in each neighborhood, peer interactions imply that there is feedback from a family's decisions to the aggregate state. In practice, given the size of neighborhoods in the estimated model, this feedback effect is small, so we assume that parents do not internalize this feedback.

Here the function $V_T(\theta_T)$ is taken as given and assumed to be identical across neighborhoods. As in Del Boca, Flinn, and Wiswall (2014), this continuation utility captures the value of entering a new stage in the child's life, which depends on the skill endowment at the beginning of that stage. This continuation utility, which creates dynastic link between parents and children, can be thought as the discounted present value of lifetime earnings as well as non-monetary benefits of having more skills. The parental decision problem in the preceding period $t = 3$ is modified because the final continuation utility does not depend on the skill of the peers. Therefore, parents no longer attempt to shape the peer group.

C. The Child's Decision Problem and the Equilibrium Peer Network

The only decisions taken by children concern who to be friends with. The set of friendship links in a given neighborhood defines a peer network. A new round of friendship formation takes place at the end of each period, when the children's updated skills $\theta_{i,t+1}$ have already been realized according to the skill acquisition technology (1). When making new friends, children take this distribution of skills in the neighborhood as well as their parents' decision $P_{i,t}$ on the parenting style as given.

Friendships are formed as the outcome of a set of bilateral decisions, in which two children become friends if there is mutual consent. There are no matching frictions, that is, all children meet and can potentially form a friendship with all children living in the same neighborhood. The potential utility $f_{i,j,t+1}$ child i would derive from forming a new friendship with j in the same neighborhood, $i, j \in \mathcal{X}^n$, is given by:

$$f_{i,j,t+1} = g(\theta_{i,t+1}, \theta_{j,t+1}, P_{i,t}, \phi_{i,j,t+1}). \tag{4}$$

The utility of a friendship link depends both on the own skill of child i and the skill of the potential friend j. This specification allows for homophily bias in terms of skills, a feature that will play a central role in the analysis.[15] The potential utility of forming a particular friendship does not depend on the number and characteristics of other friendships.

The utility of a friendship also depends on the parenting style $P_{i,t}$. As parents seek to encourage skill formation, our parameterization below implies that an authoritarian parenting style ($P_{i,t} = 1$) lowers the utility of befriending a low-achieving peer relative to a high-achieving

[15] Homophily bias refers to the common inclination of individuals within social networks to gravitate towards others who share similarities with them. See, e.g., McPherson, Smith-Lovin, and Cook (2001); Currarini, Jackson, and Pin (2009); Jackson (2010), and, in a context similar to ours, Agostinelli (2018).

one. For instance, the parent can reward the child for making "desirable" friends or mete out punishments for befriending less desirable peers.

Finally, the utility depends on an i.i.d. taste shock $\phi_{i,j,t+1}$, which guarantees that the probability of establishing a friendship is a smooth function of fundamentals as in the canonical random utility model. Note that the realization of the taste shock is not assumed to be symmetric, that is, generically, $\phi_{i,j,t+1} \neq \phi_{j,i,t+1}$. Intuitively, it is possible for child i to be attracted to child j without that feeling being reciprocated.

Given the potential utility accruing from each friendship, the problem of child i is to choose a set of friends $\mathcal{F}_{i,t+1} \subseteq \mathcal{X}^n$ so as to maximize the total utility derived from friendships. Formally, the optimization problem for the child is:

$$\max_{\mathcal{F}_{i,t+1} \subseteq \mathcal{X}^n} \left\{ \sum_{j \in \mathcal{F}_{i,t+1}} f_{i,j,t+1} \right\}, \tag{5}$$

where child i would like to befriend child j if she benefits from that friendship, that is, if and only if $f_{j,i,t+1} \geq 0 \ \forall \ j \neq i$. Note that we normalize the value of no-friendship to zero. Therefore, the child will want to engage in all friendships that yield positive utility, but the friendship is formed ($j \in \mathcal{F}_{i,t+1}$) only if the desire is mutual. More formally, a friendship between child i and child j is formed if and only if:

$$f_{i,j,t+1} \geq 0 \ \ \& \ \ f_{j,i,t+1} \geq 0. \tag{6}$$

The total utility that child i earns from being in friendship relationships is the sum of the utilities derived from the individual friendships she forms:

$$f_{i,t+1} = \sum_{j \in \mathcal{F}_{i,t+1}} f_{i,j,t+1}. \tag{7}$$

The child's period utility $u(f_{i,t+1})$—that also enters in the altruistic component of the parent's value function (2)—is given by an increasing weakly concave function $u(\cdot)$ of total friendship utility $f_{i,t+1}$.

From the perspective of the parent who makes her decisions on $I_{i,t}$ and $P_{i,t}$ before friendship formation takes place, the child's utility and friendship network are random variables that depend on the realization of the vector of taste shocks in the neighborhood $\Phi^n_{t+1} = \{\phi_{i,j,t+1}\}_{i,j \in \mathcal{X}^n}$. The parent can influence the distribution of these variables through her choices

of $I_{i,t}$ and $P_{i,t}$, both of which enter in the determination of friendship utility (4) (in the case of $I_{i,t}$, by shaping the child's skills $\theta_{i,t+1}$ through the skill acquisition technology (1)).

Our formulation of the child's problem assumes that the child takes the parent's decisions as given and then selects her optimal group of friends accordingly. In other words, we establish a non-cooperative result where the parent acts as the Stackelberg leader, and the child follows. This setup excludes the possibility for the parent and child to make commitments towards a potentially mutually beneficial outcome. If such agreements were possible, the parent might commit not to adopt an authoritarian stance (which, as a reminder, comes with costs for both the parent and the child), and the child could promise to form friendships to maximize the joint surplus for the parent and the child, rather than just maximizing her own utility (5). The non-cooperative outcome is a natural focus given the myopic preferences of the child; there is no future utility to reward or enforce cooperation.[16] In a broader sense, we hold the view that a certain level of non-cooperative decision-making is a valuable component in an examination of the relationships between parents and teenagers.

Given that friendships are formed by mutual consent, the process of friendship formation involves externalities between families. When a parent meddles in the process of friendship formation, this intervention affects not only her child, but also other children. Because parents do not care about other children, their decisions generally fail to be socially optimal across families.

Once new friendships are formed, this also pins down the evolution of the peer effects that matter for skill acquisition. Specifically, given the new set of friends $\mathcal{F}_{i,t+1}$ we have:

$$\bar{\theta}_{i,t+1} = \frac{\sum_{j \in \mathcal{F}_{i,t+1}} \theta_{j,t+1}}{|\mathcal{F}_{i,t+1}|}, \tag{8}$$

i.e., the new peer effect is given by the average skill of the new friends. These new peer effects together with the children's own skills $\theta_{i,t+1}$ form the state variables for the parental decision problem in the following period $t+1$.

In the aggregate, we can write the full peer network $\mathcal{F}^n_{t+1} = \{\mathcal{F}_{i,t+1}\}_{i \in \mathcal{X}^n}$ as a function of the

[16] Although myopic preferences simplify the analysis, they are not a fundamental requirement. It would be feasible to provide the child with a discounted continuation utility and a preference for skill development. The key aspect is that there is a disagreement between the child and the parent regarding the relative significance of enjoying friendships versus enhancing skills.

skill distribution, parenting style decisions, and the vector of preference shocks:

$$\mathcal{F}^n_{t+1} = F(\{\theta_{i,t+1}, P_{i,t}\}_{i\in\mathcal{X}^n}, \Phi^n_{t+1}), \tag{9}$$

where each friendship link exists if and only if (6) is satisfied, with friendship utilities $f_{i,j,t+1}$ generated by (4). Likewise, given (8), the full set of peer effects can be written as a function of the skill distribution and the realized friendship network:

$$\{\bar{\theta}_{i,t+1}\}_{i\in\mathcal{X}^n} = Q(\{\theta_{i,t+1}\}_{i\in\mathcal{X}^n}, \mathcal{F}^n_{t+1}). \tag{10}$$

In setting up the parent's decision problem, we also need to specify the initial distribution ($t = 1$, corresponding to the ninth grade) of the peer skills $\bar{\theta}_{i,1}$. Rather than taking this state variable as parametric, we assume that only the initial distribution of skills is given and that friendships are formed through the same process as in later periods. This approach allows us to run policy analyses where we counterfactually vary the initial skill distribution and adjust the network of friends accordingly. A limitation is that we do not observe the parenting style in the preceding period. For this reason, we assume that parents cannot affect the initial choice of friends.[17] Since this happens in the period when children enter high school and are exposed to new peers, this entails only a limited loss of generality.

An equilibrium in a given neighborhood requires that both parents and children make optimal choices on parenting and friendships, respectively, and these choices jointly determine the laws of motion of individual skills and peer effects. We provide formal definitions of the peer network, its equilibrium law of motion, and the full neighborhood equilibrium in Appendix C.[18]

[17] Formally, we set $P_{i,t-1} = 0$ when evaluating Equation (4) and Equation (6) at time $t = 1$.

[18] In our model the endogenous peer network structure is simplified by certain model features. Specifically, the creation of each bilateral friendship link hinges on solving two separate static utility-maximization problems, which are independent of each other and do not involve strategic interactions within the network structure. While the decision of parents to embrace or abstain from an authoritarian parenting style does impact network formation, parents act atomistically, disregarding the network externality their decision entails—see Footnote 14. Finally, we assume that peer effects are determined solely by the average skill level within the peer groups. These features significantly simplify the characterization of the equilibrium network formation conditional on the state vector simplifies. Given the equilibrium policy functions of the parents and the endogenous network formation, the endogenous state vector evolves consistently in equilibrium via the law of motion.

D. Functional Forms for Estimation

To estimate the model, we impose functional forms and restrictions that allow us to summarize the model by a set of parameters.

Initial Conditions. The initial distribution of children's skills within each neighborhood n is drawn from a log-normal distribution. This specification captures the initial (and to us unobserved) sorting of families into different neighborhoods. We define the initial condition for each neighborhood n as:

$$\ln \theta_{i,1} \sim N(\mu^n, (\sigma^n)^2), \tag{11}$$

where μ^n and σ^n represent the neighborhood-specific mean and standard deviation of log skills.

Once the initial heterogeneity of children's skills within the neighborhood is realized, children select their initial peer group according to their friendship choice problem (5).[19] At this stage, the initial vector of state variables $\{\theta_{i,1}, \bar{\theta}_{i,1}\}$ is determined, and the dynamic parent-child interaction starts according to the model described above.[20]

Technology of Skill Formation. We parameterize the skill formation technology with the following nested CES production function:

$$s(\theta_{i,t}, \bar{\theta}_{i,t}, I_{i,t}, P_{i,t} \equiv p) = A_p(t) \cdot H_p(\theta_{i,t}, \bar{\theta}_{i,t}, I_{i,t}), \tag{12}$$

where $p \in \{0, 1\}$, $A_p(t) = exp(\psi_0 + \psi_1 \cdot t + \psi_2 \cdot p)$, and

$$H_p(\theta_{i,t}, \bar{\theta}_{i,t}, I_{i,t}) = \left[\alpha_{1,p}\, \theta_{i,t}^{\alpha_{4,p}} \;+\; (1-\alpha_{1,p}) \left[\alpha_{2,p}\, \bar{\theta}_{i,t}^{\alpha_{3,p}} + (1-\alpha_{2,p})\, I_{i,t}^{\alpha_{3,p}}\right]^{\frac{\alpha_{4,p}}{\alpha_{3,p}}}\right]^{\frac{\alpha_{5,p}}{\alpha_{4,p}}}.$$

Note that all parameters of the skill formation technology depend on $P_{i,t} \in \{0, 1\}$, namely, whether the parent chooses an authoritarian parenting style. First, this affects the total factor productivity $A_p(t)$, capturing the potential disruptive effect of authoritarian parenting on the

[19] We do not have information about parenting style leading up to this round of friendship formation, and hence we set $P = 0$ for all children in this initial round. Note that children start high school at time $t = 1$, which is generally a new environment where they meet new potential friends. For this reason, we find it plausible to assume that parents have a limited impact on peer selection in the first period.

[20] An alternative specification for the initial conditions would be to specify an exogenous bivariate joint distribution of children's and peer skills. However, in this case, the initial skills of peers would be exogenously determined, and hence policy-invariant. Our model specification allows immediate endogenous peer selection, which is important when evaluating policies that change the initial neighborhood composition, as we do below.

parent-child relationship documented by the developmental psychology literature. Our estimation below indeed finds that $\psi_2 < 0$, i.e., an authoritarian parenting style depresses skill accumulation. Second, the parenting style affects the parameters $\alpha_{1,p}$ and $\alpha_{2,p}$, which capture the weights of the different inputs. Our estimation finds that the authoritarian style attenuates the influence of peers. Third, an authoritarian parenting style also affects the elasticity of substitution parameters $\alpha_{3,p}$ and $\alpha_{4,p}$ and the return-to-scale parameter ($\alpha_{5,p}$). Here, the data suggest that whether peer effects are substitutes or complements of other inputs in the production of skills depends on the parenting style $P_{i,t}$.

Parent Preferences. We specify the parent's period utility in (2) as follows:

$$U^n(I_{i,t}, P_{i,t}, \xi_{i,t}) = \delta_1 \ln(1 - I_{i,t}) + \delta_2^n P_{i,t} + \xi_{i,t}(P_{i,t}), \tag{13}$$

where δ_1 defines the disutility of authoritative investment, while $\xi_{i,t}(P_{i,t})$ is a taste shock that is conditional on the parenting style. We assume that this shock follows a type-I extreme value distribution. We allow the disutility of engaging in an authoritarian parenting style to be neighborhood specific to account for possible selection into locations based on preferences for parenting (δ_2^n). We make this parameter a function of the neighborhood (average) family income ($\overline{Y}^n$):

$$\delta_2^n \equiv \delta_{2,0} + \delta_{2,1} \cdot (\overline{Y}^n - \overline{Y}^4)\,.$$

Hence, $\delta_{2,0}$ represents the disutility of being authoritarian for the highest-income neighborhood (n=4), while $\delta_{2,1}$ represents the income gradient that applies to the lower-income neighborhoods.

The paternalistic utility of the parent takes the following form:

$$\tilde{u}(\theta_{i,t}, I_{i,t}, P_{i,t}) = \delta_3 \ln(\theta_{i,t}) \cdot (1 + \delta_4 P_{i,t}), \tag{14}$$

where δ_3 captures the level of the parent's paternalistic enjoyment of the child's skills, which may depend on the parenting style through the parameter δ_4. The utility derived from the child's adult skills $\theta_{i,T+1}$ takes the same form as the period-by-period paternalistic utility from skills:

$$V_{T+1}^n = \delta_3 \ln(\theta_{i,T+1})\,.$$

We set the altruism factor to one ($Z = 1$), while we set the discount rate (B) to 0.95. This is without loss of generality, as an increase in B or Z is observationally equivalent to a propor-

tional decrease in cost parameters δ_1 and δ_2. Changing B and/or Z would affect the numerical estimates of these parameters without altering the fit of the model or the counterfactual experiments.

Child preferences. Recall that the formation of a friendship requires mutual consent and that the value of no friendship between two children is normalized to zero. The function $f_{i,j,t+1} = g(\theta_{i,t+1}, \theta_{j,t+1}, P_{i,t}, \phi_{i,j,t+1})$ that specifies the utility child i earns from being friends with child j is:

$$g(\theta_{i,t+1}, \theta_{j,t+1}, P_{i,t}, \phi_{i,j,t+1}) = \gamma_0 + \gamma_1 \ln \theta_{i,t+1} + \gamma_2 \ln \theta_{j,t+1} + \gamma_3 (\ln \theta_{i,t+1} - \ln \theta_{j,t+1})^2 + \gamma_4 \mathbb{1}(\theta_{j,t+1} < \theta_{i,t+1}) (\ln \theta_{i,t+1} - \ln \theta_{j,t+1})^2 P_{i,t} + \phi_{i,j,t+1}, \quad (15)$$

where $\phi_{i,j,t+1}$ is a random taste shock, which we assume to be i.i.d. standard logistic distributed. The first and second terms capture, respectively, the effect of child i's and child j's skills on the utility child i earns from being friends with child j. The quadratic term $(\ln \theta_{i,t+1} - \ln \theta_{j,t+1})^2$ captures a potential homophily bias. If $\gamma_3 < 0$, the greater the skill difference between the two children, the lower the utility for child i of being friends with child j.

The last term captures the effect of an authoritarian parenting style. If $\gamma_4 < 0$, authoritarian parents impose a penalty on the child's utility whenever the child befriends a peer with lower skills. The penalty increases with the skill gap between the two children. The goal of parental intervention (through, e.g., moral suasion, threat of punishment, or incentives) is to improve the academic achievement of the child's chosen friends.

Given the assumption that friendships require mutual consent, the conditional probability that a friendship link between child i and child j is formed is:[21]

$$Pr(j \in \mathcal{X}_{i,t+1} | \theta_{i,t+1}, P_{i,t}, \theta_{j,t+1}, P_{j,t}) = \frac{\exp(\Gamma_{i,j})}{1 + \exp(\Gamma_{i,j})} \frac{\exp(\Gamma_{j,i})}{1 + \exp(\Gamma_{j,i})}, \quad (16)$$

where:

[21] The conditional probability in Equation (16) might suggest a potential strategic interaction between parents when choosing their own parenting style. However, under our assumptions, only the parent of the child with the higher skill can actively affect the probability in Equation (16), so there is in fact no strategic interaction among parents. Note that in our model, parents have an additional motive to invest in their children's skills, namely, to give them more opportunities to condition their children's choice of peers in the future.

$$\Gamma_{i,j} = \gamma_0 + \gamma_1 \ln \theta_{i,t+1} + \gamma_2 \ln \theta_{j,t+1} + \gamma_3 \left(\ln \theta_{i,t+1} - \ln \theta_{j,t+1}\right)^2 + \gamma_4 \mathbb{1}(\theta_{j,t+1} < \theta_{i,t+1}) \left(\ln \theta_{i,t+1} - \ln \theta_{j,t+1}\right)^2 P_{i,t},$$

$$\Gamma_{j,i} = \gamma_0 + \gamma_1 \ln \theta_{j,t+1} + \gamma_2 \ln \theta_{i,t+1} + \gamma_3 \left(\ln \theta_{i,t+1} - \ln \theta_{j,t+1}\right)^2 + \gamma_4 \mathbb{1}(\theta_{i,t+1} < \theta_{j,t+1}) \left(\ln \theta_{i,t+1} - \ln \theta_{j,t+1}\right)^2 P_{j,t}.$$

To summarize, authoritarian parenting has a direct effect on the technology of skill formation given the current child's skill and peers. Additionally, it impacts peer selection by dissuading the child from associating with low-achieving peers. Our subsequent estimations infer that *ceteris paribus*, an authoritarian parenting style induces a reduction in the productivity of the skill formation technology. However, some parents still choose authoritarian parenting because it can enhance future peer effects. Consequently, in neighborhoods characterized by uniform affluence, where the likelihood of a child connecting with low-achieving peers is minimal, adopting an authoritarian parenting style yields limited benefits. It is in disadvantaged neighborhoods where children are more exposed to low-achieving peers that parents are more prone to embrace authoritarianism.

IV. Model Estimation

We estimate the model using the Simulated Method of Moments (SMM) by matching a set of moments generated from the Add Health data. We adopt an indirect inference strategy where several of the target moments are estimated coefficients originating from regression models. This encompasses both school-grade fixed effects models and regression models based on child-level panel data.

A. Identification

We leverage multiple sources of identifying variation, namely within-school/grade and within-child longitudinal variation in the academic achievement of peers, parenting, and children's outcomes. A crucial assumption is that, conditional on the residential choice, the initial distribution of individual skill endowments within neighborhoods is exogenous. In other words, given the neighborhood, initial conditions are uncorrelated with unobservable factors that could also influence parenting decisions.

This form of conditional independence assumption is common in the child development literature (Cunha, Heckman, and Schennach 2010; Agostinelli and Wiswall 2023).[22] For example, Cunha, Heckman, and Schennach (2010) use a similar exclusion restriction between initial skills and unobserved heterogeneity in parental investments in the initial period to identify the parental investment response function, although the authors allow for rich time-varying unobserved heterogeneity in their dynamic model of skill formation.[23] The limited longitudinal structure of our data (we have only two consecutive waves) limits our ability to model time-varying unobserved heterogeneity in parenting choices or outcomes. As a partial remedy, we show that our results are robust to an extension where both the skill formation technology and preferences over parenting styles vary with the mother's education. Since the proportion of college-educated mothers varies across neighborhoods, this extension introduces a correlation between preferences, the productivity of parental inputs in the skill formation technology, and initial neighborhood characteristics.

However, some of the variation that we document might stem from unobserved heterogeneity, both at the neighborhood and individual levels. For instance, the decision to choose a neighborhood to live in in might result in a pre-sorting of families with distinct attributes. This could influence both parental decisions and the peer environment. We address these concerns in a variety of ways.

First, we refrain from using the variation across schools in the regressions we target. Instead, conditioning on the neighborhood/school choice, we use the within-school-grade variation in peer group realizations and parental choices to identify the correlation between peer skills and parenting choices. Hence, the identifying assumption is grounded in the notion that given the neighborhood and initial skill levels, any remaining variation can be attributed to conditionally independent shocks to the peer network formation.

Second, we acknowledge the potential for additional time-invariant heterogeneity in preferences for parenting style, even among families residing in the same neighborhood. Such heterogeneity in preferences could explain a portion of the within-school correlation between parenting style and the realized peer groups, yet might not offer insight into actual parental reactions to the peer environment. To mitigate this concern, we incorporate into our estimation a

[22] Heckman, Humphries, and Veramendi (2016) develop a framework, which can be applied in dynamic models of skill formation, to estimate dynamic treatment effects through instrumental variables (when available) and conditional independence assumptions.

[23] Cunha, Heckman, and Schennach (2010) also analyze a longer period of child development starting from the early childhood period.

set of targeted moments consisting of estimated coefficients from panel data regression models with child-fixed effects. Specifically, we leverage the panel structure of the Add Health data to generate two-period child-level panel data, providing repeated information about parenting and peers. The additional target moments are estimated coefficients of panel data regression models of longitudinal changes in parenting style and peer groups between consecutive school years. This approach filters out time-invariant heterogeneity at the child level that could affect both the shocks experienced by parents and children. More generally, we employ cross-sectional and panel regressions as target moments, demonstrating that the estimated model accurately matches both sets of regression coefficients.

Third, we address the concern that the allocation of families to neighborhoods is not random and could be shaped by a residential choice that parents make before their children enter high school. We allow preferences for parenting to vary across neighborhoods. This unobserved heterogeneity becomes especially relevant for counterfactual analyses. If family attributes (beyond the skills and peer environments we observe) vary across neighborhoods, this has implications for the counterfactual experiment where we transfer some children from less to more affluent neighborhoods and examine the ensuing endogenous parental responses. In such a scenario, it becomes crucial to acknowledge that, given the child's skill level and peer environment, parents of relocated children might exhibit distinct inclinations and behaviors compared to parents in the receiving neighborhood. To tackle this concern, we introduce in the model the notion of neighborhood-specific preferences for parenting, with the utility term U^n. By modeling this form of heterogeneity, we are able to account for residential sorting based on unobserved attributes that are linked to preferences for parenting styles.

B. Target Moments

The initial skill distribution is estimated externally to the model. We follow Heckman, Pinto, and Savelyev (2013), and measure latent skills through the Bartlett factor score, which creates a composite unbiased predictor of skills by aggregating multiple "error-contaminated" measures. This method allows us to infer the initial parametric distribution of latent skill outside the model.[24] We employ the same methodology to construct unbiased measures of parenting style and parental investments, drawing from multiple measures available in the Add Health data set. Appendix Table A-1 furnishes a summary of our skill, parenting style, and parental

[24]Consonant with the model, we gauge a child's initial skill endowment using skill measurements taken during the 9th grade.

investment measurements. More information on the measurement of skills and parental investments is provided in Appendix B.

We target the following 36 moments:

1. Aggregate and neighborhood-specific shares of authoritarian parents, as well as school-grade fixed effects regressions of parenting style on current period own child's and peers' skills (seven moments, see Table D-1)

2. Child's skill dynamics: Average by school grades, as well as school-grade fixed effects regressions of a child's next-period skills on previous-period own skills, peers' skills, and authoritarian parenting style (eleven moments, see Table D-2).

3. Peers' skill dynamics: Number of friends and school-grade fixed effects regressions of next-period peers' skills on previous period own skills, peers' skills, and authoritarian parenting style (eight moments, see Table D-3).

4. Parental investment: Mean and regressions of parental investments on current-period own skills, peers' skills, by authoritarian parenting style (six moments, see Table D-4).

5. Within-child longitudinal changes in parenting style: Panel data regressions (at the child level) of parenting style on longitudinal changes in peers' skills and own child's skills; longitudinal changes in parental investments by previous (t-1) adopted parenting style (four moments, see Table D-5).

To estimate the model, it is necessary to define the neighborhoods within which children form friendships and to solve for a local equilibrium within each neighborhood. Ideally, there should be as many distinct environments as there are schools in our data set. However, when a simulation-based estimator is employed, this approach becomes computationally infeasible. To tackle this challenge, we adopt a parsimonious approach, whereby each neighborhood is characterized by the mean and standard deviation of a log-normal distribution of initial skills. We create synthetic neighborhoods based on the variation between schools present in the Add Health sample. To be precise, we sort schools by the children's average skills and generate four synthetic neighborhoods by partitioning the distribution into quartiles. This approach allows us to reduce computational complexity while still capturing the essential heterogeneity across different school environments.

Table 4 summarizes the characteristics of these synthetic neighborhoods, arranged from lowest to highest quartile. Based on the Add Health data, we we map the quartiles of the skill distribution to quartiles of the income distribution. As expected, students in higher-income neighborhoods exhibit higher average grades. The median real family income in 2016 US dollars for the four neighborhoods are approximately $48,500 (Neighborhood 1), $53,000 (Neighborhood 2), $68,000 (Neighborhood 3), and $83,000 (Neighborhood 4).

Table 4: Characteristics of Synthetic Neighborhoods

	Mean (μ_e)	Standard Deviation (σ_e)	Population
Neighborhood 1	-0.56	0.92	229
	(0.061)	(0.047)	
Neighborhood 2	-0.15	0.98	273
	(0.047)	(0.035)	
Neighborhood 3	0.13	0.91	340
	(0.042)	(0.040)	
Neighborhood 4	0.47	0.85	189
	(0.058)	(0.040)	

The table shows the mean and standard deviation of skills (from log-normal distributions) in four synthetic neighborhoods. The associated distributions are the initial conditions in the structural estimation of the dynamic model of skill formation. We use schools with more than ten students in ninth grade (initial period). The standard errors reported in parentheses are calculated via 100 school-clustered non-parametric bootstrap repetitions.

C. Parameter Estimates

Skill Formation Technology.

Table 5 presents the parameter estimates for the skill formation technology outlined in Equation (12). These parameters differ for parents who adopt an authoritarian ($P = 1$) parenting style compared to those who adopt a nonauthoritarian ($P = 0$) style. In our baseline parameterization for authoritarian parents ($P = 1$), we adopt a parsimonious specification wherein we assume a Cobb-Douglas production function. This choice is grounded in evidence that among authoritarian parents, there is only a small, statistically insignificant behavioral response of parental investments to the skills of the child and the peers, as indicated in Appendix Table D-4. Such a pattern aligns with a unit elasticity of substitution as in a Cobb-Douglas setup. For further robustness, we include a supplementary exercise in the appendix, in which we calibrate a more general CES technology for authoritarian parents. The results in Table 5 are

robust to this alternative methodology (see footnote 27 below). Our Cobb-Douglas production function looks as follows:

$$H(\theta_{i,t}, \bar{\theta}_{i,t}, I_{i,t}, 1) = \theta_{i,t}^{\bar{\alpha}_{1,1}} \ \bar{\theta}_{i,t}^{\bar{\alpha}_{2,1}} \ I_{i,t}^{\bar{\alpha}_{3,1}}, \tag{17}$$

where $\bar{\alpha}_{1,1} = \alpha_{1,1}\alpha_{5,1}$, $\bar{\alpha}_{2,1} = (1-\alpha_{1,1})\alpha_{2,1}\alpha_{5,1}$, and $\bar{\alpha}_{3,1} = (1-\alpha_{1,1})(1-\alpha_{2,1})\alpha_{5,1}$.

In contrast, the estimated elasticities of substitution are significantly different from unity for nonauthoritarian parents. Specifically, when $P = 0$, we estimate $\alpha_{3,0} > 0$, which implies that parental investment and peer skills are substitutes, as in Agostinelli (2018). This elasticity is primarily identified by the covariation between inputs in the technology of skill formation. For authoritarian parents, parental investment barely responds to the skills of the child and peers, consistent with unit elasticity. In contrast, nonauthoritarian parents spend more time with their children when the peer group is on average less academically proficient, suggesting that parental investment and peer skills are substitutes.

The estimates of the other technology parameters reveal additional interesting patterns. An authoritarian parenting style reduces both total factor productivity and the relative importance of peers. Both outcomes align with intuition and are consistent with findings in the literature on child development. For parents who are nonauthoritarian, we identify a robust complementarity between child skills and the combined impact of peer effects and parental investments ($\alpha_{4,0} < 0$). This complementarity relationship bears an interesting implication: nonauthoritarian parents face a high return to investing time in their children when these are high achievers. Therefore, high achievers are less likely to be exposed to an authoritarian parenting style and more likely to attract other forms of time-intensive (authoritative) parental investments.

This observation provides a fresh perspective on the conventional wisdom prevailing in the child development literature, which tends to associate an authoritarian parenting style with unfavorable child outcomes. This perception is often rooted in the positive correlation observed in the observational data. However, our structural model suggests that children with lower cognitive or noncognitive abilities are more prone to elicit an authoritarian parenting style. Hence, a portion of the observed correlation in the data could reflect (and, as our estimates indicate, indeed does reflect) a form of reverse causation.

Preferences. Table 6 displays the estimates of parents' preferences. In the estimation, we exogenously set $\lambda = 0.95$, that is, we assume that the parents are highly paternalistic. It is difficult to find sources of variation in the data to credibly identify this parameter. The results

Table 5: Estimated Parameters of the Skill Formation Technology

	Cobb-Douglas (Authoritarian = 1)
Child Skills ($\alpha_{1,1}$)	0.517
	(0.0481)
Peer Skills ($\alpha_{2,1}$)	0.144
	(0.0226)
Investments ($\alpha_{3,1}$)	0.055
	(0.0520)
	CES (Authoritarian = 0)
Complementarity Parents vs. Peer ($\alpha_{3,0}$)	0.791
	(0.0507)
Share Self-Production ($\alpha_{1,0}$)	0.566
	(0.0173)
Share Peer Skills ($\alpha_{2,0}$)	0.384
	(0.0349)
Complementarity Self-Production vs. Parents-Peer ($\alpha_{4,0}$)	-1.734
	(0.2150)
CES Return to Scale ($\alpha_{5,0}$)	1.128
	(0.0619)
	Total Factor Productivity
TFP Constant (ψ_0)	0.399
	(0.0328)
TFP Age Trend (ψ_1)	0.019
	(0.0032)
TFP Parenting Style (ψ_2)	-0.300
	(0.0428)

The table shows the estimated parameters of the skill formation technology. See Equation (12) for $P = 0$ and Equation (17) for $P = 1$. The standard errors in parentheses are calculated via 100 school-clustered non-parametric bootstrap repetitions.

show little sensitivity to changes in λ, as long as we remain in a high range. For lower values of λ, the model cannot match the observed share of authoritarian parents.[25] According to our estimates, parents dislike being authoritarian ($\delta_{2,0}$<0), and more so when they live in a higher-income neighborhood ($\delta_{2,1}$<0) or when they have high-achieving children (δ_4<0).

Table 7 presents the estimates for the child's preferences within the random utility model. Both the coefficients for own and peer skills are negative, indicating that children with a high GPA are less inclined to form friendship bonds and are less sought-after by other children. Intuitively, from a child's viewpoint, those who perform less well in school tend to be more

[25]The results are very similar for any $\lambda \geq 0.9$.

Table 6: Estimated Parent's Preference Parameters

Disutility of Investment (δ_1)	1 (Normalized)
	(-)
Disutility of Authoritarian: Intercept ($\delta_{2,0}$)	-2.503
	(0.1931)
Disutility of Authoritarian: Heterogeneity by Neighborhood Income ($\delta_{2,1}$)	-0.080
	(0.0098)
Child Skills (δ_3)	2.086
	(0.3918)
Authoritarian $\times$ Child Skills (δ_4)	-0.196
	(0.0222)

The table shows the estimated parents' preference parameters, see Equations (13) and (14). The standard errors in parentheses are calculated via 100 school-clustered nonparametric bootstrap repetitions. The value of $\delta_{2,1}$=-0.080 implies that a neighborhood with an average family income of \$50,000 displays approximately a 20% lower cost of being authoritarian than a neighborhood with \$100,000 average family income.

Table 7: Estimated Child's Preference Parameters

Child i Skills (γ_1)	-0.189
	(0.0270)
Child j Skills (γ_2)	-0.202
	(0.0400)
Homophily (γ_3)	-0.261
	(0.0352)
Authoritarian (γ_4)	-0.538
	(0.1301)
Constant (γ_0)	-1.431
	(0.0368)

The table shows the estimated child's preference parameters, see Equation (15). The standard errors in parentheses are calculated via 100 school-clustered non-parametric bootstrap repetitions.

appealing as friends than high achievers. The estimated value of the homophily parameter is also negative. Given that this parameter is multiplied by the squared discrepancy between the own and peer skills, a negative estimate implies a positive homophily bias. In other words,

the larger the skill gap between two children, the smaller the value of forming a friendship. The parameter γ_4 captures the penalty arising from making friends with less academically proficient children when parents are authoritarian. This penalty is quantitatively large: its estimated value is almost double the magnitude of the homophily coefficient γ_3. Thus, an authoritarian parenting style has a strong causal effect on a child's future peer selection.

These estimation findings present a clear picture of the tradeoff involved in the selection of a parenting style. On the one hand, an authoritarian parenting style introduces an efficiency loss within the skill-formation mechanism. On the other hand, it improves the peer selection process over time. Consequently, adopting an authoritarian approach becomes more appealing in disadvantaged and unequal neighborhoods, where the advantage of refining friend selection holds substantial weight. Everything else equal, it is the parents of children with many low-GPA friends who have the strongest incentive to behave in an authoritarian fashion, because their children's skill formation benefits little from their current peers. Finally, parents who embrace a nonauthoritarian parenting style are more responsive to the peer environment. Specifically, parents who grant their children more autonomy devote more time to them when the peer environment is weaker.

D. Sample Fit

Appendix Tables D-1–D-5 report information about the sample fit of the model. The model is estimated via indirect inference, that is, the SMM estimation targets auxiliary regression coefficients from the data. All regressions, both in the data and in the model, include school-grade fixed effects (and, in some cases, individual fixed effects that are differenced out.) The tables show the success of the simulated model in matching the target moments.

Table D-1 focuses on the results of linear probability models where $P = 1$ (that is, being authoritarian) is regressed on the child's and the peers' skills. For the reasons discussed above, parents are less likely to interfere with peer formation when both their own children and their potential peers are high achievers. The model accurately predicts both the sign and magnitude of the coefficients, as well as the fraction of authoritarian parents.

Table D-2 presents the results regarding the dynamics of skills. In the upper panel, we focus on the regression of a child's skills in the upcoming period on her current skills, the average skills within her peer group, and the parenting style to which she is exposed. In both the model and the data, the coefficient for the child's skills is the largest, followed by a slightly smaller but substantial coefficient for the peers' skills. Furthermore, in both cases, the effect of parenting

style on subsequent-period skills is moderate in size. Despite this moderate correlation, our structural estimate indicates a substantial causal impact of an authoritarian parenting style. The lower panel shows the progression of mean skills throughout the high school years for both the model and the data. Once again, the alignment is remarkably accurate.

Table D-3 compares the regression coefficients for the evolution of peer skills in the model and in the data. Both data and the model show a modest correlation between authoritarian parenting and the academic proficiency of peers in the next period. However, the model implies a large positive causal effect of authoritarian parenting on peer selection.

Table D-4 displays the results for the authoritative parental investments broken down by parenting style (authoritarian versus nonauthoritarian). For authoritarian parents, time investments are responsive to neither the child's nor the peers' skills, consistent with a unit elasticity of substitution (Cobb-Douglas) in the skill formation technology.[26] In contrast, when $P = 0$, parental investments are positively related to the child's skills and negatively related to the peers' skills. The model accounts for this pattern by estimating a higher elasticity of substitution in the CES technology. Note that the average level of investment hinges on the parenting style and that the model fits well the data in this dimension.

Table D-5 shows the sample fit for the child-level panel data regression coefficients. Even after accounting for time-invariant determinants of parental choices, the model replicates the longitudinal correlation between parenting style and both child and peer skills (top panel). Moreover, the model also replicates the longitudinal substitution between authoritarian parenting style and authoritative investments (bottom panel).

E. Heterogeneous Parental Inputs and Parenting Style

In our model, conditional on the child's and peers' skills, there is no heterogeneity in the return to or quality of parental inputs. In reality, these factors could vary across parents and, moreover, could be correlated with the parents' propensity to adopt different parenting styles. To illustrate, suppose that parents with lower educational attainment offer less effective parenting inputs and are also more inclined to adopt authoritarian parenting styles. Failing to account for these interrelated factors may result in an overestimation of the extent to which productivity is impacted by an authoritarian parenting approach.

[26] The point estimates of the regression coefficients are small and are not statistically different from zero. In footnote 27, we discuss a robustness exercise after calibrating a general CES technology for authoritarian parents (see Appendix Figure E-1).

To assess this dimension of heterogeneity, in this section, we allow both the productivity parameter A_p in Equation (12) and the disutility parameter of being authoritarian δ_2^n in Equation (13) to depend on the mothers' education (college graduates vs. noncollege graduates). The structure of the data (a short panel where we only have two observations per child while at school) does not allow us to control more general forms of unobserved heterogeneity in the skill production. The estimated heterogeneity is shown in Appendix Table D-6. Less educated mothers have a higher propensity to be authoritarian. However, the estimated productivity is essentially the same for the two education categories. All the main results are very similar to the baseline model.

F. Comparative Statics

In this section, we discuss the comparative statics of the estimated model to illustrate the role of parental decisions and some of the key parameters.

Appendix Figure D-1 illustrates how the probability of friendship between two children, i and j, varies depending on their individual skills and the parenting styles they experience. We plot the skill percentile of child i' on the horizontal axis. The red and blue lines represent the probability that child i will form a friendship with child j when child j is in the 10th and 90th percentiles of the skill distribution, respectively. Each panel represents a different configuration of parenting style for the two children. In all panels, the red curve shows a negative slope, indicating that as the level of skill of child i' increases, the probability of forming a friendship with a low achiever decreases. Conversely, the blue curve shows a positive slope across most deciles, indicating that as child i's skill level increases, the probability of forming a friendship with a high achiever increases. Both of these relationships reflect the homophily bias discussed earlier.

Turning to the effects of parenting style, the upper right panel depicts a scenario in which child i is subject to an authoritarian parenting style. In this case, the red curve is lower than in the upper left panel, indicating that unless she is in the lowest decile of the skill distribution, child i is less likely to befriend a low achiever. The lower left panel shows the case in which child j is subject to an authoritarian parenting style. In this case, the blue curve is lower than in the upper left panel, indicating that child j is less likely to befriend child i when the latter is a low achiever. Finally, when both children are subject to an authoritarian parenting style (lower right panel), the matching becomes strongly positively assortative. In summary, the authoritarian parenting style magnifies the homophily bias, increasing the positive assortativeness of the peer network.

Appendix Figure D-2 shows the effect of perturbing key parameters around their estimated value on a variety of empirical moments that are important for their identification. The scale on the horizontal axis is normalized so that the estimated value of each parameter is set to unity. Each dot represents a particular simulated moment from the new equilibrium of the model computed for each new parameterization.

The upper panels illustrate the quantitative effect of changing the parameters of the friendship formation process. Both homophily bias and an authoritarian parenting style increase the correlation of child i's skills with the average skill level of her future peers. The three lower panels illustrate the effects of parameters in the skill formation technology. Increasing the elasticity of substitution between peer effects and parental investment amplifies the influence of the peer environment on parental authoritative time investments (panel c). Increasing the elasticity $\alpha_{4,0}$ implies that high achievers receive more attention than low achievers relative to the baseline (panel d). Finally, panel e shows that increasing the productivity parameter ψ_2 reduces the fraction of authoritarian parents (by increasing the opportunity cost of the authoritarian style). All correlations are sensitive to parameter changes, indicating that the parameters are well-identified.

V. Parents, Peers, and Policy Interventions

In this section, we run counterfactual policy experiments based on the estimated structural model. We focus on the endogenous response of parenting styles and friendship networks to policy interventions that change the peer environment. Moreover, we explore the repercussions of such interventions for the accumulation of human capital and inequality. We consider two distinct sets of experiments. The first is a "moving-to-opportunity policy" that relocates some children from underprivileged to affluent neighborhoods. The second consists of a change in initial conditions, which we construe as resulting from interventions influencing children's skills before they start high school.

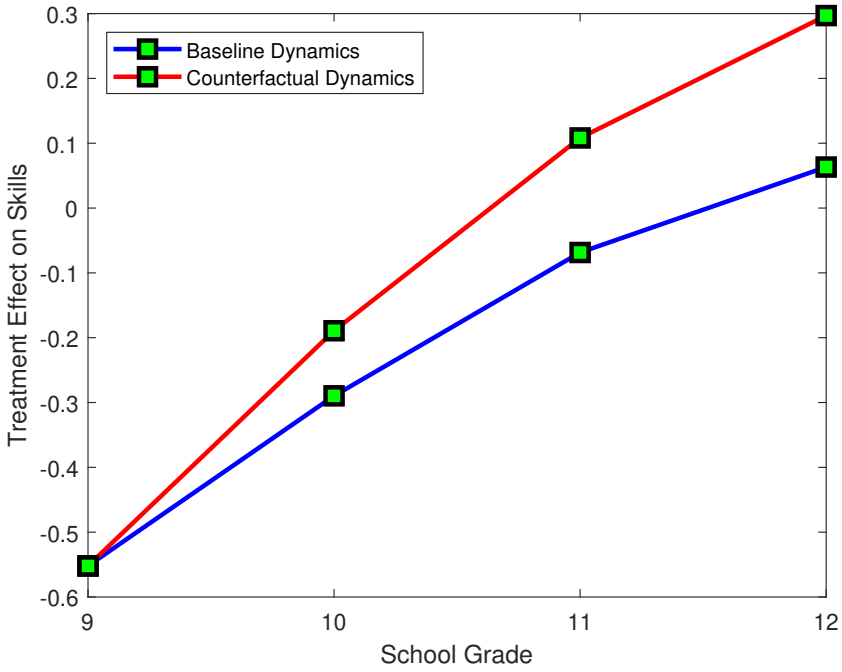
A. Moving to Opportunity

Consider a policy experiment that relocates children from the synthetic neighborhood with the lowest income, denoted as N1, whose median family income is \$48,500, to the highest-income neighborhood, referred to as N4, where the median family income is \$83,000. As a reference point, in 2016, the year of income measurement, the national median family income

was $58,000. At the outset, there is a difference in the mean skills of children between these two neighborhoods of approximately one standard deviation.

We are interested in understanding the individual treatment effect of transitioning to a more prosperous neighborhood, uncovering the underlying mechanisms behind this treatment effect, and assessing how the treatment effect evolves when the policy is scaled up to encompass a larger number of students.

Figure 3: Treatment Effects of Moving to a Better Neighborhood



The figure shows the treatment effect of moving a child in 9th grade from N1 to N4. The blue line displays the baseline skills dynamics for the median child in the skills distribution in N1. The red line shows the counterfactual skills dynamics if the child moves to N4 at the beginning of 9th grade. The skill dynamics are calculated by averaging among 200 model simulations.

Individual Treatment Effects. Figure 3 illustrates the dynamic treatment effect that results from a child moving from N1 to N4 upon entering 9th grade. The blue line denotes the average skill trajectory for a typical child who remains in N1 throughout high school. The red line represents the hypothetical evolution of skills had the same child been relocated to N4. The treatment effect first appears in 10th grade, given that skill levels are predetermined at the outset of the 9th grade. Subsequently, the gap between the child's skill trajectory in the counterfactual versus the benchmark scenario continues to rise. The treatment effect increases

over time because of the dynamic complementarity between skill accumulation and friendship formation. In other words, the gain in skills accruing to the moved child in the 10th grade has a positive effect on skill accumulation in the following periods and also improves the peer group to which the child is exposed to owing to the homophily bias in preferences.

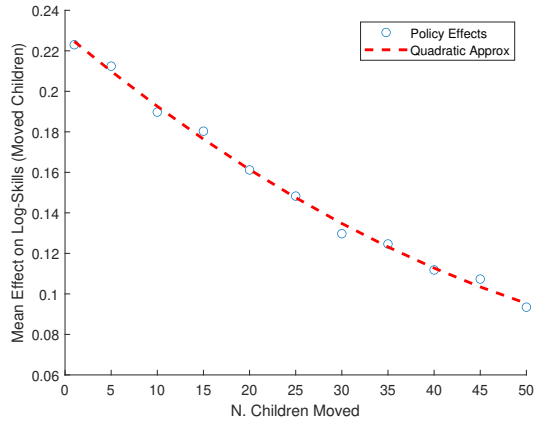
To gauge the quantitative impact of the policy, we compare our treatment effect with the quasi-experimental evidence of Chyn (2018). Chyn studies the effect the demolition of public housing in Chicago, which resulted in the displacement of numerous families from impoverished neighborhoods. Three years after the demolition, the typical displaced family lived in a less poor and less crime-ridden neighborhood than a similar family that did not have to move. The displaced children earned on average $602 more per year during their first adult years than those who stayed—a 16 percent increase. In addition, displaced children had 14 percent fewer arrests for violent crimes and a significantly lower probability of dropping out of high school.

To compare our findings with Chyn's results, we performed a back-of-the-envelope calculation. First, we convert differences in children's school achievement into earning differences by regressing adult earnings in the Add Health data on our measure of skills during adolescence. Second, we note that, according to our estimates, a child moving from N1 to N4 experiences a skill increase equal to approximately 0.2 standard deviations, which translates into an increase in future annual earnings of about $900 to $1,000 (in 2012 dollars).

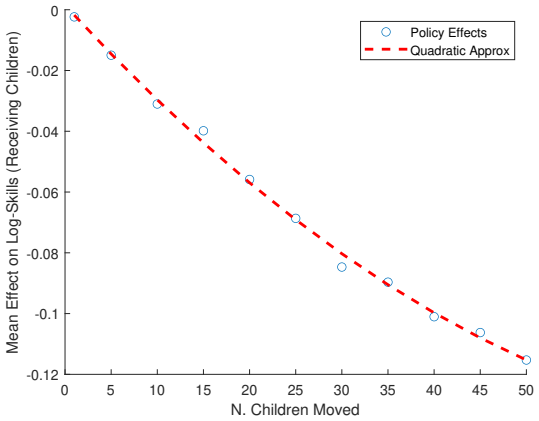
Our calculation yields an effect that exceeds the causal impact estimated by Chyn (2018) by approximately 50 percent. Note that our "moving-to-opportunity" policy involves relocating children from an impoverished neighborhood to an affluent one, which constitutes a more substantial treatment than that experienced by the average child displaced by the Chicago public housing demolition. Furthermore, our approach of quantifying skill disparities in Add Health is based on an empirical correlation between test scores and earnings, which likely overestimates the actual causal effect of test scores on earnings. In light of these factors, we conclude that our model's quantitative predictions regarding policy effects broadly align with recent estimates present based on natural experiments.

Scaling Effects. Figure 3 refers to the treatment effect when a single child is moved from N1 to N4. However, when many children are moved collectively, the treatment effect changes due to the cumulative impact on the peer environment in N4. Figure 4 illustrates how the effect of the "moving-to-opportunity" policy varies with the scale of the policy. The upper panel shows the effects on the relocated children, while the lower panel shows the effects on the children

Figure 4: Scaling of Treatment Effects on Skills



(a) Moved Children



(b) Receiving Children

The figure shows the equilibrium policy effect on skills in 12th grade of moving children from N1 to N4 as a function of the number of relocated children. Panel (a) illustrates the average effect for relocated children. Panel (b) illustrates the average effect for receiving children. The policy effects represent the average impact on skills for moved children (panel a) or receiving children (panel b) for a given number of moved children. The policy effects are calculated by averaging among 200 different model simulations.

in the receiving community.

For a small-scale policy, relocated children experience substantial gains, while receiving children hardly experience any losses. As the number of relocated children increases, the positive effects on the moved children diminish, while the negative effects on the receiving children intensify. The impact of the scale of the policy is large. With 50 children moving simultaneously, the positive effect of treatment on relocated children is halved compared to the scenario

in which only one child is moving. In addition, children in the affluent neighborhood face average skill reductions that are comparable in magnitude to the skill gains of newly arrived children. As the number of receiving children exceeds the number of newcomers (there are about 200 children per school), the average impact on the skill accumulation of all involved children (both relocated and receiving) becomes negative as the policy is expanded.[27]

The attenuation of the beneficial effects of the policy stems from several interacting factors. To begin with, there is a mechanical dilution effect. With more children being relocated, the peer environment in the receiving neighborhood naturally deteriorates. In addition, two endogenous mechanisms contribute to this attenuation.

The first mechanism relates to peer formation. In our model, low-achieving students are often preferred as friends. As a result, as the number of relocated children rises, they become overrepresented in peer groups. Furthermore, due to homophily bias, many relocated children establish connections with each other, thereby reducing the advantages derived from forming relationships with high-achieving students already present in the receiving community.

The second mechanism pertains to parental behavior. Panels (a) and (b) of Figure 5 show how the parents of the relocated children adjust their behavior as the scale of the program increases. When a single child moves from N1 to N4, the probability that her parent adopts an authoritarian parenting style falls. This adjustment is a rational reaction to the more advantageous peer group available in N4. This change in parenting style, in isolation, supports skill accumulation. However, if the parent originally had a nonauthoritarian approach, her authoritative time investment decreases due to the enhanced peer environment. As more children move to N4, both of these effects diminish.

Panels (c) and (d) of Figure 5 show the response of parents in the host community. The share of authoritarian parents increases with the scale of the policy. Intuitively, as more low-achieving children arrive, parents in N4 start to worry about their own children befriending them, and more of the parents turn authoritarian. Some parents, especially those of the most proficient children, do not turn authoritarian, but rather increase their time investments to compensate for the weaker peer environment. The intensity of both parental responses increases with the scale of the policy.

[27] In our primary analysis, we utilize a Cobb-Douglas function to parameterize the skill formation technology for authoritarian parents. As a robustness check, we also perform the counterfactual exercise using a generalized CES technology for authoritarian parents. Appendix Figure E-1 shows that the results in Figure 4 remain consistent even with this alternative specification.

The interplay of homophily in the formation of peer groups and the response of parents within the host community contribute to the emergence of more assortative friendship networks as the policy is expanded. This means that, with an increasing number of relocated children, there is a reduced blending of the existing community members with the newcomers.

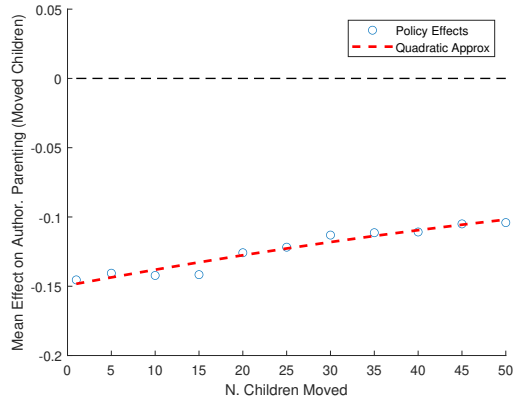
Endogenous Parenting Behavior. To assess the importance of the endogenous parental response, we conduct alternative policy simulations where we hold parenting choices constant at the baseline level while allowing other factors (such as the dilution of the peer group and endogenous peer formation) to operate. The results are shown in Figure 6. The upper panel highlights the impact of endogenous parental responses on the skill accumulation of relocated children. The blue dots represent the effect of the moving-to-opportunity policy as a function of the number of relocated children, while the red dots illustrate the counterfactual effects after suppressing the endogenous parental response. It becomes evident that the benefits for the treated children would be considerably greater if parents in both communities did not modify their behavior. The quantitative impact of the parental response is substantial: The policy effect under fixed parenting behavior with 50 children moved is akin to the policy effect with an endogenous parental response when only 25 children are moved.

The lower panel of Figure 6 shows the quantitative effect of the endogenous response of parents in N4 on the skills of their own children. In the scenario where 50 children are moved from Neighborhood N1 to N4, the defensive response of parents in N4 mitigates the adverse effect on their children's skill accumulation by approximately 30 percent.

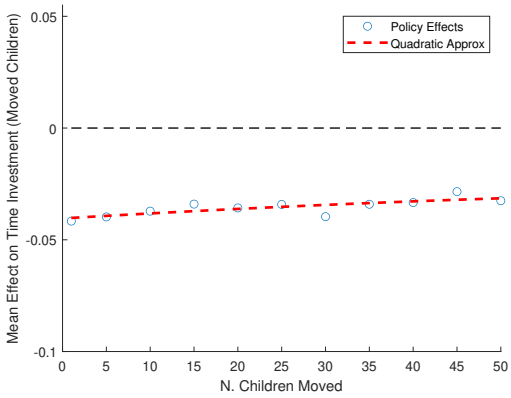
Homophily and Skill Formation Technology. Appendix Figure E-2 illustrates how the effect of moving 50 children, as shown in panels (a) and (b) of Figure 4, changes in response to variations in the homophily parameter γ_3. When γ_3 is reduced by 50 percent compared to its estimated value, the effect of the policy on the logarithm of skills for relocated children increases by approximately one-third. This suggests that initiatives aimed at promoting the integration of relocated children could potentially improve the effectiveness of the policy. However, the impact of reducing homophily bias by 50 percent is less than the impact of muting the parental response, as shown in panel (a) of Figure 6.

The extent of parental responses hinges on the elasticity of substitution between parental investments and peers skills in the skill formation technology. Appendix Figure E-3 shows the effect of changing the technological parameter $\alpha_{3,0}$ in a scenario involving the relocation of 50 children. As inputs become closer substitutes, nonauthoritarian parents of relocated children decrease their investments more significantly. In contrast, nonauthoritarian parents in the host

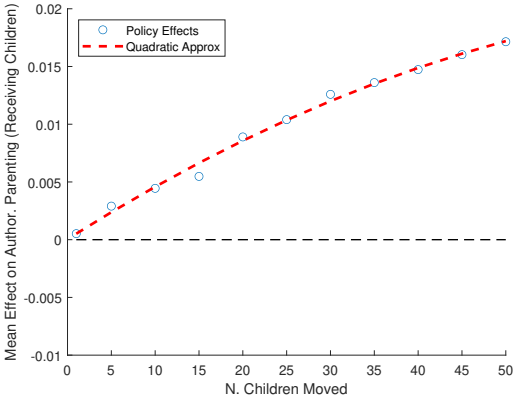
Figure 5: Scaling of Treatment Effects on Parental Behavior



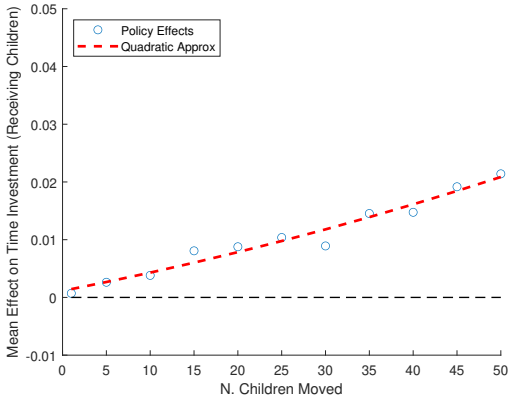
(a) Authoritarian (Moved)



(b) Time Investment (Moved)



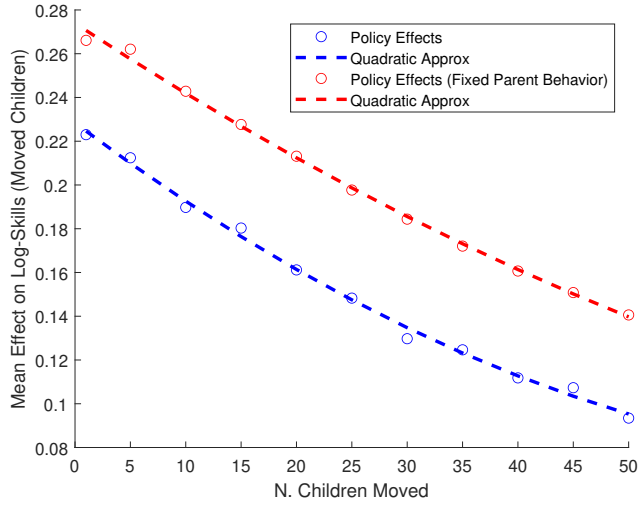
(c) Authoritarian (Receiving)



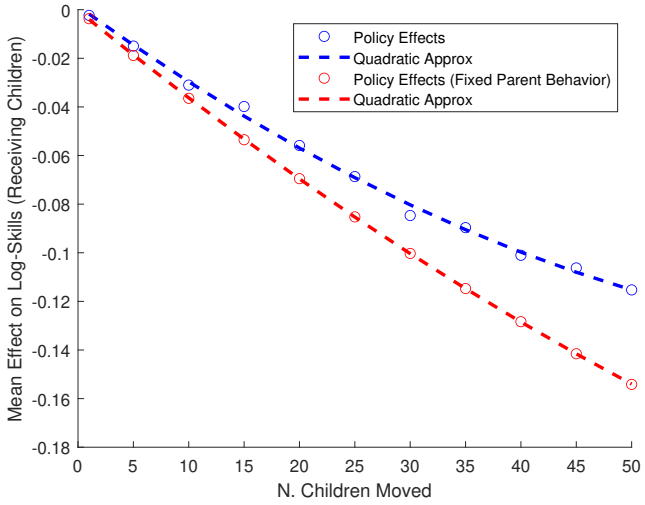
(d) Time Investment (Receiving)

The figure shows the equilibrium policy effect on the probability of being authoritarian (panels (a) and (c)) and on parental time investment (panels (b) and (d)) of moving children from N1 to N4 as a function of the number of moved children. Panels (a) and (b) illustrate the effect of the policy on parental behavior for moved children. Panels (c) and (d) illustrate the effect of the policy on parental behavior for receiving children. The policy effects represent the average impact on parenting style or parental investments for moved children (panels (a) and (b)) or receiving children (panels (c) and (d)) for a given number of moved children. The policy effects are calculated by averaging among 200 different model simulations.

Figure 6: Endogenous Parental Behavior and Policy Effects



(a) Moved Children



(b) Receiving Children

The figure shows the quantitative importance of the endogenous parental response for the counterfactual policy effects. The outcome is skills in 12th grade. The blue lines represent the equilibrium effect of the policy on skills in 12th grade of moving children from N1 to N4 as a function of the number of moved children (as in Figure 4). The red lines show the effect of the policy when parental behavior is held fixed. Panel (a) illustrates the effect for moved children. Panel (b) illustrates the effect for receiving children. Policy effects represent the average impact on skills for a given number of moved children. The policy effects are calculated by averaging among 200 different model simulations.

community increase their investments more in response to the policy. As a result, a higher elasticity of substitution reduces both the advantages of the policy for the relocated children and the negative effects on the children in the host community.

Endogenous Residential Responses. Some families residing in the affluent neighborhood may respond to the influx of disadvantaged children by leaving the neighborhood. To explore the quantitative importance of this aspect, we estimate how many families might actually choose to do so. Our estimation is based on the findings of Agostinelli, Luflade, and Martellini (2022), which provide an estimate of the elasticity of neighborhood choice with respect to peer achievement at the school level.

We assume that families can make an irrevocable decision to relocate during the initial period ($t = 1$) in response to the shift in the peer environment induced by the policy. Then, we establish the counterfactual equilibrium within the receiving neighborhood, which encompasses both the relocated children and the children of families who opt to remain. Appendix Figure E-5 demonstrates the implications of residential mobility for the scalability of the moving-to-opportunity policy. As more children move simultaneously, the positive policy effects dwindle more rapidly due to the added element of families leaving the affluent neighborhood. An exacerbating factor in this environment is that families with the most proficient children are more prone to leaving, a prediction that aligns with empirical observations and is taken into account in our calibration. This selective outmigration has a detrimental effect on the skill development of children in the receiving neighborhood, as it depletes the local peer environment of higher-skill peers.

B. Changing Initial Conditions

In this section, we study counterfactual changes in the initial distribution of skills, distinguishing between different forms of inequality reductions. We interpret these experiments as interventions that occur before children reach high school, including early childhood education policies, interventions in middle school, and policies that target residential segregation. Altering the initial distribution of skills affects both the process of friendship formation and the endogenous parental responses. We evaluate the effect of these policies by comparing moments of the skill distribution in 12th grade.

The first column of Table 8 describes how we change the initial conditions. The other columns report the effects of each counterfactual relative to the baseline on the mean skill accumulation, on three measures of inequality (where the 10th percentile is reported to zoom in on poor

Table 8: Counterfactual Policy Experiments: Changing Initial Conditions (e.g., Early Childhood Interventions)

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Aggregate					
	Mean	90–10 Ratio	10th Percentile	Gini	Author. Parenting	Time Inv.
No Inequality	10.18%	-42.68%	53.75%	-0.12	-0.04	0.06
No Between-Neighb. Inequality	-2.15%	-9.10%	3.65%	-0.02	-0.00	0.00
No Within-Neighb. Inequality	10.98%	-18.18%	30.58%	-0.05	-0.03	0.05
Truncate Local Distrib. at 10th percent	9.75%	-13.16%	21.23%	-0.03	-0.03	0.01
Halving Cost of Parental Investments	29.38%	11.27%	19.86%	0.02	-0.03	0.17
	Panel B: Low-Income Neighborhood					
	Mean	90–10 Ratio	10th Percentile	Gini	Author. Parenting	Time Inv.
No Inequality	37.90%	-41.43%	88.80%	-0.11	-0.10	0.05
No Between-Neighb. Inequality	22.76%	-8.82%	29.69%	-0.02	-0.05	-0.00
No Within-Neighb. Inequality	8.08%	-41.27%	50.42%	-0.11	-0.06	0.05
Truncate Local Distrib. at 10th percent	8.98%	-16.40%	23.05%	-0.04	-0.04	0.02
Halving Cost of Parental Investments	25.88%	12.12%	16.71%	0.02	-0.04	0.16
	Panel C: High-Income Neighborhood					
	Mean	90–10 Ratio	10th Percentile	Gini	Author. Parenting	Time Inv.
No Inequality	-10.30%	-23.07%	3.10%	-0.06	0.01	0.07
No Between-Neighb. Inequality	-21.76%	24.51%	-32.74%	0.04	0.03	0.02
No Within-Neighb. Inequality	11.96%	-25.22%	31.58%	-0.06	-0.01	0.04
Truncate Local Distrib. at 10th percent	9.53%	-11.96%	18.52%	-0.03	-0.01	-0.01
Halving Cost of Parental Investments	31.35%	5.60%	26.30%	0.01	-0.02	0.18

The table shows the results for a set of different counterfactuals (each row represents a different counterfactual). All the results are compared to the baseline economy. Each result is calculated by averaging among 200 different model simulations. Columns (1) to (3) are percentage changes relative to the baseline model, and columns (4) to (6) are absolute changes compared to the baseline.

families), and on parenting decisions. The table also shows the aggregate effect across all neighborhoods and a breakdown into below- and above-median neighborhoods.

No Inequality. The initial experiment entails equalizing the initial human capital of all students, while maintaining the national mean at the baseline level. While this intervention eliminates the initial inequality, some differences in skill levels do emerge over time due to the stochastic nature of peer network formation. However, the ultimate outcome is significantly lower inequality compared to the baseline scenario. What is particularly noteworthy is that equalizing opportunities leads to an overall increase in average skill accumulation. This positive effect is primarily driven by an upturn in poor neighborhoods that outweighs the minor setback in affluent ones. This outcome can be attributed, in part, to a decrease in the prevalence of the authoritarian parenting style within impoverished neighborhoods. The proportion of parents adopting an authoritarian approach drops from 18 to 8 percent. In contrast, authoritative parental investments rise across the board. In disadvantaged neighborhoods, this increase can be attributed to fewer parents adopting an authoritarian parenting style. In wealth-

ier neighborhoods, the increase in parental investments primarily represents a response to the less favorable peer environment, which is a substitute for parental investments for nonauthoritarian parents.

No Inequality Between Neighborhoods. In the second experiment, we equalize the initial conditions across neighborhoods while maintaining the nationwide inequality at the baseline level. This implies that overall inequality, measured by the variance of the log-normal skill distribution, remains unchanged, but all inequality is concentrated within neighborhoods. Conceptually, this policy can be interpreted as a radical reduction in residential segregation.

Similarly to the first experiment, this policy leads to an increase in skill accumulation in low-income neighborhoods and a corresponding decrease in high-income neighborhoods. However, the aggregate effect on average skill accumulation is now negative. Although inequality diminishes, the benefit for families in the bottom decile remains modest. This may seem counterintuitive, considering that disadvantaged children are now living in more diverse neighborhoods, potentially affording them opportunities to interact with high-achieving peers. However, eliminating residential segregation does not guarantee that these children will form friendship ties with their less disadvantaged counterparts. The presence of homophily bias, coupled with an expanding number of authoritarian parents, puts up obstacles to the successful integration of high- and low-achieving children.

No Inequality Within Neighborhoods. In the third experiment, we focus on eliminating all within-neighborhood inequality, while maintaining the original inequality between neighborhoods. This policy intervention ensures that inequality is eradicated within each neighborhood, while the preexisting disparities between neighborhoods persist.

Despite the similarity in the reduction of aggregate inequality compared to the previous experiment, this third scenario leads to a more substantial enhancement in average skill accumulation. Notably, families in the bottom decile experience substantial gains, enjoying an increase of around 30 percent relative to the baseline scenario. The positive outcome can be attributed to a combination of factors, including the reduction of the prevalence of the authoritarian parenting style and a simultaneous increase in authoritative parental investments.

No Lower Tail Inequality. The fourth experiment involves truncating the initial skill distribution at the 10th percentile within each neighborhood. The portion of the lower tail that has been truncated is redistributed in proportion to the original distribution at each other percentile. This policy intervention can be conceptualized as an early childhood initiative that targets the

most disadvantaged segments within each neighborhood's population. Remarkably, this policy yields even more substantial average gains compared to the scenario where inequality is completely eradicated. Although some of these gains are mechanical in nature, the interplay between skill development and peer networks ensures that these benefits rise over time. In particular, the policy triggers a sharp decline of approximately one-quarter in the prevalence of the authoritarian parenting style relative to the baseline. This aspect of the counterfactual underscores an advantage of early childhood interventions that has remained unexplored in previous research: by reducing the share of low-achieving peers in the population, the policy cultivates a more relaxed attitude among parents regarding their children's peer groups. In turn, this leniency decreases the obstacles faced by disadvantaged children, thereby fostering more favorable skill formation outcomes.

Subsidy to Time-Intensive Parental Investments. Lastly, we examine a policy that entails a reduction in the cost of authoritative investments. The magnitude of this policy intervention is set so that the expense of authoritative investments is halved. This shock results in a notable surge in investments by 17 percentage points relative to the mean baseline investments.

The outcomes of this policy intervention are decidedly positive. While a significant portion of the gains originates from increased parental investments, an accompanying alteration in parenting styles also plays a role. In particular, there is a reduction of approximately 2 to 4 percentage points in the prevalence of authoritarian parents. This change in parenting dynamics underscores the broad-based efficacy of the policy, encompassing both enhanced investments and a more general shift in parenting behavior.

Across all policies examined, a recurring theme is the pivotal role of endogenous parental reactions in shaping the outcomes of interventions. Interventions aimed at reducing local inequality are especially effective. Such policies serve to enhance the peer environment, which consequently leads to a decreased proportion of parents adopting an authoritarian parenting style. This shift yields a twofold advantage: it directly enhances skill accumulation by virtue of heightened productivity, while simultaneously fostering a conducive environment for interactions among peers from diverse backgrounds. This interplay between policy and parental choices underscores the fundamental role of endogenous behavioral responses in shaping the efficacy of interventions.

VI. Conclusions

In this paper, we study the effects of parents and peers on the skill formation of children during the high school years through the lens of a dynamic rational choice model. In the model, the children choose who to be friends with. Parents can actively discourage friendships with academically low-achieving peers, which we interpret as adopting an authoritarian parenting style. An authoritarian parenting style improves the academic proficiency of the (future) child's peer group, but reduces the productivity of the technology of skill formation.

We estimate our model through an indirect inference approach, leveraging variation in skills and peers within schools, grades, and over time. With the estimated model, we analyze the potential effects of a "moving-to-opportunity" policy, wherein children from low-income neighborhoods are relocated to more affluent areas. Our model is particularly effective in investigating how the policy's benefits evolve when implemented at a larger scale, meaning that many disadvantaged children move simultaneously to better schools. The results indicate a sharp reduction in the treatment effect as the policy scales, with a substantial portion of this decline attributed to the responses of parents.

Our study raises broader questions about the interpretation of reduced-form estimates of neighborhood effects (e.g., Chetty, Hendren, and Katz 2016). When a single family moves to a better neighborhood, the children may indeed enjoy large gains, in part because of the better peer effects. However, larger-scale policies, such as building social housing in affluent areas, can trigger reactions that limit their effectiveness. Our analysis highlights complementary policy interventions—both before and after children reach high school—that can sustain the effectiveness of moving-to-opportunity policies when such policies are scaled up.

While our study provides valuable insights, it is important to acknowledge limitations that could be addressed in future research. First, our analysis lacks information on families' residential choices prior to their children entering high school. This omission could affect our understanding of neighborhood effects and parental decisions. Second, the short time dimension of the panel limits our ability to fully control for individual-specific characteristics that influence parental inputs. Third, our model simplifies by omitting some socio-economic factors known to influence skill formation during adolescence. Additionally, we do not differentiate between the distinct roles of fathers and mothers in child development due to data

constraints.[28] Fourth, the Add Health data is from the 1990s, and recent changes in technology and social dynamics may affect peer interactions and parental influences. Further research could investigate these aspects to provide a more complete understanding of skill formation and parental behaviors.

In spite of these and other limitations, our paper provides a first theory- and data-driven exploration of the dynamic interaction between parenting, children's decisions, and society in the process of skill formation of teenagers whose insights we hope can contribute to the success of future policy interventions.

[28] An extensive literature in developmental psychology (e.g., Flouri 2005 and Lamb 2010) underscores the distinct roles of fathers and mothers across various childhood stages. Economics studies investigating the distinct impacts of fathers and mothers on skill formation include Del Boca, Flinn, and Wiswall (2013) and Doepke and Zilibotti (2019).

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APPENDIX

A Additional Figures and Tables

Table A-1: Summary Statistics

	Wave I: In-School Interview					
	Full Sample			Saturated Sample		
	Mean	SD	Obs	Mean	SD	Obs
English Grade	2.80	0.98	58,766	2.75	0.99	3,679
Math Grade	2.68	1.03	56,502	2.48	1.04	3,490
History Grade	2.84	1.00	52,182	2.79	1.02	3,350
Science Grade	2.77	1.01	52,914	2.58	1.02	3,278
Child GPA	2.76	0.79	61,113	2.64	0.78	3,730
Peer GPA	2.79	0.53	56,845	2.73	0.52	3,429
Number of Schools		75			12	
	Wave I: In-Home Interview					
	Full Sample			Saturated Sample		
	Mean	SD	Obs	Mean	SD	Obs
PPVT Score	65.67	11.05	13,018	64.46	10.53	2,965
Talked with your mom about a party you attended	0.52	0.50	12,770	0.50	0.50	2,910
Talked with your mom about a personal problem	0.41	0.49	12,770	0.40	0.49	2,910
Worked with your mom on a project for school	0.11	0.31	12,770	0.10	0.30	2,910
Do your parents let you choose your own friends?	0.14	0.34	13,327	0.15	0.36	3,065
Do your parents let you choose the time you must be home on weekend nights?	0.60	0.49	13,322	0.59	0.49	3,062
Do your parents let you choose what you wear?	0.09	0.28	13,332	0.12	0.32	3,067
Do your parents let you choose what time you go to bed on week nights?	0.26	0.44	13,334	0.28	0.45	3,066
	Wave II: In-Home Interview					
	Full Sample			Saturated Sample		
	Mean	SD	Obs	Mean	SD	Obs
English Grade	2.82	0.94	7,670	2.79	0.95	1,891
Math Grade	2.64	1.02	6,697	2.62	1.00	1,554
History Grade	2.89	0.97	6,576	2.79	1.00	1,567
Science Grade	2.80	0.98	6,127	2.63	1.00	1,451
Child GPA	2.77	0.74	7,861	2.70	0.76	1,926
Peer GPA	2.80	0.70	6,930	2.71	0.62	2,362
Talked with your mom about a party you attended	0.55	0.50	8,296	0.53	0.50	2,001
Talked with your mom about a personal problem	0.46	0.50	8,296	0.43	0.49	2,001
Worked with your mom on a project for school	0.11	0.31	8,296	0.09	0.29	2,001
Do your parents let you choose your own friends?	0.11	0.32	8,634	0.12	0.33	2,100
Do your parents let you choose the time you must be home on weekend nights?	0.52	0.50	8,630	0.52	0.50	2,099
Do your parents let you choose what you wear?	0.07	0.25	8,638	0.08	0.27	2,100
Do your parents let you choose what time you go to bed on week nights?	0.20	0.40	8,635	0.22	0.41	2,100

The table shows summary statistics for the variables in the sample of schools used in our estimations. Note that our Full Sample restricts the original sample in Add Health to high schools with at least 200 children. The table also shows summary statistics for the variables in the sample of saturated schools used in our estimation (Saturated Sample). The saturated sample is used to estimate the regression models in Tables 2–3, and to construct the targeted moments about the within-child dynamics of both peer achievement and parenting behavior in Tables D-3 and D-5.

Table A-2: Authoritarian Parenting and Peer Environment Across Schools

	(1)	(2)
	Authoritarian	
Median Family Income at School	-0.031***	-0.021***
	(0.005)	(0.004)
90-10 Family Income at School	0.006*	0.005*
	(0.003)	(0.003)
Mean Dependent Var.	0.162	0.162
Observations	20033	20033
Clusters	144	144
Controls	No	Yes

The table shows the effect of within-school median family income and inequality on authoritarian parenting. The dependent variable is an indicator variable for authoritarian parenting at the individual level. The regressions are estimated with the entire In-Home sample in Add Health. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

Table A-3: Authoritarian Parenting and Neighborhood

	(1)	(2)	(3)	(4)	(5)	(6)
	Authoritarian					
Mean GPA within Grade	-0.135***		0.005	-0.086**		0.006
	(0.039)		(0.052)	(0.039)		(0.049)
Gini GPA within Grade		0.035***	0.036***		0.026***	0.027**
		(0.007)	(0.009)		(0.008)	(0.010)
Mean Dependent Var.	0.138	0.138	0.138	0.138	0.138	0.138
Observations	13327	13327	13327	13327	13327	13327
Clusters	73	73	73	73	73	73
Controls	No	No	No	Yes	Yes	Yes
School F.E.	Yes	Yes	Yes	Yes	Yes	Yes

The table shows the effect of school-grade mean of GPA and Gini coefficient for GPA on authoritarian parenting. The dependent variable is an indicator variable for authoritarian parenting at the individual level. The Gini GPA within grade is calculated as the Gini coefficient for GPA at the school-grade level. All regressions include school fixed effects. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

Table A-4: Authoritarian Parenting and Peer Environment within Schools (by Gender)

	(1)	(2)	(3)	(4)	(5)	(6)
	Authoritarian					
Male × Mean GPA within Grade	-0.135***		-0.065*	-0.087**		-0.052
	(0.038)		(0.039)	(0.040)		(0.037)
Female × Mean GPA within Grade	-0.135***		-0.075*	-0.085**		-0.044
	(0.039)		(0.040)	(0.041)		(0.042)
Male × SD GPA within Grade		0.389***	0.295***		0.255***	0.211**
		(0.078)	(0.083)		(0.094)	(0.089)
Female × SD GPA within Grade		0.389***	0.328***		0.328***	0.290***
		(0.078)	(0.084)		(0.096)	(0.099)
Mean Dependent Var. (Male)	0.138	0.138	0.138	0.138	0.138	0.138
Mean Dependent Var. (Female)	0.137	0.137	0.137	0.137	0.137	0.137
Observations	13327	13327	13327	13327	13327	13327
Clusters	73	73	73	73	73	73
Controls	No	No	No	Yes	Yes	Yes
School F.E.	Yes	Yes	Yes	Yes	Yes	Yes

The table shows the effect of school-grade mean and standard deviation of the GPA by gender on authoritarian parenting. The dependent variable is an indicator variable for authoritarian parenting at the individual level. The SD GPA is the standard deviation in GPA across pupils within school and grade. Both Mean GPA and SD GPA are interacted with a child's gender. All regressions include school fixed effects. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

Table A-5: Authoritarian Parenting (Index) and Peer Environment within Schools

	(1)	(2)	(3)	(4)	(5)	(6)
	Authoritarian (Index)					
Mean GPA within Grade	-1.005***		-0.579***	-0.449***		-0.291***
	(0.172)		(0.145)	(0.131)		(0.105)
SD GPA within Grade		2.680***	2.038***		1.302***	1.053***
		(0.343)	(0.331)		(0.333)	(0.305)
Mean Dependent Var.	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Observations	13307	13307	13307	13307	13307	13307
Clusters	73	73	73	73	73	73
Controls	No	No	No	Yes	Yes	Yes
School F.E.	Yes	Yes	Yes	Yes	Yes	Yes

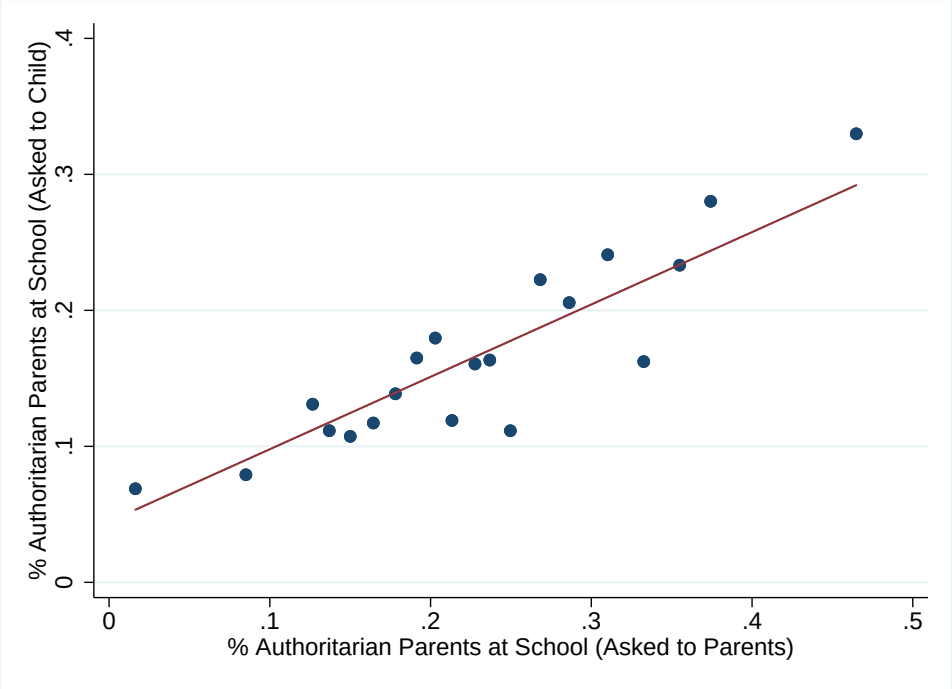
The table shows the effect of school-grade mean and standard deviation of the GPA on an index for authoritarian parenting. The dependent variable is an index (Bartlett score) for authoritarian parenting at the individual level. The SD GPA is the standard deviation in GPA across pupils within school and grade. All regressions include school fixed effects. The set of controls are mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

Table A-6: Authoritarian Parenting and Dynamics of Peer Achievement
(Index Measure)

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Authoritarian Style (Index)					
Change in Peer GPA	-0.117***	-0.111***	-0.110***	-0.122***	-0.118***	-0.116***
	(0.029)	(0.030)	(0.029)	(0.033)	(0.033)	(0.032)
Change in Child GPA		-0.057**	-0.224**		-0.058**	-0.234**
		(0.018)	(0.081)		(0.019)	(0.079)
Child GPA (t-1) $\times$ Change in Child GPA			0.070			0.073
			(0.040)			(0.041)
Mean Dependent Variable	-0.062	-0.062	-0.062	-0.062	-0.062	-0.062
Observations	1484	1484	1484	1484	1484	1484
Clusters	10	10	10	10	10	10
Controls	Yes	Yes	Yes	Yes	Yes	Yes
School-Grade F.E.	No	No	No	Yes	Yes	Yes

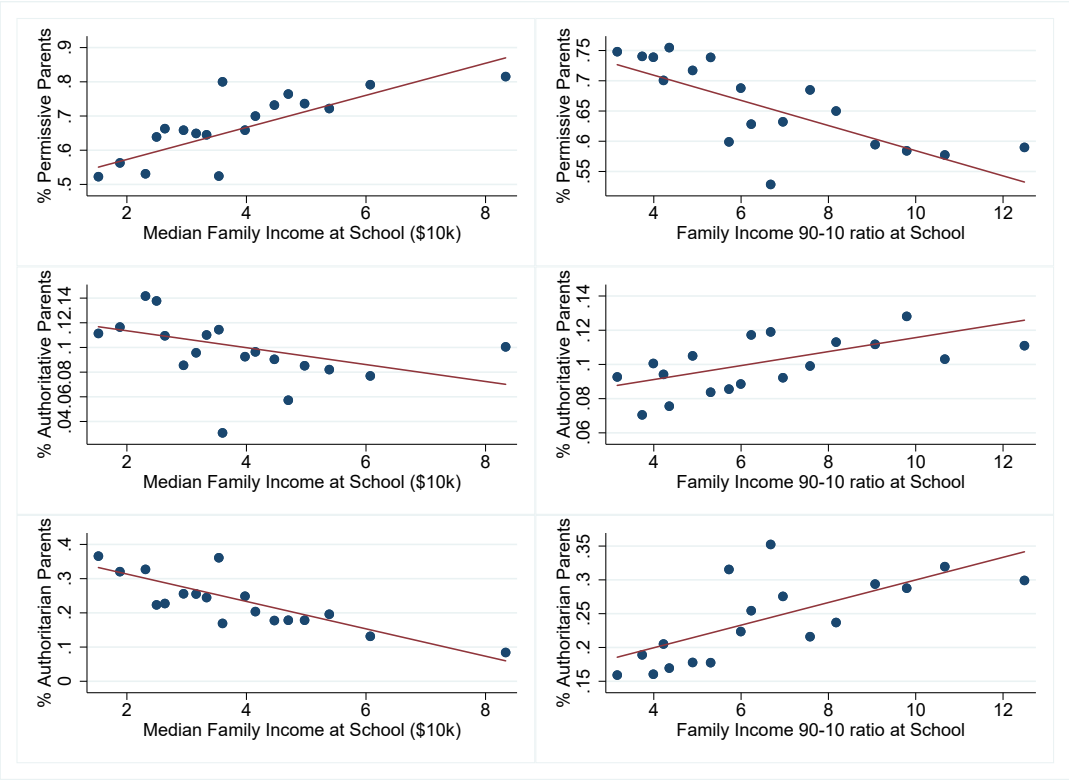
The table shows the effect of changes in peers and a child's GPA on changes in an index for authoritarian parenting. The dependent variable is the within-child longitudinal change in authoritarian parenting between the first and second waves of interviews. The Change in Peer GPA and the Change in Child's GPA represent the longitudinal change between the first and second waves of interviews of the average GPA of peers and a child's GPA, respectively. Finally, the Child's GPA $(t-1)$ represents the GPA of a child during the first wave of interviews. The regressions are estimated with the sample of saturated schools in Add Health. Regression models in columns (4)-(6) also include school-grade fixed effects. The set of controls comprises the mother's education, family income, and child's race, age, and gender. Standard errors are clustered at the school level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A-1: Correlation between Parent and Child Reported Measure of Authoritarian Parenting



The figure shows the correlation between the shares of authoritarian parents at school constructed with the child questionnaire (y-axis), versus the parent questionnaire (x-axis). Each dot represents the share of authoritarian parents at school.

Figure A-2: Parenting Style and Neighborhood



The figure shows how the incidence of the three parenting styles (permissive, authoritative, and authoritarian) varies with within-school median family income (left panel) and inequality (right panel). The measure of parenting style follows Doepke and Zilibotti (2017) and is discussed in the text. Inequality is measured by the 90th–10th percentile ratio of within-school family income. The top, central, and bottom panels show the incidence of permissive, authoritative, and authoritarian parenting style, respectively.

B Supplementary Material to Section II.

Measuring Skills and Parental Investments in Add Health

In this section, we provide additional details on how we measure children's skills and parental investment in Add Health.

Parenting Style. We measure parenting style using the following yes-no questions asked to children during the in-home survey (both Wave I and Wave II): (1) "Do your parents let you make your own decisions about the people you hang around with?" 2) "Do your parents let you make your own decisions about the time you must be home on weekend nights?" (3) "Do your parents let you make your own decisions about what you wear?" (4) "Do your parents let you make your own decisions about what time you go to bed?" Our baseline measure of parenting style is (1), which is used to anchor the model to the right fraction of authoritarian parents among different neighborhoods and in the aggregate. We classify a parent whose child answers "No" as adopting an authoritarian parenting style. Following Driscoll, Russell, and Crockett (2008) and Shakya, Christakis, and Fowler (2012), we also construct a composite index (Bartlett score), which we use to correct for measurement error that could bias the estimated regression coefficients, including the ones we use as target moments in the structural estimation. For structural estimation, we follow Driscoll, Russell, and Crockett (2008) and map the Bartlett score index to the binary parenting style (authoritarian versus nonauthoritarian) based on the median value of the score.

Other Parental Investments (Time). We measure parental investments using the following yes-no questions asked to children during the in-home survey about certain activities they engaged in with their mothers: "Talked with your mom about a party you attended"; "Talked with your mom about a personal problem"; "Worked with your mom on a project for school."We aggregate the three measures using the Bartlett factor score.

Children's Skills: We measure children's skills using both grades at school (English, Math, History, and Science) and a standardized test of receptive vocabulary (Peabody Picture Vocabulary Test, PPVT).[29] Similar to Cunha and Heckman (2007), Cunha, Heckman, and Schennach (2010), Agostinelli and Wiswall (2023), Attanasio, Meghir, and Nix (2020), and Attanasio et al. (2020), we use a linear measurement system to have a comparable scaling between different measures. The measurement model maps each of the five observed measures above ($M^m_{i,t}$) to children's skills ($\theta_{i,t}$) as follows:

$$M^m_{i,t} = \nu_{0,m} + \nu_{1,m} \ln \theta_{i,t} + \phi^m_{i,t}. \tag{B-1}$$

where the measurement error is assumed to be mean independent of the latent skills $E[\phi^m_{i,t} | \ln \theta_{i,t}] = E[\phi^m_{i,t}] = 0$. This model allows us to have a linear transformation for each measure m that measures the children's skills: $\widetilde{M}^m_{i,t} \equiv \frac{M^m_{i,t} - \nu_{0,m}}{\nu_{1,m}} = \ln \theta_{i,t} + \widetilde{\phi}^m_{i,t}$.[30] The identification and estimation of the measurement parameters is based on the normalization of the mean (zero) and variance (unitary) for skills at $t = 1$ (see Agostinelli and Wiswall (2023)). Once we have the set of rescaled measures $\left\{\widetilde{M}^m_{i,t}\right\}_{m=1}^{5}$, they can be used to identify the dynamics of (average) skills over a child's age $E[\widetilde{M}^m_{i,t}] = E[\ln \theta_{i,t}]$, while we aggregate them in a composite unbiased index using Bartlett factor scores to deal

[29] Add Health includes the PPVT scores only for Wave I.

[30] The re-scaled measurement error is $\widetilde{\phi}^m_{i,t} = \frac{\phi^m_{i,t}}{\nu_{1,m}}$.

with the measurement error in our regressions (see Heckman, Pinto, and Savelyev 2013). The estimates of the measurement parameters in Equation (B-1) are shown below.

Table B-1: Estimates for the Measurement Model in (B-1)

	ν_0	ν_1
English Grade	2.71	0.73
Math Grade	2.71	0.63
Science Grade	2.78	0.82
History Grade	2.72	0.78
PPVT	64.07	3.24

The table shows the estimates for the measurement model, see Equation (B-1). The parameters are estimated under a zero mean and unitary variance normalization of the log-skills in 9th grade (see Cunha and Heckman (2007), Cunha, Heckman, and Schennach (2010), and Agostinelli and Wiswall (2023) for further details).

C Supplementary Material to Section III.

Equilibrium Definition

In this section, we formally define equilibrium. We first provide a formal definition of an *Endogenous Peer Network* where children optimally choose their friends, conditional on the parenting style to which they were subjected in the previous period.

Definition 1 (Endogenous Peer Network)**.** *Let $\mathcal{X}^n$ denote the set of children living in n and let $|\mathcal{X}^n|$ denote its cardinality. Interactions among $|\mathcal{X}^n|$ children are captured by a network $G^n \in \mathcal{G}^{c^n}$, where $\mathcal{G}^{c^n}$ denotes the class of graphs on the $|\mathcal{X}^n|$ nodes. The set of bilateral states is represented by the adjacency matrix $\mathbf{A} = (a_{ij})_{i\in\{1,2,...,|\mathcal{X}^n|\},j\in\{1,2,...,|\mathcal{X}^n|\}}$ associated with the network G^n, where, for all $i \neq j$, $a_{ij} = 0$ if i and j are not friends and $a_{ij} = 1$ if i and j are friends. We conventionally set $a_{ii} = 0$.*

G^{n*}_{t+1} is an Endogenous Peer Network at $t+1$ if, for any $i \in \mathcal{X}^n$ and $j \in \mathcal{X}^n$ endowed, respectively, with skill levels $\theta_{i,t+1}$ and $\theta_{j,t+1}$ and subject to parenting styles $P_{i,t}$ and $P_{j,t}$ at t, $a_{ij,t+1} = 1$ if and only if $g(\theta_{i,t+1}, \theta_{j,t+1}, P_{i,t}, \phi_{i,j,t+1}) > 0$ and $g(\theta_{j,t+1}, \theta_{i,t+1}, P_{j,t}, \phi_{i,j,t+1}) > 0$, and $a_{ij,t+1} = 0$, otherwise, where $\phi_{i,j,t+1}$ is a random utility shock. G^{n*}_{t+1} uniquely pins down the set of friendships in the neighborhood n, $\mathcal{F}^n_{t+1} = \{\mathcal{F}_{i,t+1}\}_{i\in\mathcal{X}^n}$, where $\mathcal{F}_{i,t+1} = \{j \in \mathcal{X} | a_{ij,t+1} = 1\}$, cf. Equation (5).

Next, we define a *Neighborhood Equilibrium*. An equilibrium requires that parents make optimal parenting choices and that the Endogenous Peer Network is consistent with these parenting strategies, namely, children form friendships by maximizing utility conditional on their parents' optimal choices. The choices of parents and children jointly determine the laws of motion of individual skills and peer effects. Note that equilibrium is defined for a given initial state vector in the period $t = 1$. As described above, in the computational model, the initial state is drawn from an initial distribution of skills together with an initial round of friendship formation, but the equilibrium definition is applicable more generally to any arbitrary initial state.

Definition 2 (Neighborhood Equilibrium)**.** *Given a set of children $\mathcal{X}^n$ and an initial state vector $\Theta^n_0 = \left\{\theta_{j,0}, \bar{\theta}_{j,0}\right\}_{j\in\mathcal{X}^n}$, an equilibrium for the neighborhood n consists of:*

- *Parental value functions $V^n_t(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$,*
- *optimal policy functions $I_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$ and $P_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$,*
- *a friendship formation function $\mathcal{F}^n_{t+1} = F(\{\theta_{i,t+1}, P_{i,t}\}_{i\in\mathcal{X}^n}, \Phi^n_{t+1})$,*
- *and an aggregate law of motion $\Gamma(\Theta^n_t, \Xi^n_t, \Phi^n_{t+1})$*

such that:

1. *The value functions $V^n_t(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$ satisfy the parents' dynamic programming problem (2),*
2. *the optimal policy functions $I_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$ and $P_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)$ solve the maximization problem in (2),*

3. *the aggregate law of motion* $\Theta^n_{t+1} = \Gamma(\Theta^n_t, \Xi^n_t, \Phi^n_{t+1})$ *is such that each child's skill evolves according to* (1) *given the optimal policy functions and realized parental preference shocks* Ξ^n_t*, i.e., for all* $i \in \mathcal{X}^n$*:*

$$\theta_{i,t+1} = s(\theta_{i,t}, \bar{\theta}_{i,t}, I_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t), P_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)). \tag{C-1}$$

4. *Friendships in period* $t+1$ *are formed such that children solve their maximization problem* (5)*, i.e., we have:*

$$\mathcal{F}^n_{t+1} = F(\left\{\theta_{i,t+1}, P_t(\xi_{i,t})(\theta_{i,t}, \bar{\theta}_{i,t}, \Theta^n_t)\right\}_{i\in\mathcal{X}^n}, \Phi^n_{t+1}), \tag{C-2}$$

with the evolution of individual skills given by (C-1) *and* $F(\cdot)$ *such that each friendship link exists if and only if* (6) *is satisfied, with the friendship utilities* $f_{i,j,t+1}$ *generated by* (4)*.*

5. *The aggregate law of motion* $\Theta^n_{t+1} = \Gamma(\Theta^n_t, \Xi^n_t, \Phi^n_{t+1})$ *is such that the peer effects evolve according to* (10)*, i.e.,*

$$\left\{\bar{\theta}_{i,t+1}\right\}_{i\in\mathcal{X}^n} = Q(\left\{\theta_{i,t+1}\right\}_{i\in\mathcal{X}^n}, \mathcal{F}^n_{t+1}),$$

with the evolution of individual skills given by (C-1) *and the friendship network given by* (C-2)*.*

D Supplementary Material to Section IV.

Sample Fit

Tables D-1–D-5 show the sample fit of the model. Table D-1 reports the sample fit for the estimates of a linear probability model of authoritarian parenting style on a child's and peers' skills. Table D-2 focuses on the linear regression model of a child's next-period skills on current skills, peers' skills, and authoritarian parenting style. Table D-3 shows the estimates for the regression of the next-period average peers' skills on the child's current period skills, peers' skills, and authoritarian parenting style. Finally, Table D-4 reports the estimates for regressions of authoritative parental investments in the child's current period skills and peers' skills, with a breakdown between authoritarian and nonauthoritarian parents. The first panel of Table D-5 shows the sample fit of the child-level panel regression models of longitudinal changes in parenting style on the longitudinal changes in both child skills and peer skills. The second panel of Table D-5 shows the longitudinal change in parental investments by previous parenting style.

Table D-1: Sample Fit of the Model: Parenting Style

	Authoritarian	
	(1)	(2)
	Model	Data
Child Skills	-0.022	-0.014
Peer Skills	-0.039	-0.016
Fraction Authoritarian Parents	0.133	0.147
Fraction Authoritarian Parents (by Neighborhood):		
Neighborhood 1	0.182	0.206
Neighborhood 2	0.138	0.153
Neighborhood 3	0.101	0.119
Neighborhood 4	0.068	0.099

The table shows the sample fit for the estimates of a linear probability model of authoritarian parenting style on a child's skills and on the peers' skills. Column (1) displays the estimates generated from the simulated model. Column (2) shows the estimates from the data. We calculate the model's predicted coefficients by averaging among 50 different model simulations.

Table D-2: Sample Fit of the Model: Skill Accumulation

	Next-Period Skills					
	Pooled Sample		Authoritarian = 0		Authoritarian = 1	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model	Data	Model	Data	Model	Data
Child Skills	0.818	0.813	0.831	0.818	0.764	0.782
Peer Skills	0.232	0.132	0.247	0.091	0.127	0.183
Authoritarian	-0.056	-0.029				
Mean Child Skills (Grade 9)	-0.036	-0.019				
Mean Child Skills (Grade 10)	0.020	0.027				
Mean Child Skills (Grade 11)	0.136	0.112				
Mean Child Skills (Grade 12)	0.218	0.272				

The table shows the estimates for a linear regression model of the next-period child's skills on the current period child's skills, peers' skills, and parenting style. The odd columns display the estimates generated from the simulated model. Even columns show the estimates from the data. We calculate the predicted coefficients of the model by averaging among 50 different model simulations.

Table D-3: Sample Fit of the Model: Peer Skills

	Next Period Peer Skills					
	Pooled Sample		Authoritarian = 0		Authoritarian = 1	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model	Data	Model	Data	Model	Data
Child Skills	0.165	0.180	0.149	0.173	0.265	0.178
Peer Skills	0.476	0.307	0.485	0.327	0.420	0.292
Authoritarian	0.069	0.033				
Mean Number of Friends	7.621	7.643				

The table shows the estimates for a linear regression model of next-period average skill of peers on current period child's skills, peers' skills, and parenting style. The odd columns display the estimates generated from the simulated model. Even columns show the estimates from the data. We calculate the model's predicted coefficients by averaging among 50 different model simulations.

Table D-4: Sample Fit of the Model: Parental Investments

	Parental Investments			
	Authoritarian = 0		Authoritarian = 1	
	(1) Model	(2) Data	(3) Model	(4) Data
Child Skills	0.120	0.162	0.004	0.065
Peer Skills	-0.089	-0.110	-0.003	-0.056
Mean Dependent Var.	0.034	0.037	-0.218	-0.210

The table shows the estimates for a linear regression model of authoritative parental investments on current period child's skills and peers' skills with breakdown by (authoritarian) parenting style. Odd columns display the estimates generated from the simulated model. Even columns show the estimates from the data. We calculate the model's predicted coefficients by averaging among 50 different model simulations.

Table D-5: Sample Fit: Longitudinal Analysis of Parenting

	Change in Authoritarian Style	
	(1)	(2)
	Model	Data
Change in Peer Skills	-0.051	-0.060
Change in Child Skills	0.006	0.014
	Change in Parental Investments	
Authoritarian (t-1)	0.222	0.177
Intercept	-0.055	0.036

The table shows the estimates for a first-difference regression models of both authoritarian parenting style and authoritative parental investments. In the first part of the table, we show the estimated regression coefficients for the model of (within-child) longitudinal changes in parenting style on changes in a child's stock of skills and peers' skills. In the second part of the table, we show the regression coefficients for the model of (within-child) longitudinal changes in parental investments on the lagged parenting style. The odd columns display the estimates generated from the simulated model. Even columns show the estimates from the data. We calculate the predicted coefficients of the model by averaging among 50 different model simulations.

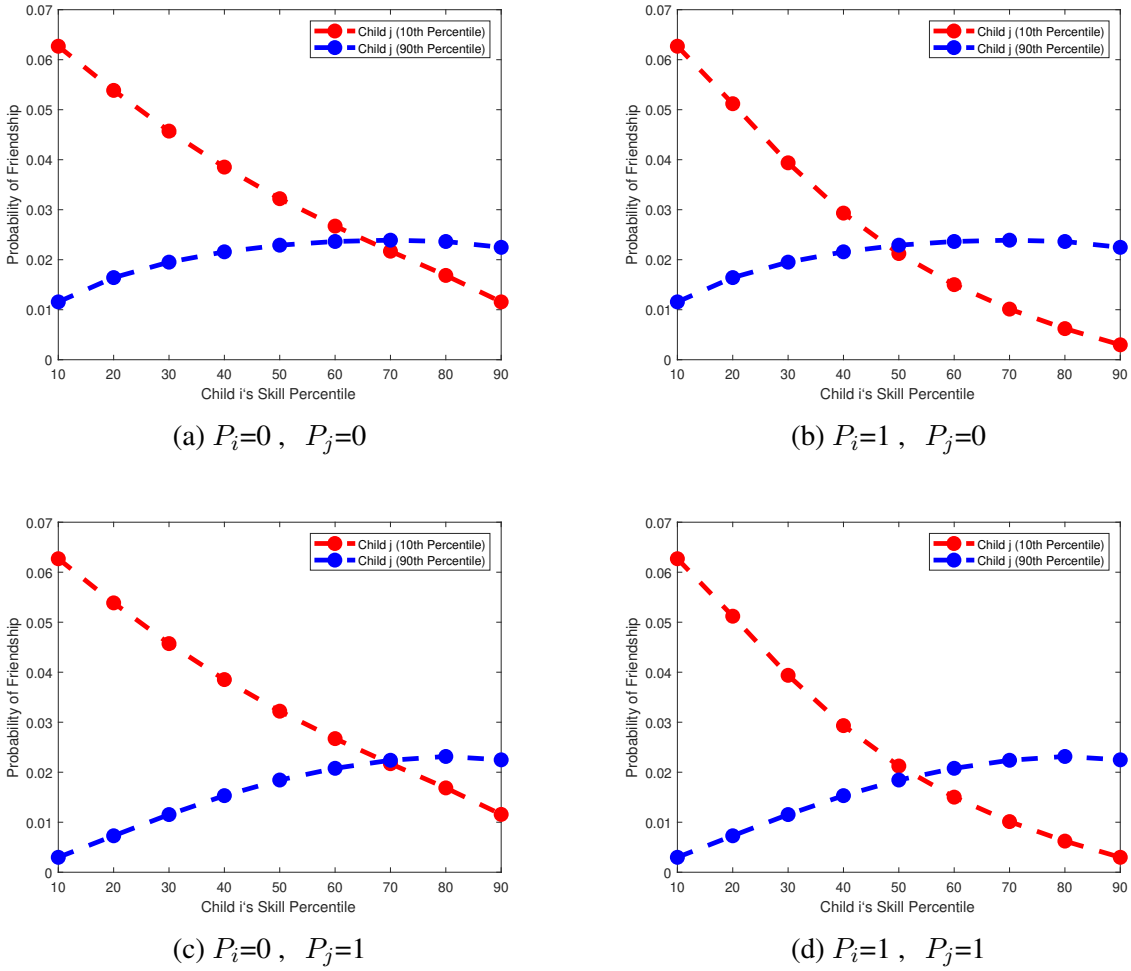
Table D-6: Estimates of Heterogeneous Productivity and Preferences by Education

Technology:	
TFP Constant (ψ_0)	0.394
Additional TFP (highly educated parents $\psi_{0,2}$)	-0.012
Preferences:	
Disutility of Authoritarian ($\delta_{2,0}$)	-2.365
Additional Disutility of Authoritarian (highly educated parents $\delta_{2,2}$)	-0.512

The table shows the estimated heterogeneity in the productivity parameter ψ_0 of the skill formation technology and in the preference parameter δ_2^n for a model in which parents have heterogeneous education (college graduates versus non-college graduates). Parameter $\psi_{0,2}$ captures the additional productivity in skill accumulation if the mother is college educated, and $\delta_{2,0}$, and similarly $\delta_{2,2}$ is the additional disutility of authoritarian parenting for college-educated compared to less-educated mothers. The remaining parameters are assumed to be homogeneous by education. The detailed results are available upon request.

Comparative Statics

Figure D-1: Comparative Statics of Friendship Formation

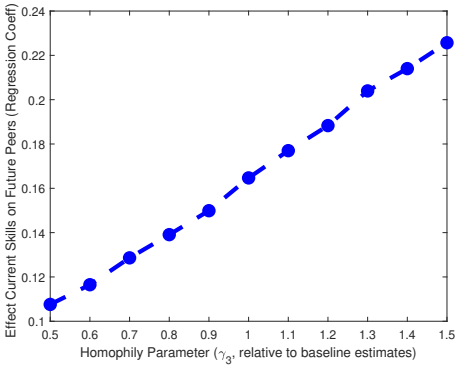


(a) P_i=0 , P_j=0 (b) P_i=1 , P_j=0

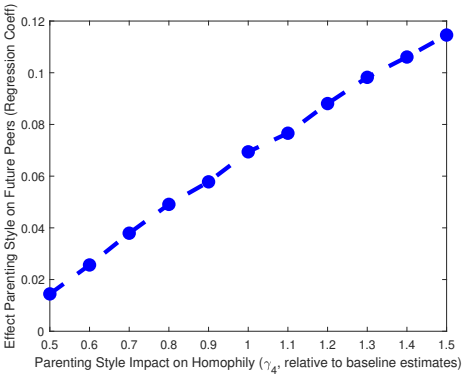
(c) P_i=0 , P_j=1 (d) P_i=1 , P_j=1

The figure shows the comparative statics of the probability of a friendship between two children with different skills, for different parenting style. In each panel, the x-axis shows the skill percentile for a child i, while the y-axis shows the probability of a friendship between child i and child j. The red and blue lines represent the probability of friendship with child j if she were in the 10th or 90th percentile of the skill distribution, respectively. Each panel represents a different scenario in terms of the adopted parenting style of the parents of the two children. For example, panels A and D show how the probability of a friendship varies between children with different skills when either no parent is authoritarian or when both parents are. Instead, panels B and C consider the case where only the parent of child i or the parent of child j is authoritarian, respectively. The figure is computed using the estimated child's preference parameters in Table 7.

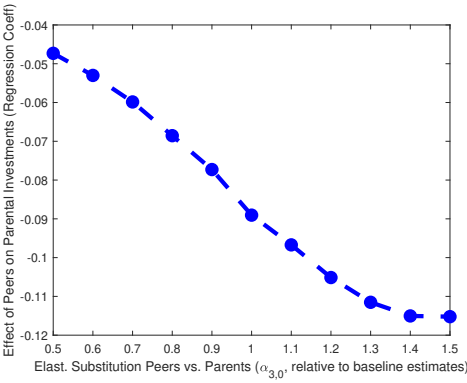
Figure D-2: Perturbation of Model's Parameters and Equilibrium Moments



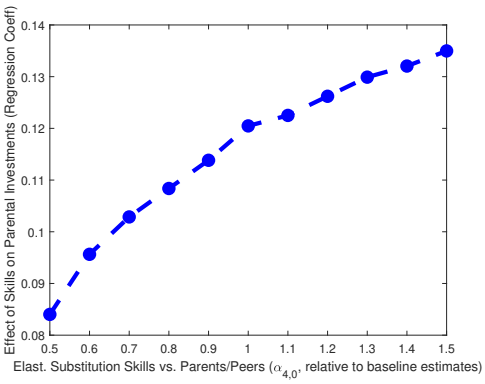
(a) Homophily (γ_3)



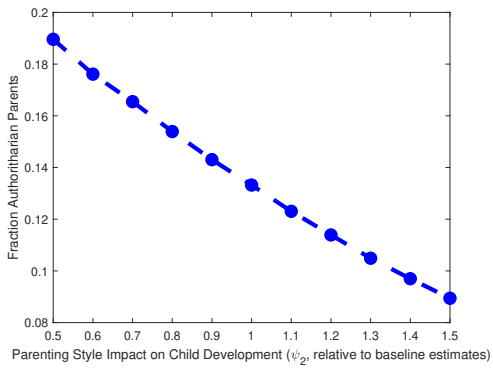
(b) Parenting Style on Homophily (γ_4)



(c) Complementarity Parents vs. Peers ($\alpha_{3,0}$)



(d) Complementarity Self-Production vs. Parents-Peers ($\alpha_{4,0}$)

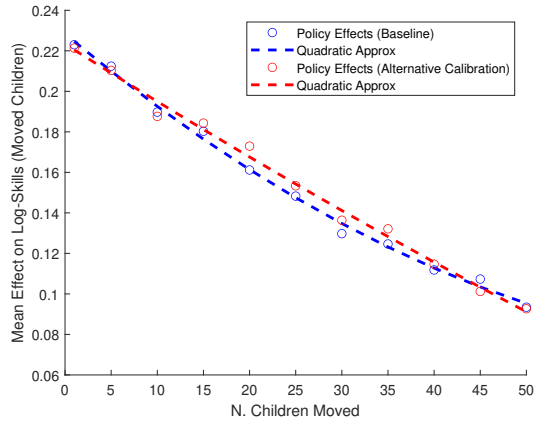


(e) Productivity Skill Accumulation (ψ_2)

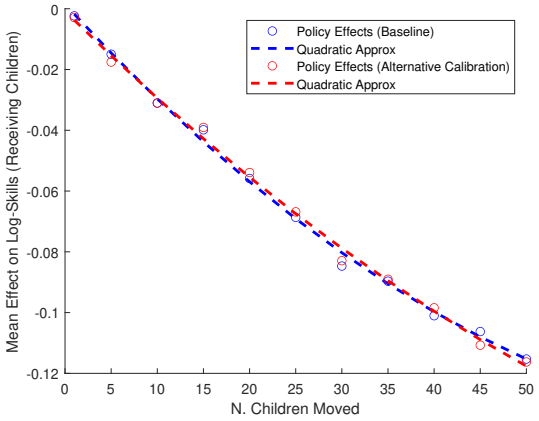
The figure shows the comparative statics of the equilibrium moments used for the estimation of the model. Each dot represents a particular simulated moment from the computed new equilibrium of the model for each new parameterization. In each panel, the x-axis represents the level of perturbation of a parameter (in $\%$) relative to its estimated value in Table 5-7 (1 represents the estimated baseline level). The y-axis represents the values of the particular simulated moment.

E Supplementary Material to Section V.

Figure E-1: Policy and Scaling Effects on Skills (Alternative Calibration)



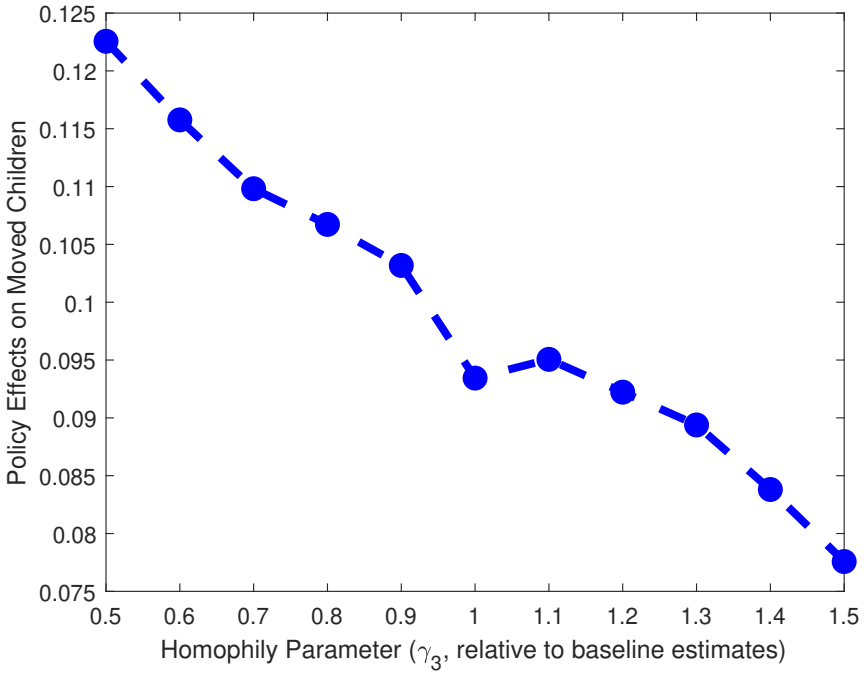
(a) Moved Children



(b) Receiving Children

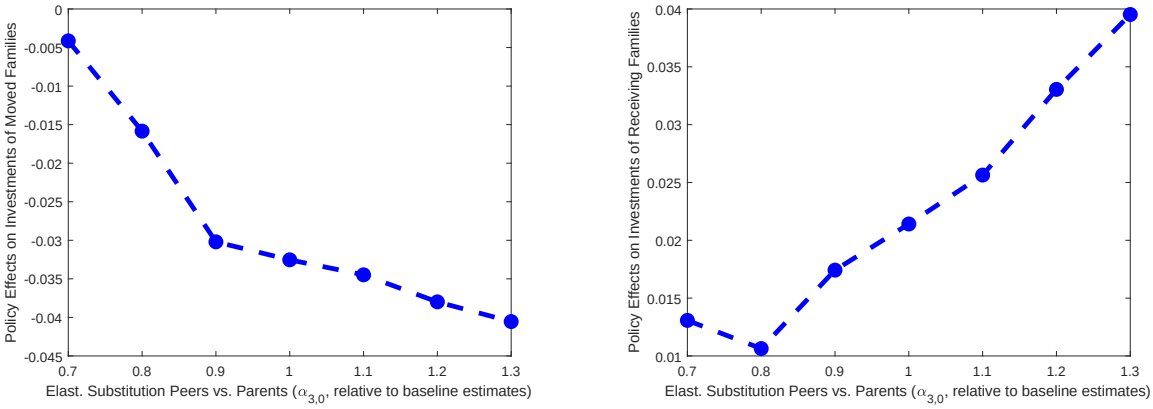
The figure shows the equilibrium policy effect on skills in 12th grade of moving children from N1 to N4 as in Figure 4. In this exercise, we provide a robustness exercise of our counterfactual results to alternative calibrations of the skill production function for authoritarian parents ($P = 1$) in equation (17). In particular, we generalize the current Cobb-Douglas specification for authoritarian parents ($P = 1$) with a calibrated CES technology with the following parameterization (see equation (12) for the general CES specification): $\alpha_{1,1}$=0.7221, $\alpha_{2,1}$=0.6734, $\alpha_{3,1}$=0.30, $\alpha_{4,1}$=-0.40, $\alpha_{5,1}$=0.7160. All the rest of other model's parameters are kept at the estimated values. Panel (a) illustrates the average effect for moved children. Panel (b) illustrates the average effect for receiving children. Each panel shows both the results from the baseline estimates (blue dots) and the alternative calibration (red dots). The policy effects represent the average impact on skills for moved children (panel a) or receiving children (panel b) for a given number of moved children. The policy effects are calculated by averaging among 200 different model simulations

Figure E-2: The Impact of Homophily on the Policy Scale Up



The figure shows how the equilibrium policy effects computed in panel A of Figure 4 (for the case of 50 children moved) change with respect to the homophily parameter (γ_3) of the model. The x-axis represent the level of perturbation of a parameter (in $\%$) relative to its estimated value in Table 7 (1 represents the estimated baseline level). The y-axis shows the computed policy effects for moved children. Each dot represents a particular equilibrium policy effect, which is calculated by computing the new equilibrium in both the baseline and the counterfactual economy, for each new parameterization.

Figure E-3: Parental Responses and the Elasticity of Substitution Peers vs. Parents

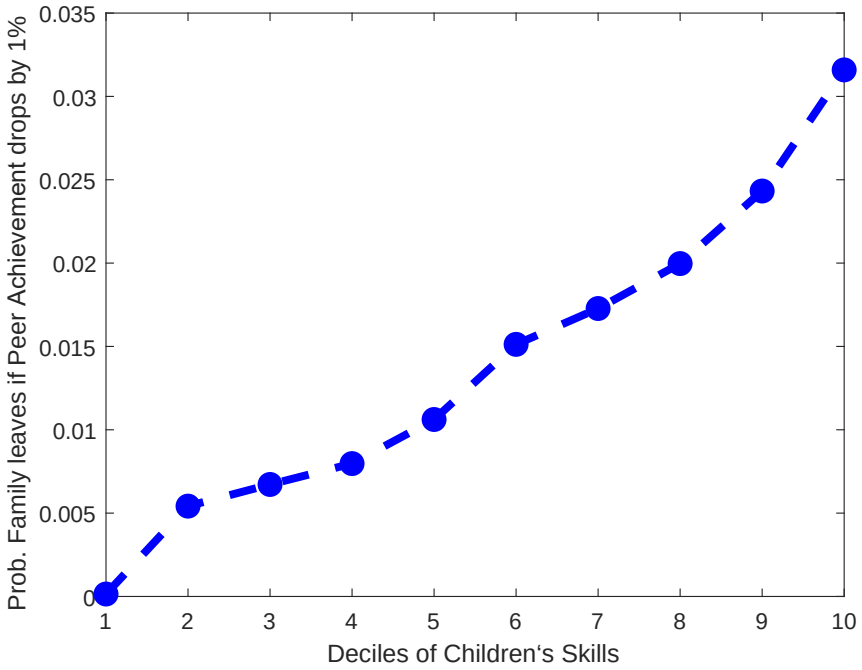


(a) Moved

(b) Receiving

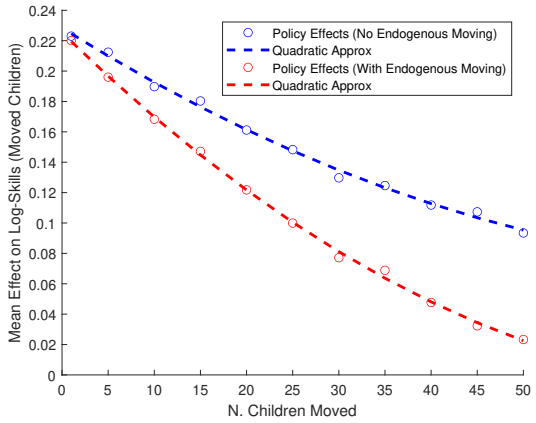
The figure shows how the equilibrium policy effects on parental investments computed in panels B and D of Figure 5 (for the case of 50 children moved) changes with respect to the elasticity of substitution parameter between parents and peers in the production of skills ($\alpha_{3,0}$). In each panel, the x-axis represents the level of perturbation of a parameter (in $\%$) relative to its estimated value in Table 5 (1 represents the estimated baseline level). The y-axis shows the computed policy effects on parental investments for moved families (panel A) and for receiving families (panel B). Each dot represents a particular equilibrium policy effect, which is calculated by computing the new equilibrium in both the baseline and the counterfactual economy, for each new parameterization. In panel A, we show how the equilibrium policy affects moved families, while in panel B we show how it affects receiving families.

Figure E-4: Residential Elasticities w.r.t. Mean School Peer Achievement

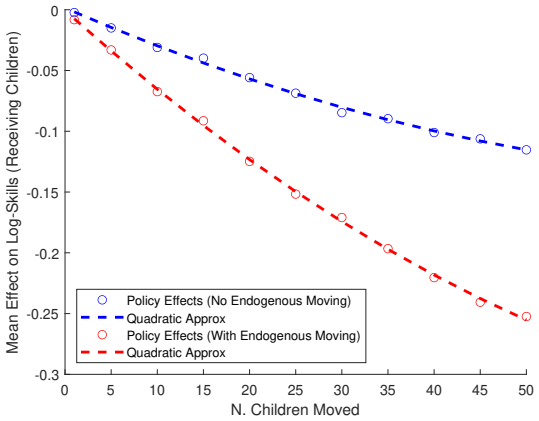


The figure shows the probability of a family leaving the receiving high-income neighborhood by their children's skill deciles. These behavioral estimates are from Agostinelli, Luflade, and Martellini (2022). A 0.01 probability means that a family has 1% probability of leaving the neighborhood if the (ex-ante) mean school peer achievement in 9th grade drops by 1% because of the policy.

Figure E-5: Policy and Scaling Effects on Skills (with Endogenous Mobility)



(a) Moved Children



(b) Receiving Children

The figure shows the equilibrium policy effect on skills in 12th grade of moving children from N1 to N4 as a function of the number of moved children (red lines). In this exercise, compared to the results in Figure 4 (blue lines), we allow receiving families living in N4 to endogenously choose to leave the neighborhood as a response to the policy. The elasticities of the residential responses are taken from estimates in Agostinelli, Luflade, and Martellini (2022) (see Figure E-4 for the values of the elasticities). Panel (a) illustrates the average effect for moved children. Panel (b) illustrates the average effect for receiving children. Policy effects represent the average impact on skills for moved children (panel a) or receiving children (panel b) for a given number of moved children. The policy effects are calculated by averaging among 200 different model simulations.