Effects of Childhood Peers on Personality Skills

Shuaizhang Feng*, Jun Hyung Kim* and Zhe Yang*

Abstract

Despite large literature on peer effects, there is relatively little understanding of peer effects on personality skills, which are predictive of subsequent human capital development and a wide range of life cycle outcomes. We fill this gap by investigating whether, and how, childhood peers affect personality skill development of children. To identify peer effects, we use variation in the proportion of disadvantaged children in the classroom, generated by random classroom assignment and parental decision to migrate to urban area for employment. Using administrative data linked to an extensive survey with information on Big-5 personalty traits, we find that the presence of disadvantaged peers significantly lowers personality skill development measured by conscientiousness, agreeableness, emotional stability, and social skill. Furthermore, the effects on personality skills are driven by the peers' average personality skills, rather than academic achievements, suggesting personality-to-personality peer effects channels.

Keywords: peer effect, personality skill, noncognitive skill, socio-emotional skill, left-behind children

JEL Codes: I21, D62, O15

PRELIMINARY AND INCOMPLETE; PLEASE DO NOT CIRCULATE

*Institute for Economic and Social Research at Jinan University

A growing literature documents the importance of childhood peers in shaping long-run life cycle outcomes such as high school graduation, college attendance, earnings, and occupational choice (Black et al. [2013], Carrell et al. [2018], Bertoni et al. [2020], Bietenbeck [2020], Balestra et al. [2021]). However, it is not well known through which channels childhood peers affect adult outcomes. Large literature on education peer effects typically focus on short-run effects on academic achievement, without examining whether these effects persist into adulthood. Few studies that investigated the persistence of academic peer effects showed that these effects faded out before adolescence (Bietenbeck [2020], Huang and Zhu [2020], Huang [2020]). Others suggested noncognitive skills[1] as potential channels linking childhood peers and life-cycle outcomes, but did not provide conclusive evidence (see Section 1). In particular, it remains unknown whether childhood peers affect noncognitive skills that generate a wide range of life cycle outcomes.

We examine the effect of childhood peers on the development of personality skills. Large literature on human capital development shows that personality skills are important inputs to the production of subsequent cognitive and noncognitive human capital, and generates life cycle outcomes including education, earnings, health, and crime (e.g., Almlund et al. [2011], Heckman and Mosso [2014], Kautz et al. [2014], Humphries and Kosse [2017]). Showing that childhood peers affect personality skill development therefore suggests that personality skills may be one of the channels behind long-run effects of childhood peers. Furthermore, policymakers would be able to use behavioral policies that have been shown to improve personality skills in childhood and adolescence (e.g., Elango et al. [2016], Almond et al. [2018]) to counteract negative impact of disadvantaged peers. Finally, the findings would reinforce the importance of nurture as opposed to nature in human development.

Specifically, we ask two main questions in this paper: (a) what is the effect of childhood peers on personality skills? and (b) how do childhood peers affect personality skills? To answer the first question, we focus on the effect of being exposed to disadvantaged peers in the same classroom in primary school. To answer the second question, we investigate whether the effects on personality skills are driven by the lower personality skills or lower academic achievement of the disadvantaged peers.

We use school administrative data from China linked to extensive surveys on home environment, school environment, and Big-5 personality traits of children in primary schools. "Disadvantaged" status of children is represented by whether the children are left-behind by their parents. Many parents in rural area choose to migrate to urban area for work, finding rural wage insufficient to fund necessary household consumption. They are discouraged from taking their children with them, however, since their residential designation called *Hukou* make it difficult for them to benefit from public goods in urban area such as public schools. Despite remittances from migrating parents, left-behind children tend to show lower cognitive skill, more behavioral problems, and more depressive symptoms (Wang and Mesman [2015], Zhang et al. [2014], Hu et al. [2014], Wang et al. [2019], Meng and Yamauchi [2017]), making them good proxies for disadvantaged peers.

Our personality skill measures are based on Big-5 model of personality (Goldberg [1993]). It is one of the most commonly used models of personality in economics and psychology, and

[1]Other terms used for noncognitive skill in the literature include personality skill, socio-emotional skill, and behavioral skill. To keep the meaning precise, we use the term 'personality skill' in this paper.

its relationship to life cycle outcomes has been validated in many studies. For example, Almlund et al. [2011] shows that Big-5 measures predict schooling and earnings as much as, and sometimes more than, cognitive skill measures such as IQ scores. Big-5 measures have also been used to investigate the relationship between personality skills and labor market performance (Fletcher [2013], Dohmen and Falk [2011], Deming [2017], Haylock and Kampkötter [2019]), marital sorting (Dupuy and Galichon [2014]), and political behavior (Gerber et al. [2011]), among others.

We make two key assumptions for identification, First, we assume that students or their parents do not self-select into classrooms based on the characteristics of classroom peers. This assumption is supported by the fact that students are randomly assigned to classrooms in our sample, which is government-mandated (Strauss [2013]) and a common feature of schools in China (Huang [2020], Huang and Zhu [2020], Xu et al. [2020], Chung and Zou [2020], and Wang [2020]). We further surveyed school principals in our sample and confirmed that they had incentives to follow random assignment protocol.

Second, we assume that parents' migration statuses are not endogenous to the characteristics of their children's peers. This assumption can be violated due to (i) reverse causality, where the migration of others can affect the parent's own migration decision, due to (ii) village-level temporal shocks such as economic depression, or due to (iii) village-level time-invariant heterogeneity. To support the second assumption, we first restrict the analysis sample to those who were never left behind during primary school period, reducing concerns of reverse causality. We also define left-behind children as those who were left-behind in the first semester of the first grade. Since outcome measures were collected between grades 4 to 6, identification threat from reverse causality and temporal village-level shocks are reduced. Lastly, we include school×cohort×wave fixed effect to account for time-invariant village-level heterogeneity.

We find that being exposed to disadvantaged peers have significantly negative effects on the personality skill development of primary school students. 10% increase in the proportion of left-behind peers in the fourth grade reduces conscientiousness by 0.181, agreeableness by 0.221, emotional stability by 0.254, and social skill by 0.218 in standard deviation unit. Effects on academic achievement measures are small and insignificant. Accounting for the fourth grade peers, first grade peers do not affect student outcomes. Our nonlinear analysis shows that the effects are concentrated in classrooms with lower levels of LBC peers. We also find that endogenous friendship formation is not likely to be the primary channel for peer effects.

Finally, we investigate whether the observed effects are driven by the academic achievements or personality skills of the left-behind peers. We find evidence suggesting that the peer effects on personality skills are primarily driven by the personality skills, but not the academic achievement, of their left-behind peers.

Our findings contribute to the understanding of peer effects in childhood. First, we contribute to a large body of literature on peer effects in education. A growing literature shows that childhood peers affect long-run life cycle outcomes such as education and earnings (Carrell et al. [2018], Bietenbeck [2020]), but without clear understanding of underlying channels. Childhood peer effects on academic achievement is well-established but it is unknown whether it persists beyond childhood, and childhood peer effect on personality (or noncognitive) skill is not well understood. Our study fills this gap by showing childhood

peer effects on personality skills, measured by the Big-5 model. Since Big-5 model is widely validated as being predictive of life-cycle outcomes including education, earnings, health, and crime (Almlund et al. [2011]), our finding suggests that personality skills may be the channel between childhood peers and their effects on long-run outcomes.

Implications of our results are consistent with the broader literature on the effect of childhood educational environment on long-run outcomes. Studies have shown that positive effects on academic achievement does not necessarily persist, while the effects on personality or noncognitive skills persist beyond childhood and mediate effects on long-run outcomes (Chetty et al. [2011], Heckman et al. [2013]).

Our findings also suggest that improving personality skills of children can be a viable way to counteract the negative effects of disadvantaged peers. Our results, as well as the results of others (e.g., Zárate [2019]) suggest that those with high level of academic achievement do not improve the personality skills of their peers, but those with high personality skills can. Given that personality skills are the likely channels connecting childhood peers and long-run outcomes, and that skills are more malleable during childhood than during later periods, it is especially important to consider programs and policies that can improve personality skills during childhood (Chetty et al. [2011], Heckman et al. [2013], Kautz et al. [2014], Elango et al. [2016]).

The remainder of the article is organized as follows. Section 1 places our study in the literature of peer effects in education. Section 2 discusses the institutional background and sample characteristics. Section 3 discusses the identification assumptions and presents a series of balance tests that supports the assumptions. Section 4 presents the empirical models and the estimation results, and Section 5 concludes.

1 Literature Review

Literature on Childhood Peer Effects on Academic Achievement Our study contributes to a large body of literature on peer effects in childhood. Many of them focus on short-run effects on academic achievement measured by test scores. Most studies find that being exposed to high-achieving peers has a positive impact on test scores, though exceptions exist.[2] Among the studies that investigated childhood peer effects on academic achievement, a large number of them showed that exposure to high-skilled peers had a positive impact on academic achievement.[3] Closer in design to our own, other studies focused on the effects of being exposed to low-skilled or disadvantaged peers, showing they had negative impact on academic achievement.[4] A few studies show that exposure to peers in preschool or kindergarten periods can affect academic achievement as well (Elder and Lubotsky [2009], Neidell and Waldfogel [2010], Bietenbeck [2020]).

It is not well known whether childhood peer effects on academic achievement persist beyond childhood. Some studies show that peer effects on academic achievement fade out relatively quickly (Bietenbeck [2020], Huang [2020], Huang and Zhu [2020]), while others suggest that they may persist into high school period (Carrell et al. [2018]).

A few studies focused on the effects of peers' behavioral aspects on academic achievement outcomes. Neidell and Waldfogel [2010] found that kindergarten children's cognitive achievement suffered when their peers displayed more externalizing problems (i.e., showing aggressive behaviors related to classroom disturbance). Golsteyn et al. [2021] presents another interesting evidence, although their sample consists of college students in a Dutch business school. Using random assignment of students to study sections, they found that students assigned to study sections with peers with more persistent personality achieved higher grades.

Literature on Childhood Peer Effects on Noncognitive Skills Compared to the number of studies examining peer effects on academic achievement, relatively fewer studies examined peer effects on behavioral outcomes. For example, Xu et al. [2020] found that middle school students in China with more low-ability classmates displayed higher levels of school disengagement, were more likely to experience negative emotions, and had lower

[2]Angrist and Lang [2004] and Abdulkadiroğlu et al. [2014] did not find evidence of childhood peer effects on academic achievement. Dobbie and Fryer Jr [2014] also reported null effects, using sample of high school students.

[3]Since the literature is very large, we mostly focus on studies examining effects of peers in middle school or below. Studies examining evidence from Western countries include Hoxby [2000], Betts and Zau [2004], Hoxby and Weingarth [2006], Vigdor and Nechyba [2007], Lavy et al. [2011], Lavy and Schlosser [2011], Imberman et al. [2012] Lavy et al. [2012], Black et al. [2013], Burke and Sass [2013], Sojourner [2013], Fruehwirth [2014], Gibbons and Telhaj [2016], Fletcher et al. [2020], Balestra et al. [2020] Balestra et al. [2021], among others. Duflo et al. [2011] studies sample from Kenya. Balsa et al. [2018] studies sample from Uruguay. Helmers and Patnam [2014] studies sample from rural India. Kang [2007] studies sample from South Korea. A growing number of studies focus on evidence from China: Ding and Lehrer [2007], Carman and Zhang [2012], Li et al. [2014], Lu and Anderson [2015], Min et al. [2019], Wang and Zhu [2019], Chung and Zou [2020], and Wang [2020].

[4]These include Gould et al. [2009], Carrell and Hoekstra [2010], Lavy et al. [2011], Kristoffersen et al. [2015], Ahn and Trogdon [2017], Hu [2018], Xu et al. [2020], Huang and Zhu [2020], Huang [2020], Balestra et al. [2020], Zhao and Zhao [2021]

educational expectations. Imberman et al. [2012] found that increase in evacuees due to Hurricanes Katrina and Rita lead to increases in absenteeism and disciplinary infractions of incumbent students in Houston's secondary schools. Moving beyond childhood peers, Bifulco et al. [2011] showed that high school students exposed to disadvantaged peers were showed more unruly behavior at school. While these measures plausibly capture some aspects of noncogntive skill, it is not well known how predictive these measures are of subsequent skill development or life cycle outcomes.

Carrell et al. [2018], while showing that exposure to disadvantaged peers in primary school lead to lower earnings in adulthood, noted that the effects observed for test scores in adolescence cannot fully explain earnings effects, and suggested that the likely channel is through noncognitive skill instead. Their examination of childhood peer effects on high school suspensions does not provide conclusive evidence, however. Bietenbeck [2020] provides another interesting example, examining the effect of peers who repeated kindergarten (plausibly representing disadvantaged status) on intermediate childhood outcomes and long-term educational performance using sample from Project STAR. Kindergarten repeaters exerted negative peer effects on academic achievement, but these effects faded out quickly. Surprisingly, students exposed to peers who repeated kindergarten showed better effort and discipline in childhood, and were more likely to graduate from high school and take college entrance exam. Author argued that the evidence is consistent with teachers adjusting teaching practices to account for the presence of repeaters in the classroom, but did not provide direct evidence to support this claim. Yet another evidence is provided by Hong and Lee [2017], which looked at randomized sitting rule at a university in South Korea. They found positive academic peer effects among college students, which was stronger when the students shared similar personality characteristics. This finding provides suggestive evidence that personality skills may play an important role in peer effects, although the setting is very different from our own.

Zárate [2019] conducted a randomized experiment at Peruvian high schools where the students were divided into four groups based on academic achievement and social skills. By randomly assigning students to dormitories, he showed that high-social-skill students improve the social skill of their low-social-skill peers, but high-achieving peers did not improve their peers' social skill or academic achievement. Since social skill is measured by openness to experience, extroversion, and agreeableness of the Big-5 measure, this study provides convincing evidence that personality-to-personality peer effect exists, among high school students and for social skill, which is a subset of personality skills. Our study adds to the literature by showing peer effects on personality skills measured by the full range of Big-5 measures as well as social skill, and by focusing on childhood (primary school period) rather than adolescence (high school period).

2 Background and Data

2.1 The Left-Behind Children

Many parents in China find employment at a different region, leaving their children behind at home for an extended period of time to be taken care of by the remaining parent, grandparents, or relatives (Zhou et al. [2020]).The number of left-behind children rose steadily over the last two decades. The 2010 Census of China identified 69.73 million children between ages of 0 to17 as left-behind children, which is almost 25% of the child population in China (Chen et al. [2015]), more than half of whom live in rural area (p.137, UNICEF et al. [2018]). Rural area provides limited earnings and employment opportunities, forcing many parents to find employment in urban regions where they receive better pay, despite long work hours, unfavorable work environment, and crowded living conditions (Keung Wong et al. [2007], Shao et al. [2007]).

These migrant workers are discouraged from taking their children with them in part because of the household registration system called *hukou*. The *hukou* system designates each person to be a resident of a specific location and as either 'rural' or 'urban' type, originally designed to restrict internal migration (Song [2014]). Although the *hukou* system of today is more relaxed, migrant parents find it difficult to benefit from various public resources at the host region, such as social insurance coverage, social welfare benefits, and public education for their children. For example, children with rural *hukou* may find it difficult to attend public schools in urban area because public schools tend to prioritize local children for the limited space, and non-local students may be subject to hefty school fees. Private migrant schools, while available, are typically of lower quality and higher cost (Chen and Feng [2013, 2017]).

Although remittances sent by the migrant parents can be beneficial to child development, on the whole the left-behind children suffer myriad disadvantages compared to non-left-behind children. Left-behind children are associated with poorer child-caregiver interaction, lower academic achievement, worse physical health, and lower psychological well-being (Zhang et al. [2014], Li et al. [2015], Meng and Yamauchi [2017], Wang et al. [2017], Zhou et al. [2020]).

2.2 Data

We use data from the Longitudinal Study of Children's Development in Mianzhu, which is designed and collected by the Survey Data Center at Jinan University in Guangzhou, China to capture the developmental environment and outcomes of children in rural China. Over 6,000 students were interviewed, all in Mianzhu county, Sichuan province. Students were in grades four through six at the time of the survey, in 17 primary schools. Their parents, guardians at home, and teachers were also surveyed, all in person. Migrant parents were separately surveyed by telephone. The questionnaires included a wide range of topics including parenting behavior, IQ tests, and Big-5 personality traits. First wave was collected in October 2017 and the second wave in November 2018. Administrative data on the students' test scores in math and Chinese as well as the classroom assignment for each semester since grade 1 were also collected.

Table 1: Summary Statistics

	Never LB (1)	Ever LB (2)	Raw Gap [p-Value]
LB in Semester 1a	0.000	0.689	0.689 [0.000]
LB in Semester 4a	0.000	0.727	0.727 [0.000]
Urban	0.506	0.193	-0.314 [0.000]
Male	0.466	0.503	0.037 [0.006]
Father's Education $\leq$ Primary School	0.164	0.331	0.168 [0.000]
Mother's Education $\leq$ Primary School	0.201	0.360	0.159 [0.000]
Class Size	43.173	39.003	-4.170 [0.000]
Teacher Finished University	0.290	0.274	-0.016 [0.178]
Teacher's Age	41.311	41.361	0.049 [0.836]
Teacher Female	0.673	0.609	-0.064 [0.000]
Teacher Married	0.868	0.824	-0.044 [0.000]
Math	0.110	0.061	-0.049 [0.048]
Chinese	0.123	0.059	-0.064 [0.009]
IQ	0.061	0.075	0.014 [0.578]
Openness to Experience	0.095	0.006	-0.089 [0.001]
Conscientiousness	0.118	-0.011	-0.129 [0.000]
Extroversion	0.074	0.004	-0.071 [0.008]
Agreeableness	0.088	-0.011	-0.099 [0.000]
Emotional Stability	0.110	-0.025	-0.134 [0.000]
Social Skills	0.108	-0.036	-0.144 [0.000]
N	2216	3597	5813
Number of Individuals	1744	2854	4530
Number of Class×Cohorts	158	160	160
Number of School×Cohorts (Clusters)	58	58	58
Number of Schools	17	17	17

Notes: p-values in brackets are calculated using standard errors clustered at the school×cohort level.

Key information in the data is children's left-behind status. Left-behind status of the children is measured by the following questions: "Did your father/mother leave home for work, for at least three months and returning home no more than once a week?" Children responded for each parent and for each semester from the first semester of grade 1 up until the time of the survey.

Another key information in the data is the personality skill of children. Personality skill measures are based on the Big-5 model of personality, one of the most popular models of personality in economics and psychology (Almlund et al. [2011], Humphries and Kosse [2017]). Big-5 model describes a person's personality using five sub-dimensions: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Emotional stability (also known as Neuroticism). In addition to the Big-5 measures, another measure called *Guanxi* is available, based on a short version of Qingnian Zhongguo Personality Scale (Wang and Cui [2004]). This scale measures a person's tactfulness in social interactions, for instance by being appropriately modest and impartial when interacting with others. In other words, it measures one's ability to form *guanxi*, or 'social network' in Chinese. Here, we use a more intuitive term 'social skill' for the skill measured by the *Guanxi* scale. Questionnaire for the Big-5 and the *Guanxi* scale are presented in Table A1.

Individual personality skills are estimated using factor analysis, where we used each individual items to estimate factor scores. These are then normalized to be mean zero and standard deviation one within school×cohort×wave. Each subscale has 4 item measures and social skill has 9 item measures. Since personality measures were reported by the homeroom teacher,[5] the guardian at home, and (self-reported) by the child, there were $4 \times 3 = 12$ measures used to construct each of the Big-5 personality skill factor, and $9 \times 3 = 27$ measures for the social skill factor.

First panel of Table 1 presents descriptive statistics of left-behind-children (LBC) and never-left-behind-children, where left-behind status is defined by whether the child was left behind at least one semester or more by either of the parent between the first semester of the first grade and the time of the survey. First row shows that 68.9% of the children who were ever left behind in the primary school period were left behind in the first semester of the first grade. The figure is 72.7% in the first semester of the fourth grade, suggesting that parental migration starts early and remains common throughout primary school years. Parental migration is primarily a rural phenomenon: 50.6% of the never-LBC live in urban area, while only 19.3% of the LBC do. In addition, LBC are from low-SES households: 33.1% of the fathers of LBC did not complete primary school, as opposed to 16.4% for the fathers of never-LBC. The difference is similar for mother's education level (36.0% vs. 20.1%). These differences suggest that LBC have disadvantaged home environment.

Unlike home environment, school environment is not noticeably different between LBC and never-LBC groups. Average class size is bigger by about 4 students for never-LBC, favoring the LBC group. Proportion of teachers who finished university education is higher by 1.6% point for never-LBC but the difference is not statistically significant. There are more girls among the never-LBC but the difference is only 3.7% point. Average teacher's

[5]While the 2018 wave teacher responses were entirely reported by the homeroom teacher, 27 out of 138 teacher responses in the 2017 wave was reported by teachers other than the homeroom teacher. For consistency, we only use observations where the reports were made by the homeroom teacher.

age is 41 for the both groups. Teachers for never-LBC are more likely to be women and be married, but the differences are small in magnitude (6.4% vs. 4.4%).

Second panel of Table 1 shows that LBC are significantly disadvantaged in personality skills, and to a lesser extent in academic achievement measures. Average values of Big-5 and social skill measures are lower for the LBC by 0.071 and 0.144 in standard deviation unit. LBC also perform worse on average in math and Chinese grades by 0.049 to 0.064 in standard deviation unit. The difference in IQ score is small and insignificant, however.

3 Identification

3.1 Identification Assumption

Since we defined peer effect at classroom level, we must address the possibility of selection bias which can undermine identification of peer effect (Manski [1993]). In our setting, the most likely scenario leading to selection bias is if the children or their parents self-select into classrooms based on characteristics that are correlated with both the personality formation of the children and the proportion of LBC in their classrooms. For instance, if children with high personality skills are systematically assigned to classrooms with fewer LBC, the magnitude of the effect of LBC peers on personality skills would be over-estimated. The selection problem would not arise if students were assigned to classrooms regardless of the characteristics related to personality skill development, such as socioeconomic status of the household and left-behind status. Random assignment of students to classrooms is one such mechanism.

One of the assumptions we make to establish identification is that selection bias is absent in our setting. This assumption is based on the institutional feature of the primary schools in our school that students were assigned to classrooms at random, conditional on some observable characteristics.[6] In our sample, students were randomly assigned to classes twice, once in the first semester of the first grade and once in the first semester in the fourth grade. Assignment in the first grade explicitly balanced gender within classrooms but was otherwise random. Assignment in the fourth grade was conditional on gender and academic achievement in the third year, in order to balance students' academic achievement across classrooms at the beginning of the fourth grade.

To further bolster our confidence on identification assumption based on random classroom assignment, we conducted interviews with the principals of schools in our sample. The principals responded that schools have strong incentive to ensure randomization so as to avoid complaints from anxious parents and students. Schools are also subject to the government mandate which requires schools to place students into classes randomly, and forbids tracking of students based on academic performance (Strauss [2013]).

Another threat to identification is that parent's migration decision may be endogenous to the personality skill development of their peers. First, there may be a reverse-causality problem where a parent decide to migrate upon learning that many others have migrated as well. The parent may have received assistance or information related to labor migration from other migrating parents, or may have felt more open to migration decision over time upon learning that it is commonly practiced. Second, parent's migration decision may be endogenous to village-specific shocks, such as economic hardship, or time-invariant village-level characteristics, that lead to both migration decision of the parents and poor personality skill development of children.

We respond to these identification threats in several ways. First, in the baseline analysis, we restrict the analysis sample to those who have never been left behind during the primary

[6]Random assignment is a common feature of primary and secondary education in China, which has often been used to study education peer effects in the literature. Examples include Hu [2018], Wang and Zhu [2019], Huang and Zhu [2020], Huang [2020], Chung and Zou [2020], Wang [2020], Wang and Zhu [2021], and Zhao and Zhao [2021]

school period. In this way, we reduce the concern that the target children's parents may be affected by endogeneity or reverse causality through their own migration decisions. In Section 4.6, we check the robustness of our results to alternative sample definitions. Second, we define left-behind status as those who were left-behind in the first semester of the first grade, immediate after random assignment. Since outcome measures were collected between grades 4 through 6, we minimize the reverse-causality channel from the target children's own behavior (grade 4 to 6) to the migration decision of their peers (grade 1). Third, we include school×cohort×wave fixed effects in our empirical specification, thus reducing the potential bias from time-invariant village-level heterogeneity. Our estimates are therefore comparisons across classrooms within school, cohort, and wave. Finally, we point out the literature on migrant workers in China which shows that migrant workers are primarily motivated by economic needs, enduring unfavorable working conditions and the mental toll of being separated from the family (Keung Wong et al. [2007], Li [2010], Zhang et al. [2016]). We believe that the parents are unlikely to be motivated to endure the hardship of being migrant workers for reasons other than the need for higher earnings.

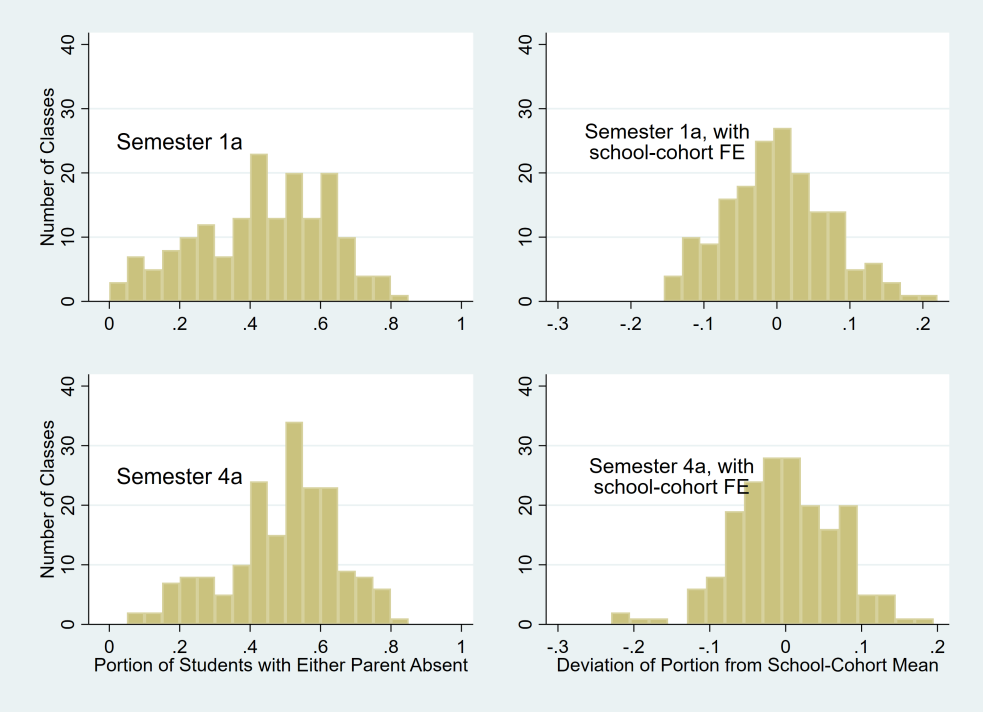
While restricting the analysis sample to those who were never left behind since the first grade helps to establish identification by reducing concerns about reverse-causality, it also helps us avoid the negative mechanical correlation between the own and peer characteristics which occurs when leave-one-out averages are used as the main peer effect variable. Clearly distinguishing the children who affect others and those who are affected can break this mechanical correlation (Angrist [2014], Carrell et al. [2018]). While we follow this advice, we recognize that children with high value of peer effect variable are now under-represented in the sample. To alleviate concerns about external validity, we implement two complementary analyses: first, we investigate non-linearity of peer effects, in Section 4.2; and second, we examine robustness of our results using an expanded sample that includes LBC as well, in Section 4.2.

Figure 1 shows a wide dispersion in the class-level proportion of LBC[7], ranging from hardly having any LBC to almost the entire class being LBC. Much of these variations are driven by the differences across schools and cohorts. By including school×cohort×wave fixed effect, only the within-school×cohort×wave variation in the first grade and the fourth grade are useful for identification. This is shown in the two graphs on the right-side column. The class-level proportion of LBC is widely dispersed with concentration around the school×cohort mean, consistent with random classroom assignment assumption.

In addition to restricting the analysis sample to those who were never left-behind, we further restrict the sample to those with nonmissing values of outcome variables, control variables, and administrative information. We also restrict the sample to those who did not switch classes since the beginning of the fourth grade. These additional restrictions represent about 0.81% reduction of the never-left-behind sample. We examine the robustness of our results to these restrictions in Section 4.6.

[7]Different waves of the same class are counted once in this analysis.

Figure 1: Distribution of Left-Behind Students



Note: Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade.

3.2 Balance Tests

As a test of our identification assumption, we conduct a series of balance tests below. Rejection of random assignment by these tests would cast doubt on our identification assumption.

Balance Test 1 First, we conduct a test of whether the proportion of left-behind classmates for each student is correlated with the student's and teacher's pre-determined characteristics using the following model:

$$\overline{LB_{-i}^{class}} = \alpha + \beta X_{it} + \rho_{sct} + \epsilon_{it}$$

where LB_{-i}^{class} denotes the leave-one-out proportion of left-behind students at the classroom level. X_{it} is a row vector that includes student i's gender, number of siblings, mother's and father's education levels, teacher's gender, age and its square, education level, marital status and class size. We also add ρ_{sct}, the school×cohort×wave fixed effects. Standard errors are clustered at the school×cohort level.

Under perfect randomization assumption, the proportion of left-behind classmates is randomly assigned and is uncorrelated with any variables that are determined at the assignment, implying $\beta = 0$ for all X-variables.

Results of Balance Test 1 is presented in Table 2. First two columns present the tests with the proportion of the first semester of the first grade peers who were left-behind, and the last two columns with the proportion of the first semester of the fourth year peers who were left-behind. 'Entire Sample' represents the sample inclusive of both LBC and never-LBC, and the 'Analysis Sample' represents those who were never left-behind in the primary school period. Consistent with our assumption, we find that the null hypothesis of $\beta = 0$ is not rejected for all specifications and for all baseline characteristics, except for one case. In the first row, column 4, mother having less than middle school education is positively correlated with having more LBC peers in the fourth grade, and the coefficient is significant at 10%. Although this estimate is inconsistent with our assumption, mother having less than primary school education is not significantly correlated with LBC peers in the fourth grade (the second row), and this coefficient is actually negative. We therefore believe that the overall test results do not reject our identification assumption.

Balance Test 2 Second, we test the correlation between a student's pre-determined characteristics and those of her classmates, including gender, mother's education, father's education, and left-behind status in the first semester of the first year. For each of these variables, we estimate:

$$Y_{it} = \alpha + \beta \overline{Y_{-i,t}^{class}} + \gamma \overline{Y_{-i,t}^{school \times cohort}} + \rho_{sct} + \epsilon_{it}$$

We control for $\overline{Y_{-i,t}^{school \times cohort}}$, the school×cohort×wave level leave-one-out average, to correct for the mechanical negative correlation caused by the fact that the student herself is not in the same urn from which her classmates are drawn (Guryan et al. [2009]).

Under the null hypothesis that classmates are randomly assigned conditional on gender, $\beta = 0$ for all variables except for gender. For gender, the coefficient is expected to be negative, because gender ratio is equalized across classrooms. When there are more boys in the leave-one-out group, for example, the student in question is more likely to be a girl.

Table 2: Balance Test 1

$$\overline{LB_{-i}^{class}} = \alpha + \beta X_{it} + \rho_{sct} + \epsilon_{it}$$

	% LB among n-1 Classmates in			
	Semester 1a		Semester 4a	
	Entire Sample (1)	Analysis Sample (2)	Entire Sample (3)	Analysis Sample (4)
Mother's Education ≤ Middle School	0.209	-0.004	0.202	0.597†
	(0.300)	(0.352)	(0.282)	(0.324)
Mother's Education ≤ Primary School	0.137	0.657	-0.106	-0.221
	(0.287)	(0.549)	(0.238)	(0.517)
Father's Education ≤ Middle School	-0.016	0.528	-0.012	0.286
	(0.227)	(0.327)	(0.189)	(0.402)
Father's Education ≤ Primary School	0.160	0.112	0.180	0.211
	(0.202)	(0.469)	(0.240)	(0.396)
Male	-0.124	0.224	0.064	-0.248
	(0.115)	(0.317)	(0.111)	(0.243)
Family Size	-0.125	-0.258	-0.015	-0.224
	(0.143)	(0.285)	(0.132)	(0.237)
Teacher's Age	-0.033	-0.092	0.070	0.024
	(0.077)	(0.093)	(0.138)	(0.169)
Teacher's (Age-40) Squared	-0.003	-0.000	-0.006	-0.013
	(0.010)	(0.011)	(0.010)	(0.016)
Teacher Finished 4-year College	-0.839	-1.839	0.970	0.658
	(1.279)	(1.358)	(2.006)	(2.204)
Teacher Did Not Go to Collage	-2.402	-2.005	-3.838	1.645
	(2.583)	(1.271)	(2.623)	(2.328)
Teacher Female	0.820	0.721	1.064	-1.370
	(1.344)	(1.160)	(1.439)	(1.879)
Teacher Married	0.521	1.031	1.755	2.416
	(1.058)	(1.506)	(2.406)	(2.789)
Class Size	-0.227	-0.325	-0.070	-0.280
	(0.229)	(0.206)	(0.339)	(0.399)
Joint F-stat for Parents' Education	0.6	2.0	0.3	1.1
	[0.674]	[0.102]	[0.860]	[0.349]
Joint F-stat for Teacher's Variables	0.3	0.7	0.5	0.3
	[0.895]	[0.641]	[0.808]	[0.894]
School×Cohort×Wave FE	✓	✓	✓	✓
N	8836	2216	10772	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3 presents the results of Balance Test 2. First column shows that the coefficient on gender is negative, as implied by explicit gender-balancing in classroom assignment. For mother's education level, father's education level and left-behind status, the coefficients are close to zero and insignificant, consistent with the random assignment assumption.

Table 3: Balance Test 2

$$Y_{it} = \alpha + \beta\overline{Y_{-i,t}^{class4a}} + \gamma\overline{Y_{-i,t}^{school\times cohort}} + \rho_{sct} + \epsilon_{it}$$

Panel A: Grade One	**Male** (1)	**MomEdu≤ 6** (2)	**DadEdu≤ 6** (3)	**LB in 1a** (4)
Average of n-1 Classmates in 1a	-0.360***	-0.009	-0.017	-0.029
	(0.096)	(0.036)	(0.037)	(0.035)
Averages of n-1 Schoolmates in 1a	✓	✓	✓	✓
Baseline Controls	×	×	×	×
School×Cohort×Wave FE	✓	✓	✓	✓
N	8854	8854	8854	8854
Panel B: Grade Four	**Male** (1)	**MomEdu≤ 6** (2)	**DadEdu≤ 6** (3)	**LB in 4a** (4)
Average of n-1 Classmates in 4a	-0.512*	0.052	-0.040	0.010
	(0.232)	(0.059)	(0.057)	(0.063)
Averages of n-1 Schoolmates in 4a	✓	✓	✓	✓
Baseline Controls	×	×	×	×
School×Cohort×Wave FE	✓	✓	✓	✓
N	10794	10794	10794	10794

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples include both left-behind and non-left-behind students.

Balance Test 3 Third, we perform a simulation test of whether the within-grade variation in the proportion of left-behind students at the class level is consistent with random assignment. Following the method in Carrell et al. [2018], for each of the 58 school×cohorts in the sample, we first randomly reassign left-behind students into classes 10,000 times, with the total number of LBC in the school×cohort and the size of each class held fixed at their actual values. Second, for each of the 58×10,000 simulated school×cohort, we compute the between-class variations in the proportion of LBC (as weighted sum of squared deviation from the school×cohort mean for each 58×10,000 school×cohort) and compare them with their actual (58) values. Third, for each of the 58 school×cohorts, we count the number of cases out of 10,000 simulated school×cohorts in which the actual variation is greater than the simulated variation. If the class assignments are random, we expect the distribution of the number of such cases to be uniform on $[0, 10, 000]$. Therefore, we use a Kolmogorov-Smirnov one-sample equality of distribution test to test whether the distribution is indeed uniform.

Figure 2: Simulation Test for the Randomness of Variation in the Proportion of Left-Behind Children Across Class within Each School×Cohort for the Semester 1a

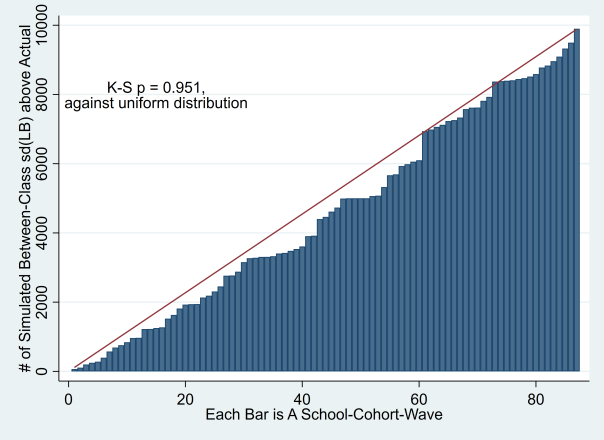
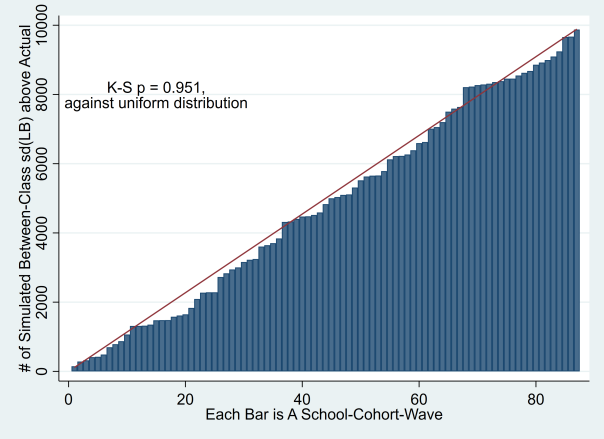


Figure 3: Simulation Test for the Randomness of Variation in the Proportion of Left-Behind Children Across Class within Each School×Cohort for the Semester 4a



The results of Kolmogorov-Smirnov tests are presented in Figures 2 and 3. In both cases, the tests do not reject the null hypothesis that the distribution is uniform, consistent with the random assignment assumption.

4 Empirical Analysis

4.1 Baseline Peer Effects

Based on our identification assumptions, we construct the empirical model that answers the first research question, the effects of childhood peers on personality skills. Our baseline model is:

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \quad (1)$$

where Y_{it} is the outcome for child i in grade t. $\overline{LB^{class1a}_{-i,1a}}$ is the proportion of classmates in the first semester of the first grade who were left behind. $\overline{LB^{class4a}_{-i,1a}}$ is the proportion of classmates in the first semester of the fourth grade who were left behind. As discussed in Section 3.1, left-behind status is defined by being left-behind in the first semester of the first year period. Peer groups are measured in the first semesters of the first grade and the fourth grade to avoid concerns about endogenous switching after random classroom assignment. $\overline{LB^{class1a}_{-i,1a}}$ and $\overline{LB^{class4a}_{-i,1a}}$ are the two key treatment variables, representing the impacts of past and current peers, respectively. Their variations are caused by fluctuations in the proportions of left-behind students at the classroom level within each school×cohort during the random assignment processes. γ_1 and γ_2 are the coefficients of interest.

Other control variables include father's and mother's education level (dummies for five categories: don't know, no education, 1-6 years, 7-9 years, and 10+ years of education), student's gender, information about current homeroom teacher including gender, age and its square, education level, and marital status, class sizes in the first semester of the first grade and the first semester of the fourth grade, and test scores in math and Chinese in the second semester of the third grade normalized within each school×cohort×wave. We control for ρ_{sct}, the school×cohort×wave fixed effect to account for potential time-invariant heterogeneity affecting both the personality skill development and the parents' migration statuses. The error term ϵ_{it} consists of unobserved individual-level and class-level factors that contribute to the outcome, and is clustered at the school×cohort level. The error term is uncorrelated with the treatment variables $\overline{LB^{class1a}_{-i,1a}}$ and $\overline{LB^{class4a}_{-i,1a}}$ under our random classroom assignment assumption.

Results Table 4 presents the estimates from Equation 1 for personality skill measures, normalized to be mean zero and standard deviation one within each school×cohort×wave. The estimates show that 10% increase in the proportion of left-behind children in the fourth grade classroom decreases their never-left-behind peers' conscientiousness by 0.181, agreeableness by 0.221, emotional stability by 0.254, and social skill by 0.218 in standard deviation unit. These personality skill measures, in particular conscientiousness and emotional stability, are highly predictive of positive long-run life-cycle outcomes (Almlund et al. [2011]). Once accounting for the peers in the fourth grade, peers in the 1st grade classrooms are not predictive of subsequent personality skill development.

Negative effects of left-behind peers on agreeableness and social skill echo the findings of Zárate [2019] which reported that high school students with high social skill promote the social skill of their peers. He showed that social skill is highly correlated with agreeableness,

extraversion, and openness to experience subscales of Big-5. Similarly, we show that left-behind peers negatively affect agreeableness and social skill, but in primary school rather than in high school.

We also estimate peer effects on school performance. According to Table 5, math grade, Chinese grade, and IQ scores are not affected by left-behind peers in the first grade or the fourth grade. This result is consistent with Wang and Zhu [2021], who examined the effect of LB classmates on middle school students. They found negative peer effects on mental health but did not find effects on academic achievement. There are also other studies reporting null effects of peers on academic achievement (e.g., Angrist and Lang [2004], Abdulkadiroğlu et al. [2014]).

Table 4: Impacts of Past and Current Left-Behind Peers on Personality Skill Outcomes

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc** (1)	**Agree** (2)	**Extro** (3)	**Openn** (4)	**E.Stability** (5)	**Social** (6)
Proportion of 1a Peers LB in 1a	0.399	-0.100	0.005	0.391	0.444	0.063
	(0.347)	(0.497)	(0.395)	(0.343)	(0.438)	(0.427)
Proportion of 4a Peers LB in 1a	-1.811**	-2.209**	-0.331	-0.321	-2.538***	-2.184***
	(0.579)	(0.821)	(0.481)	(0.620)	(0.651)	(0.612)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
F-Test for Two LB proportions	5.3**	5.7**	0.3	0.6	7.8**	8.0***
p-Value for F-Test	[0.008]	[0.005]	[0.761]	[0.526]	[0.001]	[0.001]
N	2216	2216	2216	2216	2216	2216
Individuals	1744	1744	1744	1744	1744	1744
Class×Cohorts	158	158	158	158	158	158
School×Cohorts (Clusters)	58	58	58	58	58	58
Schools	17	17	17	17	17	17

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

4.2 Nonlinear Effects

Our baseline model estimates average peer effect for the overall sample. We now turn to the question of whether the peer effects change as the proportion of LBC increases in a given classroom. As discussed in Section 3.1, this also alleviates the external validity concern due to restricting the analysis sample to those who were never left behind since the first grade.

Table 5: Impacts of Past and Current Left-Behind Peers on Academic Achievement Outcomes

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Math**	**Chinese**	**IQ**
	(1)	(2)	(3)
Proportion of 1a Peers LB in 1a	-0.387	-0.530	0.611
	(0.282)	(0.348)	(0.412)
Proportion of 4a Peers LB in 1a	0.228	0.045	0.143
	(0.314)	(0.275)	(0.491)
Other Controls	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓
F-Test for Two LB proportions	1.0	1.2	1.6
p-value for F-Test	[0.392]	[0.310]	[0.212]
N	2216	2216	2216
Individuals	1744	1744	1744
Class×Cohorts	158	158	158
School×Cohorts (Clusters)	58	58	58
Schools	17	17	17

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade.

We estimate two nonlinear models. In the first model, we interact the proportion of LBC with a dummy variable indicating whether more than half of the entire school×cohort are left-behind students:

$$\begin{aligned} Y_{it} = \alpha &+ \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \delta_1 \times \mathbb{I}\left(\overline{LB^{school\times cohort}_{all,1a}} \geq 50\%\right) \times \overline{LB^{class1a}_{-i,1a}} \\ &+ \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \delta_2 \times \mathbb{I}\left(\overline{LB^{school\times cohort}_{all,1a}} \geq 50\%\right) \times \overline{LB^{class4a}_{-i,aa}} \\ &+ \theta X_{it} + \rho_{sct} + \epsilon_{it} \end{aligned} \tag{2}$$

For example, assuming negative peer effects of having disadvantaged peers on the outcome of interest, negative values of δ_1 or δ_2 imply that the negative peer effects are greater when LBC students are a majority in a given classroom.

In the second nonlinear model, we include square terms of the classroom LBC proportions as below:

$$\begin{aligned} Y_{it} = \alpha &+ \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} \\ &+ \gamma_{11}\left(\overline{LB^{class1a}_{-i,1a}} - 0.5\right)^2 + \gamma_{12}\left(\overline{LB^{class1a}_{-i,1a}} - 0.5\right)\left(\overline{LB^{class4a}_{-i,1a}} - 0.5\right) \\ &+ \gamma_{22}\left(\overline{LB^{class4a}_{-i,1a}} - 0.5\right)^2 + \theta X_{it} + \rho_{sct} + \epsilon_{it} \end{aligned} \tag{3}$$

where γ_{11} and γ_{22} measures the rate of change in the marginal effects of past and current peers, respectively. γ_{12} measures the complementarity between the effects of past and current peers. For example, assuming negative peer effects of having disadvantaged peers on the outcome of interest, complementarity between the past and the current peer effects implies negative γ_{12}, while diminishing negative peer effects imply positive γ_{11} and γ_{22}.

Results Examining the estimates of Equation 2 in Table 6, we find that the negative peer effects of LBC is concentrated in classrooms where the proportion of LBC is less than 50%. In the second panel, peer effects are observed for all personality skills except for openness to experience and extroversion, as in Table 4. The interaction terms for these are mostly positive and sizable. For agreeableness and emotional stability, estimates imply that the effects are almost nonexistent in classrooms where more than 50% are LBC.[8] The effects from the first grade peers is mostly insignificant.

Examining the estimates of Equation 3 in Table 7, we find evidence that the effects of left-behind peers decrease in the proportion of LBC in the classroom, although the estimates are less significant. Looking at the third row of the second panel, all of the interaction term estimates are positive, suggesting that the negative peer effects decrease in magnitude as the proportion of left-behind peers increases. The estimates are insignificant except for emotional stability, however. The row above shows interaction with the first grade peers and the fourth-year peers. The estimate suggests complementary relationship between the two peer effects for emotional stability, but it is significant only at 10%, and other estimates

[8]Note that the indicator variable is for the classroom proportion being greater than 50%, not for being greater than sample median.

are statistically insignificant and inconsistent in sign. First row of the second panel shows the squared term for the first grade peers. The estimates are positive and significant for extroversion and emotional stability. Considering that the main effects of first grade peers are close to zero, these estimates are surprising. However, estimates for other personality skills are small, insignificant, and inconsistent in sign, making it difficult to interpret the estimates for extroversion and emotional stability.

4.3 Heterogeneous Effects

Several studies show that the effects of male and female peers may be different (Hoxby [2000], Lavy and Schlosser [2011], and Gong et al. [2019]). To investigate this possibility for left-behind boys and left-behind girls, we separate the proportion of left-behind boys and left-behind girls among all boy and girl classmates as below:

$$\begin{aligned} Y_{it} = \alpha &+ \gamma_{11}\overline{LB^{class1a}_{-i,boy,1a}} + \gamma_{12}\overline{LB^{class1a}_{-i,girl,1a}} \\ &+ \gamma_{21}\overline{LB^{class4a}_{-i,boy,1a}} + \gamma_{22}\overline{LB^{class4a}_{-i,girl,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \end{aligned} \tag{4}$$

Results Table 8 presents the estimates from Equation 4. Focusing on the fourth-year peers, male LBC and female LBC both exert negative peer effects as shown in the second panel. The effects are somewhat greater in magnitude for female LBC, however. Interestingly, while the overall effect was small and insignificant for extroversion, the effect is negative and significant at 10% level for male LBC peers, but not for female LBC peers. Although it seems as if this result contradict the findings in the literature showing that female peers have positive effects in school (Hoxby [2000], Lavy and Schlosser [2011], and Gong et al. [2019]), our results actually show the effects of 'disadvantaged' female peers, not female peers in general. It remains to be seen whether similar effects of disadvantaged female peers is replicated elsewhere. Furthermore, it should be noted that the children in our sample may be affected by One Child Policy and son preference, potentially reducing the external validity of our gender-specific effects.[9]

4.4 Friends and Deskmates

It is likely that peers with stronger ties, such as friends or deskmates, may have greater impact on one's personality skill development than an average classmate. A relevant question, then, is whether the LBC peer effects are channeled through friendship network. To investigate this possibility, we first study whether friendship formation is affected by the presence of LBC in the same classroom. 2018 wave asks students to nominate three closest friends in the same classroom. Using this information, we estimate:

$$\overline{LB^{3friends}_{it}} = \alpha + \pi_1\overline{LB^{class1a}_{-i,1a}} + \pi_2\overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \tag{5}$$

where $\overline{LB^{3friends}_{it}}$ is the proportion of LBC among the self-reported three closest friends. If friendship network is segregated along left-behind status, we expect $\pi_1 = 0$ or $\pi_2 = 0$. If, on

[9] According to the administrative data, average male-female sex ratio among primary school students in Mianzhu area in 2017 and 2018 is 1.045.

Table 6: Nonlinear Model 1

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \delta_1 \times \mathbb{1}(\overline{LB^{school\times cohort}_{all,1a}} \geq 50\%) \times \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \delta_2 \times \mathbb{1}(\overline{LB^{school\times cohort}_{all,1a}} \geq 50\%) \times \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc**	**Agree**	**Extro**	**Openn**	**E.Stability**	**Social**
	(1)	(2)	(3)	(4)	(5)	(6)
Peers LB in 1a	0.401	-0.016	-0.460	0.281	0.093	-0.155
	(0.359)	(0.600)	(0.342)	(0.381)	(0.480)	(0.503)
× LB ≥ 50%	-0.481	-1.146	2.135†	0.265	0.760	0.432
	(0.999)	(1.038)	(1.103)	(0.988)	(1.149)	(0.903)
Peers LB in 4a	-2.515**	-3.339**	-0.344	-0.685	-3.816***	-3.040***
	(0.852)	(1.161)	(0.611)	(0.856)	(0.943)	(0.861)
× LB ≥ 50%	1.973	3.296*	-0.694	0.845	3.027*	2.054
	(1.253)	(1.589)	(1.028)	(1.259)	(1.385)	(1.392)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
Joint F-Test for Both	1.3	2.2	1.9	0.5	3.8*	1.8
LB × (LB ≥ 50%)	[0.273]	[0.126]	[0.160]	[0.596]	[0.028]	[0.171]
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

Table 7: Nonlinear Model 2

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + +\gamma_{11}(\overline{LB^{class1a}_{-i,1a}} - 0.5)^2 + \gamma_{12}(\overline{LB^{class1a}_{-i,1a}} - 0.5)(\overline{LB^{class4a}_{-i,1a}} - 0.5) + \gamma_{22}(\overline{LB^{class4a}_{-i,1a}} - 0.5)^2 + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc**	**Agree**	**Extro**	**Openn**	**E.Stability**	**Social**
	(1)	(2)	(3)	(4)	(5)	(6)
Past LB Peers (Portion)	0.327	-0.200	0.652	0.829	0.911	0.402
	(0.493)	(0.526)	(0.600)	(0.514)	(0.561)	(0.513)
Recent LB Peers (Portion)	-1.465**	-1.594*	-0.774	-0.558	-2.218***	-1.957**
	(0.531)	(0.621)	(0.510)	(0.615)	(0.534)	(0.593)
(Past - 0.5)(Past - 0.5)	-0.268	-1.034	6.118*	3.985	4.700**	0.226
	(2.402)	(3.024)	(2.540)	(2.522)	(1.615)	(2.464)
(Past - 0.5)(Recent - 0.5)	0.682	2.539	-7.946	-4.938	-4.972†	2.693
	(3.623)	(5.334)	(4.838)	(5.205)	(2.601)	(4.981)
(Recent - 0.5)(Recent - 0.5)	3.034	4.737	2.589	2.168	8.329**	2.340
	(2.783)	(4.872)	(2.628)	(3.005)	(3.087)	(3.655)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
Joint-F for 3 quadratics	0.7	1.3	2.2†	1.7	9.1***	2.7†
p-value	[0.548]	[0.297]	[0.096]	[0.184]	[0.000]	[0.052]
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

Table 8: Impact of Left-Behind Male Peers and Left-Behind Female Peers

$$Y_{it} = \alpha + \gamma_{11}\overline{LB^{class1a}_{-i,boy,1a}} + \gamma_{12}\overline{LB^{class1a}_{-i,girl,1a}} + \gamma_{21}\overline{LB^{class4a}_{-i,boy,1a}} + \gamma_{22}\overline{LB^{class4a}_{-i,girl,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc**	**Agree**	**Extro**	**Openn**	**E.Stability**	**Social**
	(1)	(2)	(3)	(4)	(5)	(6)
LB Boy Classmates in 1a	0.096	-0.552	0.328	0.511	-0.311	-0.133
	(0.684)	(0.660)	(0.575)	(0.517)	(0.771)	(0.641)
LB Girl Classmates in 1a	0.703*	0.392	-0.601	0.103	1.356**	0.417
	(0.380)	(0.785)	(0.602)	(0.508)	(0.628)	(0.535)
LB Boy Classmates in 4a	-1.621*	-2.112	-1.156*	-0.378	-1.139	-1.728*
	(0.939)	(1.276)	(0.688)	(0.940)	(1.238)	(0.970)
LB Girl Classmates in 4a	-2.326***	-2.651*	0.358	-0.368	-4.029***	-2.785***
	(0.676)	(1.411)	(0.737)	(0.872)	(0.891)	(0.824)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
Joint F-Test for Difference	0.3	0.5	1.2	0.2	2.0	0.4
between Boys and Girls	[0.745]	[0.633]	[0.304]	[0.850]	[0.145]	[0.701]
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

the other hand, friendship formation is completely independent of left-behind status or its determinants, then we expect $\pi_1 = 1$ or $\pi_2 = 1$. We further compare these results with the placebo regression using deskmates, as below:

$$LB_{it}^{deskmate} = \alpha + \delta_1 \overline{LB_{-i,1a}^{class1a}} + \delta_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \tag{6}$$

Interviews with the principles suggest that schools have an incentive to downplay classroom disruptions by separating close friends in classroom seating allocation, and often the seating rule is close to random. We therefore expect δ_1 and δ_2 to be close to 1 for deskmates. Literature shows that deskmates can exert peer effects in education setting (Li et al. [2014], Lu and Anderson [2015]).

We then assess the relative importance of impact on personalities from friends and deskmates compared with that from classmates by adding proportion of LBC among the three friends and the left-behind status of the deskemate to our baseline model:

$$Y_{it} = \alpha + \gamma_1 \overline{LB_{-i,1a}^{class1a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \gamma_3 \overline{LB_{-i,1a}^{3friends}} + \gamma_4 \overline{LB_{-i,1a}^{deskmate}} + \rho_{sct} + \epsilon_{it} \tag{7}$$

The coefficient values of $\pi_1 \neq 0$ or $\pi_2 \neq 0$, along with $\gamma_1 \neq 0$ or $\gamma_3 \neq 0$ are consistent with the interpretation that some of the LBC peer effects are channeled through friendship networks. If $\gamma_1 = \gamma_3 = 0$, then we must conclude that the peer effects are most likely not through three of the closest friends, but through alternative channels such as classroom atmosphere.

Results Tables 9, 10, 11 present the results of the Equations 5, 6, and 7, respectively. First, Table 9 shows that the average characteristics of the three closest friends are affected by the proportion of LBC peers in the classroom, so that $\pi_2 \neq 0$ while $\pi_1 = 0$. First column shows that an increase in the proportion of LBC peers in the fourth grade increases the proportion among the three friends who are also left-behind. The coefficient is less than 1, however, implying that there is imperfect sorting along LBC status. Second through seventh column shows that increase in the proportion of LBC peers in the fourth grade predicts lower values of friends' average conscientiousness, agreeableness, emotional stability and social skills. LBC peers from the first grade do not predict friends' average characteristics. This pattern is consistent with the pattern for the peer effects found in Table 4.

Table 10 presents the same analyses for deskmates, which is likely to be less reflective of students' preferences than those for friends. The estimates are consistent with the idea that the assignment of deskmate is less endogenous than the formation of friends. The magnitudes of coefficient estimates on personality skills are smaller than those in Table 9. In addition, the coefficient of the proportion of LBC among fourth-year classroom peers on the deskmate's left-behind status is close to 1, suggesting that the chance of having an LBC as a deskmate is exactly the proportion of LBC in the classroom. Together with the estimates in Table 9, these estimates are consistent with the idea that friends are formed endogenously and at least partly reflects the effects from having left-behind peers in the classroom.

Table 11 shows that putting the proportion of LBC in the fourth-year class and the proportion of LBC among the three best friends together, the effects from the classmates dominate. While the signs are mostly consistent, the magnitude of the coefficients for the friends variable is about 10% of those for the classmates variable. Altogether, the estimates

in Tables 9, 10, 11 imply that while the characteristics of the friends are affected by the presence of LBC in the classroom, the peer effects are driven more by direct effects from the peers, perhaps through classroom disruption, rather than through friendship formation.[10] The readers are however cautioned that we do not interpret the coefficient estimates as marginal effects, but only as a comparison of the associations of the two variables in the same regression.

Table 9: Impact of Left Behind Peers on Characteristics of Friends

$$\overline{Y_{it}^{3friends}} = \alpha + \pi_1 \overline{LB_{-i,1a}^{class1a}} + \pi_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent = 4a-Friends'	**LB in 1a** (1)	**Consc** (3)	**Agree** (4)	**Extro** (5)	**Openn** (6)	**E.Stability** (7)	**Social** (8)
Portion of 1a-Classmates LB in 1a	0.095	0.400	0.289	0.157	0.300	0.629	0.531
	(0.131)	(0.458)	(0.497)	(0.336)	(0.454)	(0.438)	(0.438)
Portion of 4a-Classmates LB in 1a	0.608*	-2.767**	-3.312**	0.119	-0.174	-2.727**	-2.797**
	(0.236)	(0.793)	(1.063)	(0.573)	(1.042)	(0.960)	(0.988)
Other Controls	✓	✓	✓	✓	✓	✓	✓
School×Cohor×Wave FE	✓	✓	✓	✓	✓	✓	✓
N	1007	1007	1007	1007	1007	1007	1007

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

4.5 Channels to Peer Effects on Personality Skills

So far, we developed empirical models that answer the first question, whether there are childhood peer effects on personality skills. We now turn to the second question, how childhood peers affect personality skills. More specifically, we ask whether it is academic achievement or personality skills (or both) of LBC that drive the childhood peer effects.

First, we more rigorously establish the disadvantaged suffered by the LBC by estimating the following regression:

$$Y_{it} = \alpha + \gamma_1 LB_{i,1a} + \gamma_2 Math_{i,3b} + \gamma_3 Chin_{i,3b} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \tag{8}$$

The sample includes both ever-left-behind and never-left-behind students. Y_{it} is the academic achievement or personality skills of student i. $LB_{i,1a}$ indicates whether the student was left behind by either of the parents in the first semester of the first grade, consistent with the

[10] This result is consistent with Foster [2006] which used a sample of college students and found that friends did not impact academic performance more than randomly assigned housing peers.

Table 10: Impact of Left Behind Peers on Characteristics of Deskmate

$$Y_{it}^{deskmate} = \alpha + \gamma_1 \overline{LB_{-i,1a}^{class1a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent = 4a-Deskmates'	**LB in 1a** (1)	**Consc** (3)	**Agree** (4)	**Extro** (5)	**Openn** (6)	**E.Stability** (7)	**Social** (8)
Portion of 1a-Classmates LB in 1a	0.031	-0.343	-0.250	-0.311	-0.481	0.729	-0.071
	(0.248)	(0.663)	(0.626)	(0.649)	(0.575)	(0.632)	(0.572)
Portion of 4a-Classmates LB in 1a	1.064***	-2.061**	-2.796**	0.126	-0.722	-2.566**	-2.264*
	(0.247)	(0.668)	(0.860)	(0.571)	(0.953)	(0.739)	(0.878)
Other Controls	✓	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓	✓
N	1007	1007	1007	1007	1007	1007	1007

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

Table 11: Association between Friends and Deskmate's LB status and Self's Personality Skill Outcomes

$$Y_{it} = \alpha + \gamma_1 \overline{LB_{-i,1a}^{class1a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \gamma_3 \overline{LB_{-i,1a}^{3friends}} + \gamma_4 \overline{LB_{-i,1a}^{deskmate}} + \rho_{sct} + \epsilon_{it}$$

Dependent = Self's	**Consc** (3)	**Agree** (4)	**Extro** (5)	**Openn** (6)	**E.Stability** (7)	**Social** (8)
Portion of 1a-Classmates LB in 1a	0.487	0.294	0.144	0.682	0.852	0.332
	(0.480)	(0.669)	(0.603)	(0.539)	(0.632)	(0.530)
Portion of 4a-Classmates LB in 1a	-1.731*	-2.064*	0.780	0.554	-2.167**	-1.802*
	(0.742)	(0.991)	(0.592)	(0.925)	(0.790)	(0.885)
Portion of Three 4a-Friends LB in 1a	-0.156	-0.194†	-0.106	-0.329**	-0.302***	-0.163†
	(0.095)	(0.101)	(0.117)	(0.099)	(0.078)	(0.081)
4a-Deskmate LB in 1a	0.038	0.027	0.033	-0.081	0.017	-0.034
	(0.064)	(0.053)	(0.064)	(0.056)	(0.052)	(0.067)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
N	1010	1010	1010	1010	1010	1010

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates first semester of the first grade. Semester 4a indicates first semester of the fourth grade. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

definition of left-behind status in the baseline model. $Math_{i,3b}$ and $Chin_{i,3b}$ are respectively math and Chinese test scores in the second semester of the third grade, normalized within each school×cohort×wave. X_{it} include the same set of control variables in the baseline model. In other words, these are the same set of regressors used in the baseline model, other than the own left-behind status.

Results Table 12 shows that being left behind in the first semester of the first grade predicts lower personality skills of students. The estimates are negative and significant for all measures of personality skill except for extroversion. The effects are small and insignificant for math and Chinese test scores and IQ score, however. It seems that being left-behind predicts lower personality skills, but not lower test scores.

4.5.1 Peers' Average Characteristics and the Proportion of LBC

Having shown that LBC are primarily disadvantaged in personality skills rather than academic achievement at the individual level, we then show how the 4th-grade classroom peers' average left behind status in the first semester of the first year and the average test score in the second semester of the third year, all prior to the 4th-grade random classroom assignment, relate to the peers' average academic achievement and personality skill after the 4th-grade random classroom assignment. We estimate the following model with leave-one-out classroom level variables:

$$\overline{Y_{-i,t}^{Test,class4a}} = \alpha + \gamma_{11}\overline{Test_{-i,3b}^{class4a}} + \gamma_{12}\overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \quad (9)$$

$$\overline{Y_{-i,t}^{Pers,class4a}} = \alpha + \gamma_{21}\overline{Test_{-i,3b}^{class4a}} + \gamma_{22}\overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \quad (10)$$

where $\overline{Y_{-i,t}^{Test,class4a}}$ and $\overline{Y_{-i,t}^{Pers,class4a}}$ are the $n-1$ averages of classmates' academic achievement and personality skill, respectively. This exercise establishes whether left-behind status predicts lower personality skills not just at individual level but also at group level.

To reduce dimensionality problem, we estimate a single factor for the personality skill and a single factor the academic achievement. The personality skill factor is calculated as the major factor of the big-5 personality and social skill measures. The academic achievement factor is the major factor of math and Chinese test scores and the IQ score. Factors are based on measures collected in the current semester within each school×cohort×wave, and are all normalized within school×cohort×wave. $\overline{Test_{-i,3b}^{class4a}}$ is the average of classmates' academic achievement defined as the sum of math and Chinese test scores in the second semester of the third grade normalized within each school×cohort×wave.[11] Other control variables include all of the control variables in the baseline model and their leave-one-out averages among classmates in the fourth grade and the first grade.

We test the following two sets of hypotheses: in terms of group averages, (i) low past academic achievement of the peers predict low current academic achievement of the peers ($\gamma_{11} > 0$), but not personality skill ($\gamma_{12} = 0$); (ii) left-behind status in the first grade predict low current personality skill ($\gamma_{22} < 0$), but not academic achievement ($\gamma_{21} = 0$).

[11] IQ tests were administered at the time of the survey, so historical scores are not available.

Results Left panel of Table 13 presents the results of the models in this section. First row shows that the average of classmates' past test scores predict their current average of academic achievement, but not the average personality skills. Second row shows that their average left-behind status in the first semester of the first year predicts current average personality skills, but not average academic achievement. In other words, there is no evidence of cross-effects for the averages of classmates, from test scores to personality skills, or from left-behind status to academic achievement.

4.5.2 Peer Effects through Academic Achievement and Personality Skill

Finally, since students are randomly assigned to different classes in the first semester of the fourth grade conditional on gender and third grade academic achievement, average peer characteristics in the first semester of the fourth year is exogenous to unobservable factors that determine students' personality skills. Exploiting this opportunity, we estimate the impact of peers' $n-1$ average past academic achievement and left-behind status on one's own academic achievement and personality skills.

The following model is used:

$$\begin{aligned} Y_{i,t}^{TEST} &= \alpha + \gamma_{11}\overline{Test_{-i,3b}^{class4a}} + \gamma_{12}\overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \\ Y_{i,t}^{PERS} &= \alpha + \gamma_{21}\overline{Test_{-i,3b}^{class4a}} + \gamma_{22}\overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it} \end{aligned}$$

The dependent variables are student outcomes in academic achievement and personality skill. The key parameter of interest is γ_{22}, the personality channel of peer effect isolated from the academic achievement channel. Previous analyses showed that left-behind status in the first semester of the first grade is associated with lower personality skills but not lower academic achievement, while academic achievement in the second semester of the third year (right before the second random classroom assignment) is associated with subsequent academic achievement, but not with personality skill. These associations are found at individual level as well as at grade-4 class average level.

In Section 4.6, we also conduct robustness checks by (i) not including any control variables except for the school×cohort×wave fixed effects and (ii) clustering the error term at the school level instead of the school×cohort level.

Results The right panel of Table 13 presents of results of the models in Section 4.5.2, showing that for individual never-LB students, classroom peers' average left-behind status predicts personality skills, but not academic achievement. Classroom peers' past average academic achievement does not significantly predict personality skill or academic achievement.

Altogether, the results of Tables 12 13 are consistent with the interpretation that a child being left-behind suffers lower personality skill, which then affects the personality skills of her peers. Academic achievement of LBC in our sample does not predict personality skills of their classmates. It is however important to keep in mind that these results are merely

suggestive of underlying channels, relying on the assumption that left-behind status is a good proxy for lower personality skill.

Table 12: Association between Left-Behind-Status and Academic Achievement/Personality Skill Outcomes at the Individual Level

$$Y_{it} = \alpha + \gamma_1 LB_{i,1a} + \gamma_2 Math_{i,3b} + \gamma_3 Chin_{i,3b} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Personality Skill Outcomes:	**Consc** (1)	**Agree** (2)	**Extro** (3)	**Openn** (4)	**E.Stability** (5)	**Social** (6)	**All** (7)
Being LB in 1a	-0.059†	-0.077*	-0.022	-0.051†	-0.114***	-0.091*	-0.083*
	(0.033)	(0.033)	(0.029)	(0.028)	(0.029)	(0.036)	(0.033)
Math in 3b	0.202***	0.138***	0.193***	0.272***	0.147***	0.174***	0.256***
	(0.020)	(0.023)	(0.018)	(0.022)	(0.026)	(0.021)	(0.020)
Chinese in 3b	0.262***	0.106**	0.167***	0.252***	0.158***	0.180***	0.255***
	(0.031)	(0.031)	(0.025)	(0.031)	(0.032)	(0.032)	(0.034)
Other Controls	✓	✓	✓	✓	✓	✓	✓
School-Cohort-Wave	✓	✓	✓	✓	✓	✓	✓
N	5813	5813	5813	5813	5813	5813	5813

Cognitive Outcomes:	**Math** (8)	**Chinese** (9)	**IQ** (10)	**All** (11)
Being LB in 1a	0.001	-0.039	0.027	-0.014
	(0.022)	(0.026)	(0.027)	(0.022)
Math in 3b	0.527***	0.251***	0.435***	0.471***
	(0.024)	(0.019)	(0.023)	(0.020)
Chinese in 3b	0.247***	0.531***	0.107***	0.378***
	(0.036)	(0.040)	(0.030)	(0.038)
Other Controls	✓	✓	✓	✓
School-Cohort-Wave	✓	✓	✓	✓
N	5813	5813	5813	5813

Notes: Standard errors are clustered at the school-cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples include both left-behind and non-left-behind students. The dependent variable "All" indicates the major component of all the outcome variables on the left from a factor analysis. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Consc: conscientiousness; Agree: agreeableness; Extro: extroversion; Openn: openness to experience; E.Stability: emotional stability; Social: social skill.

4.6 Robustness Results

In this section, we present a series of robustness analyses. Key takeaway from this section is that the results hold under a variety of different specifications.

Robustness Test 1 Tables 14 and 15 examine the robustness of the main results in Section 4.1 to various combinations of control variables. Each cell represents coefficient estimate of

Table 13: Peer Effects: Academic Achievement Channel vs. Personality Skill Channel

Column (1) and (2): $\overline{Y_{-i,t}^{class4a}} = \alpha + \gamma_1 \overline{Test_{-i,3b}^{class4a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$, Column (3) and (4): $Y_{it} = \alpha + \gamma_1 \overline{Test_{-i,3b}^{class4a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$

Dependent Variable:	**4a-Classmates'**		**Self's**	
	Academic (1)	Personality (2)	Academic (3)	Personality (4)
4a-Classmates' Test Score in 3b	0.552***	0.096	-0.089	-0.160
	(0.072)	(0.210)	(0.121)	(0.241)
4a-Classmates' Being LB in 1a	0.195	-1.917***	0.278	-1.693**
	(0.230)	(0.548)	(0.317)	(0.629)
Other Controls	✓	✓	✓	✓
School-Cohort-Wave FE	✓	✓	✓	✓
N	2216	2216	2216	2216

Notes: Standard errors are clustered at the school-cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to never-left-behind students. "Academic" indicates the major component of the three academic achievement variables: math test score, Chinese test score and the IQ score. "Personality" indicates the major component of the six personality skill outcome variables: openness to experience, conscientiousness, extroversion, agreeableness, emotional stability, and social skills. "Other control variables" include: semester-1a-classmates' average test score in semester 3b, their proportion of left-behind children, and the same set of other control variables in the baseline regressions (dummies for mother's and father's education levels and number of siblings, student's gender, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class). Semester 1a indicates the first semester of the first year. Semester 4a indicates the first semester of the fourth year. Semester 3b indicates second semester of the third year.

γ_1 in Table 14, the impact of the first grade peers, and γ_2 in Table 15, the impact of the fourth grade peers. Baseline results are presented in column (6) in each table. Consistent with the results in Section 4.1, Table 14 shows that the effects of the first grade LB peers are mostly small and insignificant. The effect on agreeableness is borderline significant in some fo the specifications, but other effects are insignificant and often inconsistent in sign. In contrast, the effects of the fourth grade LB peers are large and significant in all of the specifications in Table 15. The significant effects are all similar in magnitude as well.

Robustness Test 2 Table 16 examines the robustness of the main results in Section 4.1 to including average values of peers' parents' education level. These tests address the concern that left-behind status may actually proxy children's other disadvantaged status, such as low education level of parents. This could be serious concern, since migrating parents tend to be of low education, and a series of studies show effects coming from peers with parents of different levels of education (Bifulco et al. [2011], Bertoni et al. [2020], Fletcher et al. [2020]). However, first two rows of Table 16 shows that the results are robust to the inclusion of a set of variables for peers' average values of father's and mother's education levels.

Robustness Test 3 Table 17 examines the robustness to different levels of the clustering of the error term. Each cell is the p-value of γ_1 in the first panel and γ_2 in the second panel. Each row represents different levels of clustering, where the second row is the baseline used in the rest of the study. The most stringent clustering is at the school level, with only 17 schools. Since conventional inference based on asymptotic distribution would be inappropriate with such small number of clusters, all of the p-values are calculated using wild cluster bootstrap t-test with 100,000 replications (Cameron and Miller [2015]). The results show that estimated p-values are stable across different levels of clustering.

Robustness Test 4 Table 18 examines the baseline results on personality skills using full sample, including both left-behind and never-left-behind students. The model additionally includes as a control variable an indicator for whether the child has ever been left behind since the first grade. With much larger sample, the negative peer effects are still found for the same set of outcomes as in Section 4.1, although slightly smaller in magnitude. The effects on extroversion and openness to experience, while insignificant, are somewhat larger in magnitude, with smaller standard error estimates. The effects of the first grade peers remain small and insignificant, despite larger sample.

Robustness Test 5 Table 19 examines the baseline model while excluding school$\times$cohort$\times$waves with a standard deviation of class-level left-behind proportion greater than 0.1. Significant violations in the random classroom assignment mechanisms, if at all, would likely be represented by these classes with large variation in the proportion of LBC. The results show that the effects remain sizable and significant, even with the smaller sample. The statistical significance declined so that the effects on conscientiousness and agreeableness are now significant at 10% level, instead of 1% level in Table 4.

Robustness Test 6 Table 20 estimates the baseline model separately for each of the 2017 and 2018 waves, whereas the observations from the two waves are pooled in the baseline analysis. We see from the table that both the magnitude and the significance of the results are robust across the 2017 wave, the 2018 wave, and the pooled sample. Estimates on agreeableness using the 2017 wave is not significant but the magnitude is comparable to those from other samples.

Robustness Test 7 Table 21 examines the robustness of the baseline results to alternative definitions of personality skills. Arbitrarily restricting the source of children's personality skills, we see that the effects are mostly driven by the reports from teachers. Reports from the parents and the students' self reports are barely informative, although the signs are somewhat consistent with the baseline results. The literature in psychology does not prioritize one source of information over another, but recommends using information from multiple sources if possible (De Los Reyes and Kazdin [2005], Stanger and Lewis [1993], and Verhulst and Van der Ende [1992]). Consistent with this recommendation, the baseline analyses use factor scores from measures reported by teachers, parents and the students, where the measures are weighted by their association with the latent factor. Incidentally, these results show that it is important to incorporate multiple sources of information when assessing personality skills of children.

Robustness Test 8 Table 22 shows the robustness of results in Table 13, showing peer effect channels through academic achievement and personality skill channel, to different sets of control variables and different levels of clustering. First three panels show results for different sets of control variables, beginning with no control variable in the first panel. The last panel shows results for clustering at the school level. Since there are only 17 schools, statistical inference is conducted using 100,000 replications of wild cluster bootstrap t-test. Across all specifications, the key results remain robust in both magnitude and statistical significance.

5 Conclusion

In this paper, we document the effects of disadvantaged peers in primary school on the development of personality skills. For identification, we rely on the random assignment of students to classrooms, and the fact that the children's disadvantage is due to parental migration for work. Our empirical design compares across classrooms never-left-behind students who are more exposed to left-behind students in the same classroom to those who are less exposed to left-behind students.

We show that disadvantaged students in primary schools have negative effects on personality development of their peers in the same classroom. 10% increase in the proportion of left-behind peers in the fourth grade classroom decreases conscientiousness by 0.148, agreeableness by 0.175, emotional stability by 0.215, and social skill by 0.199 in standard deviation unit. These effects are stronger in classrooms with smaller proportion of left-behind children. We also find suggestive evidence that primary channel of these effects are not endogenous friendship formation within the classroom. Finally, we find evidence that these effects are due to the low personality skills of left-behind children, not due to their low academic achievement or low socioeconomic status. These findings show that childhood peer effects extend beyond academic achievement and can shape personality skills. Furthermore, whereas previous studies showed peer effects from from noncognitive skills to other outcomes for high school students and college students (Zárate [2019], Golsteyn et al. [2021]), we show that similar interactions likely take place much earlier in one's life cycle.

These findings show that the effect of disadvantaged peers are not confined to specific behavior engaged by the peers, but can spill over to a wide range of problematic behaviors predicted by low personality skills. Findings in previous literature showing peer effects on specific problematic behaviors such as drinking, smoking, and other delinquent behavior, likely understate the true extent of peer effects on various problematic behavior. With our findings on peer effects in primary school, we conclude that peer interaction plays an important role in shaping one's behavior in childhood. In addition, given the widespread phenomenon of left-behind children in China and elsewhere, it is important to consider policies that can attenuate the impact of disadvantaged children on their peers in school.

Table 14: Impact of Past LB Peers: Robustness Check on Control Variables

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

	Coefficients on the Proportion of LB Peers in Semester 1a					
Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Math	-0.610	-0.440	-0.385	-0.321	-0.318	-0.387
Chinese	-0.691	-0.490	-0.468	-0.463	-0.516	-0.530
IQ	0.422	0.520	0.571	0.641†	0.654†	0.611
Conscientiousness	-0.530	-0.364	-0.339	-0.177	-0.154	0.399
Agreeableness	-0.990†	-0.873†	-0.860†	-0.819†	-0.774†	-0.100
Extroverssion	-0.320	-0.172	-0.154	-0.051	-0.097	0.005
Openness	-0.044	0.145	0.177	0.325	0.293	0.391
Emotional Stability	-0.635	-0.549	-0.536	-0.360	-0.331	0.444
Social Skill	-0.867†	-0.748	-0.733	-0.618	-0.604	0.063
Control Variables						
Sex and Parents' Educ		✓	✓	✓	✓	✓
Math and Chinese in 3b			✓	✓	✓	✓
Current Teacher's Char.				✓	✓	✓
Past and current class sizes					✓	✓
Proportion of LB in 4a						✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 15: Impact of Current LB Peers: Robustness Check on Control Variables

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

	Coefficients on the Proportion of LB Peers in Semester 4a					
Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Math	0.058	0.121	-0.005	0.108	0.078	0.228
Chinese	-0.276	-0.252	-0.293	-0.182	-0.159	0.045
IQ	0.431	0.468	0.348	0.399	0.378	0.143
Conscientiousness	-1.453*	-1.514*	-1.570**	-1.587**	-1.657**	-1.811**
Agreeableness	-2.277**	-2.276**	-2.308**	-2.201**	-2.247**	-2.209**
Extroverssion	-0.213	-0.211	-0.249	-0.203	-0.330	-0.331
Openness	-0.076	0.021	-0.049	0.040	-0.170	-0.321
Emotional Stability	-2.359**	-2.329**	-2.360**	-2.280***	-2.367***	-2.538***
Social Skill	-2.140**	-2.180**	-2.213**	-2.122***	-2.160***	-2.184***
Control Variables						
Sex and Parents' Educ		✓	✓	✓	✓	✓
Math and Chinese in 3b			✓	✓	✓	✓
Current Teacher's Char.				✓	✓	✓
Past and current class sizes					✓	✓
Proportion of LB in 1a						✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 16: Robustness Check: Extra Controls for Peers' Mothers' and Fathers' Education Levels

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \beta_m \overline{\text{MOMEDU}^{class4a}_{-i}} + \beta_f \overline{\text{DADEDU}^{class4a}_{-i}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc** (1)	**Agree** (2)	**Extro** (3)	**Openn** (4)	**E.Stability** (5)	**Social** (6)
Proportion of 1a Peers LB in 1a	0.408	-0.120	-0.095	0.356	0.408	0.088
	(0.332)	(0.473)	(0.397)	(0.348)	(0.416)	(0.398)
Proportion of 4a Peers LB in 1a	-1.845**	-2.051*	-0.023	-0.252	-2.466***	-2.308***
	(0.561)	(0.774)	(0.448)	(0.552)	(0.629)	(0.603)
Proportion of 4a-Peers' Mother's Educ 7-9	-1.216	-1.404	-0.581	-1.576†	-1.897	-0.960
	(1.059)	(1.272)	(0.552)	(0.897)	(1.378)	(1.158)
Proportion of 4a-Peers' Mother's Educ 1-6	0.867	1.170	-0.159	-0.290	-0.443	1.068
	(1.122)	(1.355)	(0.730)	(1.173)	(1.448)	(1.372)
Proportion of 4a-Peers' Mother's Educ = 0	-2.301	-0.897	2.424	-0.088	-1.036	-2.885
	(2.824)	(4.071)	(1.559)	(2.228)	(3.312)	(2.822)
Proportion of 4a-Peers' Mother's Educ Missing	0.086	-0.089	-0.232	-0.451	0.036	0.163
	(1.652)	(1.866)	(1.175)	(1.643)	(2.012)	(1.887)
Proportion of 4a-Peers' Father's Educ 7-9	1.479	2.105	0.015	1.837†	1.741	1.268
	(1.091)	(1.547)	(0.785)	(1.080)	(1.388)	(1.139)
Proportion of 4a-Peers' Father's Educ 1-6	-0.161	-0.196	-0.134	1.484	0.988	-0.243
	(1.018)	(1.277)	(0.866)	(1.170)	(1.165)	(1.074)
Proportion of 4a-Peers' Father's Educ = 0	-2.019	-3.617	5.725*	2.205	3.300	-2.317
	(3.622)	(4.312)	(2.621)	(4.343)	(3.899)	(4.198)
Proportion of 4a-Peers' Father's Educ Missing	0.539	-0.407	0.021	1.315	1.428	0.685
	(1.047)	(1.566)	(1.114)	(1.398)	(1.451)	(1.301)
Other Controls	✓	✓	✓	✓	✓	✓
School-Cohort-Wave FE	✓	✓	✓	✓	✓	✓
N	2216	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school-cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. The reference group for peers' mothers' or fathers' education level is 9+ years of schooling (some high school and above). Dependent variables are: "Consc"=contentiousness, "Agree"=agreeableness, "Extro"=extroversion, "Openn"=openness to experience, "E.Stability"=emotional stability (neuroticism), "Social"=social skills. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. "LB in 1a-3b" refers to the fraction of semesters during grade 1-3 with at least one parent being absent.

Table 17: Robustness Check on the Cluster Level of Standard Errors

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc**	**Agree**	**Extro**	**Openn**	**E.Stability**	**Social**
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of 1a Peers LB in 1a	**0.399**	**-0.100**	**0.005**	**0.391**	**0.444**	**0.063**
Cluster = Class-Cohort	[0.230]	[0.817]	[0.990]	[0.272]	[0.221]	[0.874]
Cluster = School-Cohort, Baseline	[0.264]	[0.845]	[0.991]	[0.263]	[0.305]	[0.890]
Cluster = School	[0.119]	[0.848]	[0.990]	[0.158]	[0.154]	[0.883]
Proportion of 4a Peers LB in 1a	**-1.811**	**-2.209**	**-0.331**	**-0.321**	**-2.538**	**-2.184**
Cluster = Class-Cohort	[0.002]	[0.006]	[0.489]	[0.597]	[0.000]	[0.001]
Cluster = School-Cohort, Baseline	[0.004]	[0.010]	[0.524]	[0.636]	[0.001]	[0.002]
Cluster = School	[0.013]	[0.002]	[0.594]	[0.657]	[0.003]	[0.001]
Other Controls	✓	✓	✓	✓	✓	✓
School-Cohort-Wave FE	✓	✓	✓	✓	✓	✓
N	2216	2216	2216	2216	2216	2216
# of Current Class-Cohorts	158	158	158	158	158	158
# of School-Cohorts	58	58	58	58	58	58
# of Schools	17	17	17	17	17	17

Notes: p-values are few-cluster-adjusted in brackets using wild bootstraps (rep=100,000). The default level of cluster in the baseline results is the school-cohort level. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class. Semester 1a indicates the first semester of the first year. Semester 4a indicates the first semester of the fourth year.

Table 18: Robustness Check on the Baseline Using Full Sample

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc**	**Agree**	**Extro**	**Openn**	**E.Stability**	**Social**
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of 1a Peers LB in 1a	0.355	0.080	0.030	0.208	0.306	0.405
	(0.257)	(0.291)	(0.206)	(0.238)	(0.340)	(0.284)
Proportion of 4a Peers LB in 1a	-1.442***	-1.695***	-0.428	-0.512	-1.800***	-1.916***
	(0.340)	(0.450)	(0.291)	(0.364)	(0.403)	(0.430)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
F-Test for Two LB proportions	9.1***	7.4**	1.6	1.1	10.0***	10.0***
p-Value for F-Test	[0.000]	[0.001]	[0.210]	[0.348]	[0.000]	[0.000]
N	6553	6553	6553	6553	6553	6553
Individuals	4853	4853	4853	4853	4853	4853
Class×Cohorts	164	164	164	164	164	164
School×Cohorts (Clusters)	58	58	58	58	58	58
Schools	17	17	17	17	17	17

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples include both left-behind and non-left-behind students. Samples includes students who switched classes after semester 4a. Other control variables include: a dummy indicating whether the student had ever been left-behind since grade one, dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 19: Robustness Check on the Baseline by Dropping School×Cohort×Waves with Large Between-Class Variations in the Proportion of Left-Behind Students

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

Dependent =	**Consc** (1)	**Agree** (2)	**Extro** (3)	**Openn** (4)	**E.Stability** (5)	**Social** (6)
Proportion of 1a Peers LB in 1a	0.243	-0.384	-0.026	0.291	0.326	-0.139
	(0.387)	(0.587)	(0.411)	(0.351)	(0.511)	(0.496)
Proportion of 4a Peers LB in 1a	-1.552†	-2.251†	-0.227	-0.024	-2.583**	-1.614*
	(0.830)	(1.185)	(0.646)	(0.760)	(0.848)	(0.713)
Other Controls	✓	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓	✓
F-Test for Two LB Proportions	2.0	3.6*	0.1	0.4	4.7*	3.7*
p-Value for F-Test	[0.151]	[0.035]	[0.920]	[0.671]	[0.014]	[0.031]
N	2018	2018	2018	2018	2018	2018
Individuals	1590	1590	1590	1590	1590	1590
Class×Cohorts	139	139	139	139	139	139
School×Cohorts (Clusters)	50	50	50	50	50	50
Schools	17	17	17	17	17	17

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to school×cohort×waves with the standard deviation of mean LB across classes $\leq$0.1. Other control variables include: a dummy indicating whether the student had ever been left-behind since grade one, dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 20: Baseline Results Using Single Sample Wave

$$Y_{it} = \alpha + \gamma_1 \overline{LB^{class1a}_{-i,1a}} + \gamma_2 \overline{LB^{class4a}_{-i,1a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$$

	Wave 2017	Wave 2018	All
Dependent: Math	-0.091	0.678	0.228
Chinese	-0.263	0.329	0.045
IQ	0.187	0.261	0.143
Conscientiousness	-2.101**	-1.615**	-1.811***
Agreeableness	-2.463	-2.209**	-2.209**
Extroverssion	-0.376	-0.108	-0.331
Openness	-0.048	-0.600	-0.321
Emotional Stability	-2.839***	-2.554***	-2.538***
Social Skill	-2.224**	-1.935*	-2.184***
Current LB Peers and Other Controls	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓
N	1008	1208	2216
# of Individuals	1008	1208	1744
# of Current Class×Cohorts	92	124	158
# of School×Cohorts (Clusters)	42	45	58
# of Schools	15	17	17

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 21: Baseline Results Using Alternative Sources of Students' Personalities

Dependent Assessed by	Parents	Students (Self)	Teachers	**All**	Teacher & Student
	(1)	(2)	(3)	**(4)**	(5)
Conscientiousness	-0.708†	-0.140	-1.952**	**-1.811****	-1.782**
Agreeableness	0.102	-0.016	-2.279**	**-2.209****	-2.223**
Extroverssion	-0.248	0.001	-0.375	**-0.331**	-0.293
Openness	0.032	0.242	-0.403	**-0.321**	-0.346
Emotional Stability	-0.186	-0.248	-2.784***	**-2.538*****	-2.573***
Social Skill	-0.391	-0.157	-2.142**	**-2.184*****	-2.166**
Current Proportion of LB	✓	✓	✓	✓	✓
School×Cohort×Wave FE	✓	✓	✓	✓	✓
Other Baseline Controls	✓	✓	✓	✓	✓
N	2216	2216	2216	2216	2216

Notes: Standard errors are clustered at the school×cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Samples are restricted to students who had never been left-behind since grade one. Other control variables include: dummies for mother's and father's education levels and number of siblings, student's gender, student's math and Chinese normalized test scores in the second semester of grade 3, teacher's gender, age, age-squared, education level and marital status, the size of the current class and the reference student's grade-one class.

Table 22: Academic Achievement Channel vs. Personality Skill Channel: Robustness to Control Variables and the Clustering of Standard Errors

Column (1) and (2): $\overline{Y_{-i,t}^{class4a}} = \alpha + \gamma_1 \overline{Test_{-i,3b}^{class4a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$,
Column (3) and (4): $Y_{it} = \alpha + \gamma_1 \overline{Test_{-i,3b}^{class4a}} + \gamma_2 \overline{LB_{-i,1a}^{class4a}} + \theta X_{it} + \rho_{sct} + \epsilon_{it}$

No Other Control Variables	**4a-Classmates'**		**Self's**	
	Cognitive (1)	Non-Cognitive (2)	Cognitive (3)	Non-Cognitive (4)
4a-Classmates' Test Score in 3b	0.577***	0.224	-0.211	-0.249
	(0.081)	(0.316)	(0.198)	(0.353)
4a-Classmates' Being LB in 1a	-0.066	-1.861**	0.055	-1.528*
	(0.165)	(0.620)	(0.391)	(0.664)
School-Cohort-Wave FE	✓	✓	✓	✓
N	2216	2216	2216	2216
Benchmark Control Variables	**4a-Classmates'**		**Self's**	
	Cognitive	Non-Cognitive	Cognitive	Non-Cognitive
4a-Classmates' Test Score in 3b	0.552***	0.096	-0.089	-0.160
	(0.072)	(0.210)	(0.121)	(0.241)
4a-Classmates' Being LB in 1a	0.195	-1.917***	0.278	-1.693**
	(0.230)	(0.548)	(0.317)	(0.629)
School-Cohort-Wave FE	✓	✓	✓	✓
N	2216	2216	2216	2216
Additional Controls: 4a-Classmates' Gender, # of Siblings, Parents' Education	**4a-Classmates'**		**Self's**	
	Cognitive	Non-Cognitive	Cognitive	Non-Cognitive
4a-Classmates' Test Score in 3b	0.558***	0.066	-0.042	-0.157
	(0.054)	(0.169)	(0.146)	(0.221)
4a-Classmates' Being LB in 1a	0.106	-1.775***	0.173	-1.550**
	(0.202)	(0.445)	(0.320)	(0.575)
School-Cohort-Wave FE	✓	✓	✓	✓
N	2216	2216	2216	2216
Benchmark Control Variables, Clustered at the School Level	**4a-Classmates'**		**Self's**	
	Cognitive	Non-Cognitive	Cognitive	Non-Cognitive
4a-Classmates' Test Score in 3b	0.552***	0.096	-0.089	-0.160
	[0.001]	[0.568]	[0.385]	[0.513]
4a-Classmates' Being LB in 1a	0.195	-1.917**	0.278	-1.693*
	[0.492]	[0.002]	[0.316]	[0.014]
School-Cohort-Wave FE	✓	✓	✓	✓
N	2216	2216	2216	2216

Notes: standard errors are clustered at the school-cohort level in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. p-values are few-cluster-adjusted at the *school* level in brackets using wild bootstraps (rep=100,000). Samples are restricted to never-left-behind students. "Cognitive" indicates the major component of the three cognitive outcome variables: math test score, Chinese test score and the IQ score. "Non-Cognitive" indicates the major component of the six non-cognitive outcome variables: openness to experience, conscientiousness, extroversion, agreeableness, emotional stability, and social skills. "Benchmark control variables" include: semester-1a-classmates' average test score in semester 3b, their proportion of left-behind children, and the same set of other control variables in the baseline regressions. Semester 1a indicates first semester of the first year. Semester 4a indicates first semester of the fourth year. Semester 3b indicates second semester of the third year.

Appendices

Table A1: Big 5 Questionnaire, 29 Items

	Question: "The child . . ."
	Openness to experience
9	is inventive, find clever ways to do things
14	values art and beauty
17	is curious about many different things
20	is original, comes up with new ideas
	Conscientiousness
5	leaves a mess, doesn't clean up
6	is dependable, steady
13	keeps things neat and tidy
15	is efficient, gets things done
	Extraversion
1	is outgoing or sociable
4	has an assertive personality
7	is shy, introverted
10	is dominant and acts as a leader
	Agreeableness
2	is compassionate, has a soft heart
11	has a forgiving nature
12	is outgoing and sociable / is helpful and unselfish with others
19	is polite, courteous to others
	Emotional stability (Neuroticism)
3	is relaxed, handles stress well
8	is emotionally stable, not easily upset
16	often feels sad
18	keeps their emotions under control
	Social Skill (Guanxi)
21	adheres to the principles
22	is impartial and disinterested
23	is used to expressing views tactfully
24	is straightforward
25	is frank to inevitably displease people
26	is often complacent for tiny things
27	is always modest and asks others for advice with open mind
28	feel uncomfortable if your achievements aren't recognized /often speaks out in self-satisfying way
29	is well-behaved and never does things that are taboo/forbidden by others

Note: Child's personality traits are described using Likert scale. Responses include 1: strongly disagree; 2: disagree; 3: neutral; 4: agree; 5: strongly agree.

References

Atila Abdulkadiroğlu, Joshua Angrist, and Parag Pathak. The elite illusion: Achievement effects at boston and new york exam schools. *Econometrica*, 82(1):137–196, 2014.

Tom Ahn and Justin G Trogdon. Peer delinquency and student achievement in middle school. *Labour Economics*, 44:192–217, 2017.

Mathilde Almlund, Angela Lee Duckworth, James Heckman, and Tim Kautz. Personality psychology and economics. In *Handbook of the Economics of Education*, volume 4, pages 1–181. Elsevier, 2011.

Douglas Almond, Janet Currie, and Valentina Duque. Childhood circumstances and adult outcomes: Act ii. *Journal of Economic Literature*, 56(4):1360–1446, 2018.

Joshua D Angrist. The perils of peer effects. *Labour Economics*, 30:98–108, 2014.

Joshua D Angrist and Kevin Lang. Does school integration generate peer effects? evidence from boston's metco program. *American Economic Review*, 94(5):1613–1634, 2004.

Simone Balestra, Beatrix Eugster, and Helge Liebert. Peers with special needs: Effects and policies. *Review of Economics and Statistics*, 2020.

Simone Balestra, Aurélien Sallin, and Stefan C. Wolter. High-ability influencers? the heterogeneous effects of gifted classmates. *Journal of Human Resources*, 2021.

Ana Balsa, Néstor Gandelman, and Flavia Roldán. Peer and parental influence in academic performance and alcohol use. *Labour Economics*, 55:41–55, 2018.

Marco Bertoni, Giorgio Brunello, and Lorenzo Cappellari. Who benefits from privileged peers? evidence from siblings in schools. *Journal of Applied Econometrics*, pages 1–24, 2020.

Julian R Betts and Andrew Zau. Peer groups and academic achievement: Panel evidence from administrative data. 2004.

Jan Bietenbeck. The long-term impacts of low-achieving childhood peers: Evidence from project star. *Journal of the European Economic Association*, 18(1):392–426, 2020.

Robert Bifulco, Jason M Fletcher, and Stephen L Ross. The effect of classmate characteristics on post-secondary outcomes: Evidence from the add health. *American Economic Journal: Economic Policy*, 3(1):25–53, 2011.

Sandra E Black, Paul J Devereux, and Kjell G Salvanes. Under pressure? the effect of peers on outcomes of young adults. *Journal of Labor Economics*, 31(1):119–153, 2013.

Mary A Burke and Tim R Sass. Classroom peer effects and student achievement. *Journal of Labor Economics*, 31(1):51–82, 2013.

A Colin Cameron and Douglas L Miller. A practitioner's guide to cluster-robust inference. *Journal of human resources*, 50(2):317–372, 2015.

Katherine Grace Carman and Lei Zhang. Classroom peer effects and academic achievement: Evidence from a chinese middle school. *China Economic Review*, 23(2):223–237, 2012.

Scott E Carrell and Mark L Hoekstra. Externalities in the classroom: How children exposed to domestic violence affect everyone's kids. *American Economic Journal: Applied Economics*, 2(1):211–28, 2010.

Scott E Carrell, Mark Hoekstra, and Elira Kuka. The long-run effects of disruptive peers. *American Economic Review*, 108(11):3377–3415, 2018.

Lijun Chen, Dali Yang, and Qiang Ren. Report on the state of children in china. Technical report, Chapin Hall at the University of Chicago, 2015.

Yuanyuan Chen and Shuaizhang Feng. Access to public schools and the education of migrant children in china. *China Economic Review*, 26:75–88, 2013.

Yuanyuan Chen and Shuaizhang Feng. Quality of migrant schools in china: Evidence from a longitudinal study in shanghai. *Journal of Population Economics*, 30(3):1007–1034, 2017.

Raj Chetty, John N Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan. How does your kindergarten classroom affect your earnings? evidence from project star. *The Quarterly journal of economics*, 126(4):1593–1660, 2011.

Bobby Chung and Jian Zou. Understanding spillover of peer parental education: Randomization evidence and mechanisms. Technical Report 2020-045, HCEO Working Paper Series, 2020.

Andres De Los Reyes and Alan E Kazdin. Informant discrepancies in the assessment of childhood psychopathology: a critical review, theoretical framework, and recommendations for further study. *Psychological bulletin*, 131(4):483, 2005.

David J Deming. The growing importance of social skills in the labor market. *The Quarterly Journal of Economics*, 132(4):1593–1640, 2017.

Weili Ding and Steven F Lehrer. Do peers affect student achievement in China's secondary schools? *The Review of Economics and Statistics*, 89(2):300–312, 2007.

Will Dobbie and Roland G Fryer Jr. The impact of attending a school with high-achieving peers: Evidence from the new york city exam schools. *American Economic Journal: Applied Economics*, 6(3):58–75, 2014.

Thomas Dohmen and Armin Falk. Performance pay and multidimensional sorting: Productivity, preferences, and gender. *American economic review*, 101(2):556–90, 2011.

Esther Duflo, Pascaline Dupas, and Michael Kremer. Peer effects, teacher incentives, and the impact of tracking: Evidence from a randomized evaluation in kenya. *American Economic Review*, 101(5):1739–74, 2011.

Arnaud Dupuy and Alfred Galichon. Personality traits and the marriage market. *Journal of Political Economy*, 122(6):1271–1319, 2014.

Sneha Elango, Jorge Luis García, James J. Heckman, and Andrés Hojman. *Economics of Means-Tested Transfer Programs in the United States, Volume II*, chapter 4 Early Childhood Education, pages 235–298. University of Chicago Press, 2016.

Todd E Elder and Darren H Lubotsky. Kindergarten entrance age and children's achievement impacts of state policies, family background, and peers. *Journal of Human Resources*, 44 (3):641–683, 2009.

Jason M Fletcher. The effects of personality traits on adult labor market outcomes: Evidence from siblings. *Journal of Economic Behavior & Organization*, 89:122–135, 2013.

Jason M Fletcher, Stephen L Ross, and Yuxiu Zhang. The consequences of friendships: Evidence on the effect of social relationships in school on academic achievement. *Journal of Urban Economics*, 116:103241, 2020.

Gigi Foster. It's not your peers, and it's not your friends: Some progress toward understanding the educational peer effect mechanism. *Journal of public Economics*, 90(8-9): 1455–1475, 2006.

Jane Cooley Fruehwirth. Can achievement peer effect estimates inform policy? a view from inside the black box. *Review of Economics and Statistics*, 96(3):514–523, 2014.

Alan S Gerber, Gregory A Huber, David Doherty, and Conor M Dowling. The big five personality traits in the political arena. *Annual Review of Political Science*, 14:265–287, 2011.

Stephen Gibbons and Shqiponja Telhaj. Peer effects: Evidence from secondary school transition in england. *Oxford Bulletin of Economics and Statistics*, 78(4):548–575, 2016.

Lewis R Goldberg. The structure of phenotypic personality traits. *American psychologist*, 48(1):26, 1993.

Bart Golsteyn, Arjan Non, and Ulf Zölitz. The impact of peer personality on academic achievement. *Journal of Political Economy*, 129(4), 2021.

Jie Gong, Yi Lu, and Hong Song. Gender peer effects on students' academic and noncognitive outcomes: Evidence and mechanisms. *Journal of Human Resources*, pages 0918–9736R2, 2019.

Eric D Gould, Victor Lavy, and M Daniele Paserman. Does immigration affect the long-term educational outcomes of natives? quasi-experimental evidence. *The Economic Journal*, 119(540):1243–1269, 2009.

Jonathan Guryan, Kory Kroft, and Matthew J Notowidigdo. Peer effects in the workplace: Evidence from random groupings in professional golf tournaments. *American Economic Journal: Applied Economics*, 1(4):34–68, 2009.

Michael Haylock and Patrick Kampkötter. The role of preferences, attitudes, and personality traits in labor market matching. *Economics Letters*, 185:108718, 2019.

James Heckman, Rodrigo Pinto, and Peter Savelyev. Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *American Economic Review*, 103(6):2052–86, 2013.

James J Heckman and Stefano Mosso. The economics of human development and social mobility. *Annu. Rev. Econ.*, 6(1):689–733, 2014.

Christian Helmers and Manasa Patnam. Does the rotten child spoil his companion? spatial peer effects among children in rural india. *Quantitative Economics*, 5:67–121, 2014.

Sok Chul Hong and Jungmin Lee. Who is sitting next to you? peer effects inside the classroom. *Quantitative Economics*, 8(1):239–275, 2017.

Caroline Hoxby. Peer effects in the classroom: Learning from gender and race variation. Technical report, National Bureau of Economic Research, 2000.

Caroline M. Hoxby and Gretchen Weingarth. Taking race out ofthe equation: School reassignment and the structure of peer effects. Department of Economics, Harvard University, 2006.

Feng Hu. Migrant peers in the classroom: Is the academic performance of local students negatively affected? *Journal of Comparative Economics*, 46(2):582–597, 2018.

Hongwei Hu, Shuang Lu, and Chien-Chung Huang. The psychological and behavioral outcomes of migrant and left-behind children in China. *Children and Youth Services Review*, 46:1–10, 2014.

Bin Huang and Rong Zhu. Peer effects of low-ability students in the classroom: evidence from China's middle schools. *Journal of Population Economics*, pages 1–38, 2020.

Zibin Huang. Peer effects of migrant and left-behind children: Evidence from classroom random assignment in china. *Available at SSRN 3434160*, 2020.

John Eric Humphries and Fabian Kosse. On the interpretation of non-cognitive skills–what is being measured and why it matters. *Journal of Economic Behavior & Organization*, 136:174–185, 2017.

Scott A Imberman, Adriana D Kugler, and Bruce I Sacerdote. Katrina's children: Evidence on the structure of peer effects from hurricane evacuees. *American Economic Review*, 102 (5):2048–82, 2012.

Changhui Kang. Classroom peer effects and academic achievement: Quasi-randomization evidence from south korea. *Journal of Urban Economics*, 61(3):458–495, 2007.

Tim Kautz, James J Heckman, Ron Diris, Bas Ter Weel, and Lex Borghans. Fostering and measuring skills: Improving cognitive and non-cognitive skills to promote lifetime success. 2014.

Daniel Fu Keung Wong, Chang Ying Li, and He Xue Song. Rural migrant workers in urban China: living a marginalised life. *International Journal of Social Welfare*, 16(1):32–40, 2007.

Jannie Helene Grøne Kristoffersen, Morten Visby Krægpøth, Helena Skyt Nielsen, and Marianne Simonsen. Disruptive school peers and student outcomes. *Economics of Education Review*, 45:1–13, 2015.

Victor Lavy and Analia Schlosser. Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, 3(2):1–33, 2011.

Victor Lavy, M Daniele Paserman, and Analia Schlosser. Inside the black box of ability peer effects: Evidence from variation in the proportion of low achievers in the classroom. *The Economic Journal*, 122(559):208–237, 2011.

Victor Lavy, Olmo Silva, and Felix Weinhardt. The good, the bad, and the average: Evidence on ability peer effects in schools. *Journal of Labor Economics*, 30(2):367–414, 2012.

Qiang Li, Gordon Liu, and Wenbin Zang. The health of left-behind children in rural China. *China Economic Review*, 36:367–376, 2015.

Shi Li. The economic situation of rural migrant workers in China. *China Perspectives*, 2010 (2010/4), 2010.

Tao Li, Li Han, Linxiu Zhang, and Scott Rozelle. Encouraging classroom peer interactions: Evidence from chinese migrant schools. *Journal of Public Economics*, 111:29–45, 2014.

Fangwen Lu and Michael L Anderson. Peer effects in microenvironments: The benefits of homogeneous classroom groups. *Journal of Labor Economics*, 33(1):91–122, 2015.

Charles F Manski. Identification of endogenous social effects: The reflection problem. *The review of economic studies*, 60(3):531–542, 1993.

Xin Meng and Chikako Yamauchi. Children of migrants: The cumulative impact of parental migration on children's education and health outcomes in China. *Demography*, 54(5): 1677–1714, 2017.

Shi Min, Zhouhang Yuan, Xiaobing Wang, and Lingling Hou. Do peer effects influence the academic performance of rural students at private migrant schools in china? *China Economic Review*, 54:418–433, 2019.

Matthew Neidell and Jane Waldfogel. Cognitive and noncognitive peer effects in early education. *The Review of Economics and Statistics*, 92(3):562–576, 2010.

Sijun Shao, Ingrid Nielsen, Chris Nyland, Russell Smyth, Mingqiong Zhang, and Cherrie Jiuhua Zhu. Migrants as homo economicus: Explaining the emerging phenomenon of a shortage of migrant labor in china's coastal provinces. *China Information*, 21(1):7–41, 2007.

Aaron Sojourner. Identification of peer effects with missing peer data: Evidence from project star. *The Economic Journal*, 123(569):574–605, 2013.

Yang Song. What should economists know about the current chinese hukou system? *China Economic Review*, 29:200–212, 2014.

Catherine Stanger and Michael Lewis. Agreement among parents, teachers, and children on internalizing and externalizing behavior problems. *Journal of Clinical Child Psychology*, 22(1):107–116, 1993.

Valerie Strauss. China's 10 new and surprising school reform rules. *The Washington Post*, Oct 2013. URL `https://www.washingtonpost.com/news/answer-sheet/wp/2013/10/30/chinas-10-new-school-reform-rules-reduce-standardized-testing-homework/`.

UNICEF, NWCCW, and NBS. Children in China: An atlas of social indicators. Technical report, UNICEF, 2018. URL `"https://www.unicef.cn/sites/unicef.org.china/files/2019-03/Atlas%202018%20ENG.pdf"`. Accessed August 1, 2020.

Frank C Verhulst and Jan Van der Ende. Agreement between parents' reports and adolescents' self-reports of problem behavior. *Journal of Child Psychology and Psychiatry*, 33 (6):1011–1023, 1992.

Jacob Vigdor and Thomas Nechyba. Peer effects in north carolina public schools. In Ludger Woessmann and Paul E. Peterson, editors, *Schools and the Equal Opportunities Problem*, pages 73–102, Cambridge, 2007. MIT Press.

D. Wang and H. Cui. Reliabilities and validities of the chinese personality scale. *Acta Psychologica Sinica*, 36(3):347–358, 2004. (in Chinese).

Haining Wang and Rong Zhu. China's only children and their spillover effects on academic performance in the classroom. *The BE Journal of Economic Analysis & Policy*, 19(4), 2019.

Haining Wang and Rong Zhu. Social spillovers of china's left-behind children in the classroom. Technical report, 2021.

Lamei Wang and Judi Mesman. Child development in the face of rural-to-urban migration in China: a meta-analytic review. *Perspectives on Psychological Science*, 10(6):813–831, 2015.

Tianheng Wang. Classroom composition and student academic achievement: The impact of peers' parental education. *The BE Journal of Economic Analysis & Policy*, 1(ahead-of-print), 2020.

Xiaobing Wang, Yu Bai, Linxiu Zhang, and Scott Rozelle. Migration, schooling choice, and student outcomes in china. *Population and Development Review*, pages 625–643, 2017.

Yuan-Yuan Wang, Le Xiao, Wen-Wang Rao, Jing-Xin Chai, Shu-Fang Zhang, Chee H Ng, Gabor S Ungvari, Huiping Zhu, and Yu-Tao Xiang. The prevalence of depressive symptoms in 'left-behind children'in China: A meta-analysis of comparative studies and epidemiological surveys. *Journal of affective disorders*, 244:209–216, 2019.

Di Xu, Qing Zhang, and Xuehan Zhou. The impact of low-ability peers on cognitive and non-cognitive outcomes: Random assignment evidence on the effects and operating channels. *Journal of Human Resources*, 2020.

Román Andrés Zárate. Social and cognitive peer effects: Experimental evidence from selective high schools in Peru. 2019.

Hongliang Zhang, Jere R Behrman, C Simon Fan, Xiangdong Wei, and Junsen Zhang. Does parental absence reduce cognitive achievements? evidence from rural China. *Journal of Development Economics*, 111:181–195, 2014.

Nan Zhang, Tarani Chandola, Laia Becares, and Peter Callery. Parental migration, intergenerational obligations and the paradox for left-behind boys in rural China. *Asian Population Studies*, 12(1):68–87, 2016.

Liqiu Zhao and Zhong Zhao. Disruptive peers in the classroom and students' academic outcomes: Evidence and mechanisms. *Labour Economics*, 68, 2021.

Yueyue Zhou, Yulan Cheng, Yiming Liang, Jiazhou Wang, Changning Li, Weijing Du, Yufang Liu, and Zhengkui Liu. Interaction status, victimization and emotional distress of left-behind children: A national survey in china. *Children and Youth Services Review*, 118: 105348, 2020.