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Transmission of Educational Outcomes Across Three Generations: Evidence From Migrant Workers' Children in China

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Abstract

The migration of parents or children may bring risks to children's academic performance, but intergenerational effects on the academic performance of migrant workers' children have been underexplored. This study aims to investigate how grandparents' socioeconomic status (G1) and parents' proximal and distal socioeconomic status (G2) influence the academic performance of migrant workers' children (G3) and the corresponding impacts on the academic performance of migrant and left-behind children. The data used in this study were collected from a survey of 2017 migrant workers conducted in 13 districts and cities of 7 provinces of China in 2014. The results of ordered logistic regression models indicate that G1 grandparent socioeconomic status is positively associated with G2 academic performance and education level. Similarly, G2 parental academic performance and education level are positively linked to G3 academic performance. Parental distal academic performance and education level play an important role in G3 academic performance, but grandparents' socioeconomic status is not significantly associated with G3 academic performance while controlling for both G1 and G2 variables. In addition, the influence of grandparents' and parents' socioeconomic status differs between migrant and left-behind children. Grandparent and parental occupation status only have a significant impact on left-behind children. The educational reproduction of migrant workers' children has different logics among migrant and left-behind children. Further policies and social services are required to improve the development of migrant workers' children.

Keywords Socioeconomic status · Migrant workers' children · Academic performance

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Since the 1990s, China has undergone a significant demographic shift of migration from rural to urban areas. Children who remain in their rural hometowns when their parents migrate to work in cities are known as 'left-behind' children, and those children who migrate to cities with their parents are known as 'migrant' children (Lv et al., 2018). Official Chinese statistical information shows that the number of children involved in population migration reached approximately 103 million in 2015; among these children, approximately 34.26 million were migrant children, approximately 68.77 million were left-behind children, and the number of children with rural household registration (*hukou* in Chinese) reached 61.38 million (Lv et al., 2018). The migration of parents poses a series of risks to the growth and development of children, such as risks of discrimination, social exclusion, and an absence of family supervision. One consequence of these risks is the educational inequalities faced by migrant workers' children.

Educational inequality refers to the unequal distribution of educational opportunities among different social classes (Wu & Yang, 2011). The extant literature on educational inequality has identified intergenerational persistence in educational outcomes as a key factor influencing unequal educational outcomes in children (Bryant et al., 2006). Since the adoption of reform and opening up policies in China in 1978, social stratification has grown exponentially, and family socioeconomic status has played an increasingly important role in individual education outcomes (Li & Qiu, 2016; Zhang & Su, 2018). In this context, the reproduction of educational disadvantage among migrant families has become an important focus for academics, and a large number of studies have focused on the reproduction mechanisms of educational inequality among the children of migrant workers (Lai et al., 2014; Lu et al., 2015; Shi, 2016). These studies have produced inconsistent findings.

The first group of research studies focuses on parental socioeconomic status and migrant children's academic performance. Most of these studies explore the influence of family disadvantages on the academic performance of offspring (Jensen et al., 2018). Influencing mechanisms include educational participation, educational investment, education modes, and parent–child relationships (Gong & Zhong, 2016; Liu & Teng, 2016; Wang & Cu, 2019). The second group of studies focuses on parental socioeconomic status and left-behind children's academic performance. Most studies explore the effects of economic resources, family care, and family participation brought about by parental migration on the academic performance of left-behind children. Parental migration may increase family income and consequently increase children's weight, improve their nutrition and human capital investment, and so on. Thus, parental migration may have a positive impact on children's academic performance (Hu, 2013; Mu & De Brauw, 2015). However, left-behind children are more likely to form a peer subculture that is not conducive to learning due to a lack of parental rearing and care (Zhang & Chen, 2018), which negatively influences their academic performance (Tong, 2015). Therefore, the migration of parents may have different effects on the academic performance of migrant and left-behind children. However, most of these studies have considered migrant and left-behind children within different research frameworks, potentially leading to different results due to inconsistencies in the selection of comparison groups or the use of inappropriate measurement methods. Rural children are considered a vulnerable group in

terms of education, regardless of whether they migrate or remain in their hometowns. Although migrant and left-behind children seem to be two different groups of children, in essence, they belong to a whole group formed through incomplete migration (a New Form of Mobility in Central and Eastern Europe), and the two categories can overlap considerably (Duan, 2015). Therefore, there is an urgent need to integrate migrant and left-behind children into a unified analytical framework and systematically show how the children of migrant workers perform in school.

Most studies have examined the impact of family socioeconomic status on children's academic performance across two generations (i.e., parents and children). However, the most recent statistical information shows that 96% of rural left-behind children are cared for by paternal or maternal grandparents (Xinhuanet, 2018). In the development of migrant workers' children, the influence of grandparents cannot be ignored. ARQOL recently published a special issue on the quality of life of children and adolescents in Chinese societies (Leung & Fung, 2021). We must note that the papers published in this special issue are mainly focused on Hong Kong while empirical studies on mainland China are inadequate. The present study on migrant workers' children can fill this gap and add to the existing evidence base by including migrant and left behind children in the same framework and by providing a three-generation analysis of impacts on academic performance.

Using the data from a household survey of migrant workers conducted in 13 districts and cities in 7 provinces of China, we examined multigenerational effects on the academic performance of migrant workers' children. Specifically, we explore the following four research questions. (1) For each generation, how does the older generation's proximal socioeconomic status influence the younger generation's academic performance, including how grandparents [G1] influence parents [G2] and how parents [G2] influence children [G3]? (2) How does parental distal (i.e., as children) academic performance influence parents' own education levels and children's academic performance? (3) How does grandparents' proximal socioeconomic status influence the academic performance of migrant workers' children? (4) What is the respective impact of grandparents' and parents' socioeconomic status on children's academic performance?

The purpose of our research is to extend the current evidence on the educational inequalities of migrant workers' children and to demonstrate the intergenerational reproduction of educational disadvantages among migrant and left-behind children by studying the multigenerational influence of the academic performance of migrant workers' children.

The main contributions of our study include the following. (1) Migrant and left-behind children are not fixed forms of the children of migrant workers (Tan, 2011), and the left-behind or migration status of children changes with the migration status of their parents. Therefore, our research integrates living arrangements into the analytical framework to indicate differences in the influence of parents' and grandparents' socioeconomic status on the academic performance of left-behind and migrant children, respectively. We in turn integrate migrant and left-behind children into a unified analytical framework, and the academic performance of migrant workers' children can then be more comprehensively demonstrated. (2) Our research extends the model of the acquisition of academic performance of migrant workers' children

from two generations to three generations. We examine the influence of the outcomes of parents and grandparents across multiple generations, and parents' outcomes are indexed by proximal education level and distal academic performance. The multigenerational effects observed clearly show the reproduction of educational disadvantages among migrant workers' families.

Literature Review

Research on family background and academic performance was first reported by the Coleman Report, which found students' socioeconomic characteristics, especially their parents' economic conditions, to have a significant impact on their academic performance (Coleman et al., 1966). Since then, many studies have shown that family socioeconomic status greatly affects children's academic achievement. Parents' educational achievement, occupational status and income form the basis of a family's socioeconomic status (Bryant et al., 2006). To extend this research topic, we adopt four perspectives in examining multigenerational effects on the academic performance of migrant workers' children. The first perspective focuses on the influence of parents' contemporaneous (proximal) socioeconomic status on children's well-being and development. The second perspective focuses on how parents' early and distal academic performance influences children's well-being and development. The third perspective focuses on the influence of grandparents' socioeconomic status on children's well-being and development. Finally, the fourth perspective focuses on the role of children living with their grandparents and parents in children's well-being and development. These four perspectives form the analytic framework of our research.

The first perspective focuses on the influence of parents' current socioeconomic status on children's academic performance. This theoretical perspective has been the focus of many previous studies. Most researchers have explored reproduction mechanisms of family culture, society and human capital from the perspective of "the theory of cultural and social reproduction". Human capital theory emphasizes the impact of family economic resources and educational investment on children's academic achievement, while cultural capital theory and social capital theory emphasize the influence of parents' education level and educational participation on children's academic performance (Li & Qiu, 2016). In China, researchers examining the impact of family socioeconomic status on the academic performance of migrant workers' children have also adopted these three analysis frameworks. First, in terms of resource transformation mechanisms, human capital theory involves the utilization of family financial resources. The theory holds that the difference in children's educational achievement is mainly caused by the level of family investment in education. Parents with more human capital take advantage of their resources to obtain more education and social opportunities than those of other social classes (Tang, 2015). Second, according to the theory of cultural capital, parents' educational achievement is one of the most powerful predictors of children's education levels. Parents with higher education levels have an advantage in terms of educational opportunities, and this is

especially the case for mothers' education levels, which are positively correlated with children's academic performance (Davis-Kean, 2005). Parents with rich cultural capital usually have a better understanding of the rules of school education and will invest more cultural resources to cultivate their children's educational expectations and interest in learning to help their children better master school curricula and achieve excellent academic performance (Wu, 2010). Although the theory of cultural reproduction is also challenged by the theory of cultural resistance and the theory of cultural flow (Zhu, 2018), it is still an important perspective for understanding intergenerational reproduction. Third, social capital theory emphasizes the influence of parents' educational participation on children's learning behaviour and academic achievement. Parents of higher socioeconomic status usually participate more in their children's learning activities, focus more on communicating with teachers and other parents, and thus help improve their children's academic performance (Li & Qiu, 2016). In China, migrant workers have little communication with their children due to high levels of life stress and busy work schedules and thus pay relatively little attention to the education of their children (Wang & Xu, 2020). For left-behind children, because one or both their parents are not at home, the degree of parental involvement is reduced, which may negatively affect their educational outcomes (Arguillas & Williams, 2010). Therefore, left-behind children may face difficulties with parent–child relationships, family investment, educational participation and so on. Based on the literature described above, we propose our first hypothesis (H1).

The second perspective focuses on how parents' early (distal) education attainment influences children's academic performance. This theoretical perspective shifts the emphasis from the proximal context to family history and the early development of parents. Few studies on the academic performance of migrant workers' children have adopted this perspective, and few studies have examined how the development and well-being of children are influenced from this perspective (Johnson & Hitlin, 2017; Mortimer et al., 2017; Taylor et al., 2004). The studies that have examined these areas help us focus on how parents' distal education attainment influences their children's academic performance. Based on multigenerational data for the USA (1991–2011), one study tested how family-related factors, especially parents' experiences with entering adulthood and their own adolescent agentic orientation, influence their adolescent children's development. The results show that the early orientations and experiences of parents in entering adulthood have a weak influence on children's mastery beliefs, though parents' optimistic life course expectations held in adolescence are more strongly related to adolescent children's life course expectations and mastery beliefs when current family incomes are lower (Johnson & Hitlin, 2017). Children's achievement-oriented development was found to be influenced not only by parents' contemporary achievement but also by their academic self-concept and educational plans as adolescents (Mortimer et al., 2017). These outcomes result because parents' experiences as students shape their attitudes, values and beliefs, which in turn are correlated with their educational expectations for their children (Taylor et al., 2004). Thus, the early achievements of parents will affect their ultimate socioeconomic status and parenting styles (Hitlin & Johnson, 2015). Even when socioeconomic circumstances change later on, the early achievements of the

parents' generation are equally important (Johnson & Hitlin, 2017). Based on the existing findings, we propose our second hypothesis (H2).

The third perspective focuses on the influence of grandparents' socioeconomic status on children's well-being and development. In China, there has always been a tradition of mutual assistance between generations. Researchers have focused on grandparents' influence on the development of their grandchildren in terms of providing emotional and economic support, acting as role models for their grandchildren, and maintaining family solidarity. Generally, grandparents' socioeconomic status can affect the academic performance of grandchildren through two mechanisms. First, according to the economic compensation hypothesis, grandparents can directly transmit economic resources to their grandchildren in the form of human capital, wealth, or networks, which in turn can provide access to higher-quality education or occupations (Mare, 2014). In the USA, children with grandparents with a college education show stronger literacy and math skills when entering kindergarten, and grandparents' influence remains robust when controlling for parents' education, income, and professional prestige (Ferguson & Ready, 2011). A data analysis of three British birth cohort studies found that after controlling for parents' social class, grandchildren were at least two-and-a-half times more likely to enter the professional management class than the unskilled manual class when their grandparents themselves once occupied professional management class positions rather than unskilled manual class positions. Although parents' education, income and wealth were considered, grandparents in professional management class positions still had an influence (Chan & Boliver, 2013). Second, in terms of the educational participation and care compensation hypothesis, grandparents with higher education levels better understand educational participation and high-quality care provision. Left-behind children's grandparents tend to have low levels of education and a limited awareness of the importance of education, to show relaxed educational supervision of left-behind children's learning and to be poorly equipped to support left-behind children's learning, which may have a negative impact on the academic performance of these children (Duan & Zhou, 2005). As migrant workers' children tend to have close relationships with their grandparents, especially since many left-behind children are looked after by their grandparents, it is important to further explore grandparents' effects on the academic performance of the children of migrant workers. Based on the literature described above, we propose our third hypothesis (H3).

The fourth perspective focuses on children's household circumstances: how living with grandparents and parents plays a role in children's well-being and development. Early studies mainly focused on the consequences of divorce and separation. It is generally believed that the absence of a child's father has a negative impact on a child's well-being by reducing family resources and the quality of parenting and available resources (Antman, 2012). Previous studies have suggested that parental absence affects children's health in rural China (Zhou et al., 2020). However, parents working away from their rural homes have more economic resources. A large amount of remittance income may offset the negative impact of parents' absence. After controlling for family wealth, sons of migrant parents who send more remittances, remit more frequently, and have worked overseas for a longer period of time show a higher likelihood of college matriculation, which may indicate parents'

commitment to their children and their active participation in parenting (Arguillas & Williams, 2010). However, for parents who have to work abroad, increased occupational stress and parenting difficulties, such as problems in monitoring their children, are common issues (Shek & Siu, 2019). In considering the effect of grandparents' absence on grandchildren's development, a study found that in rural China, the education level of coresident grandparents significantly increased grandchildren's educational attainment, while the education level of noncoresident and deceased grandparents showed no effect (Zeng & Xie, 2014). Therefore, for migrant and left-behind children, grandparents' socioeconomic status may have different impacts on such children's academic performance. Based on the literature described above, we propose our fourth and fifth hypotheses (H4 and H5).

Research Hypotheses and Methods

Research Hypotheses

Based on the above review of previous studies, we present five research hypotheses. (H1) For each generation, if the older generation is of lower proximal socioeconomic status, the younger generation has worse academic performance, including in terms of the influence of grandparents on parents and the influence of parents on children. (H2) Parents' distal socioeconomic status is positively associated with their education level and their children's academic performance. (H3) Grandparents' socioeconomic status is positively associated with the academic performance of migrant workers' children. (H4) Parental socioeconomic status has an impact on both migrant and left-behind children. (H5) Grandparents' socioeconomic status has different effects on the academic performance of migrant and left-behind children. The details of the hypotheses are provided in Tables 1 and 2.

Data

The data used in this article were retrieved from the Ministry of Education's Major Philosophical and Social Science Project of 2013 titled "Research on social management and services to promote the social integration of migrant workers in small and medium-sized cities amid the removal of household registration restrictions (approval no.: 13JZD018)" led by Professor Liu Linping from Nanjing University. The study involved a large-scale questionnaire survey held in Tai'an and Feicheng in Shandong, Xianyang and Xingping in Shaanxi, Changzhou and Wujin in Jiangsu, Jinhua and Yiwu in Zhejiang, Yueyang and Miluo in Hunan, Zunyi and Kaili in Guizhou, and Guangzhou in Guangdong, amounting to a total of 13 districts and cities in 7 provinces. As inclusion criteria, we selected migrant workers with their household registration residences in rural areas, with a college degree or less, who had migrated were living in cities and who were formally working at enterprises or units. A total of 2017 households were selected to participate in the survey. Children who were 6–18 years of age were included in this research. After appending data

Table 1 The first group of hypotheses and test

Research hypotheses	Detail of research hypotheses	Results
H1: Grandparental socioeconomic status is positively associated with the parents' academic performance and education level, and parental socio-economic status is positively associated with the academic performance of migrant workers' children	H1a: Grandfathers' occupational status is positively associated with parents' academic performance	Support
	H1b: Grandfathers' occupational status is positively associated with parents' education level	Not support
	H1c: Grandfathers' education level is positively associated with parents' academic performance	Not support
	H1d: Grandfathers' education level is positively associated with parents' education level	Support
	H1e: Grandmothers' occupational status is positively associated with parents' academic performance	Not support
	H1f: Grandmothers' occupational status is positively associated with parents' education level	Not support
	H1g: Grandmothers' education level is positively associated with parents' academic performance	Support
	H1h: Grandmothers' education level is positively associated with parents' education level	Support
	H1i: Parental occupational status is positively associated with the academic performance of migrant workers' children	Not support
	H1j: Parental education level is positively associated with the academic performance of migrant workers' children	Support

Table 2 The second group to fifth group hypothesis and test

Research hypotheses	Detail of research hypotheses	Results
H2: Parental distal socioeconomic status is positively associated with the academic performance of migrant workers' children	H2a: Parental distal academic performance is positively associated with their education level	Support
	H2b: Parental distal academic performance is positively associated with the academic performance of migrant workers' children	Support
H3: Grandparental socioeconomic status is positively associated with the academic performance of migrant workers' children	H3a: Grandfathers' occupational status is positively associated with the academic performance of migrant workers' children	Not support
	H3b: Grandmothers' occupational status is positively associated with the academic performance of migrant workers' children	Not support
	H3c: Grandfathers' education level is positively associated with the academic performance of migrant workers' children	Not support
	H3d: Grandmothers' education level is positively associated with the academic performance of migrant workers' children	Not support
H4: Parental socioeconomic status has an impact on both migrant and left-behind children	H4a: Parental occupational status has an impact on both migrant and left-behind children	Partially support
	H4b: Parental education level has an impact on both migrant and left-behind children	Support
	H4c: Parental academic performance has an impact on both migrant and left-behind children	Support
H5: Grandparental socioeconomic status has different influence on the academic performance of migrant and left-behind children	H5a: Grandfathers' occupational status is only positively associated with the academic performance of left-behind children	Not support
	H5b: Grandmothers' occupational status is only positively associated with the academic performance of left-behind children	Not support
	H5c: Grandfathers' education level is only positively associated with the academic performance of left-behind children	Not support
	H5d: Grandmothers' education level is only positively associated with the academic performance of left-behind children	Not support

for first-born, second-youngest, and youngest children, 935 children of 6–18 years of age were included in the dataset. However, valid data on academic performance were only available for 845 of the children ("not clear" was considered a valid answer, as some parents could not specify their children's academic performance), and for other children ($N=90$) their academic rank was designated as "not applicable" or their parents did not provide this information. Thus, the 845 children with valid academic performance data were selected to remove missing values for other variables. Only the cases with valid information on all of the employment variables were included in the analysis. A final sample of 767 children was studied.

Variables

We examined four sets of variables, namely, G1, G2, G3, and family-level variables. For the socioeconomic status variables focused on grandparents and parents, previous research shows that parents' education level and occupational achievement are important indicators of family socioeconomic background and that parents with higher education levels have more material resources to promote their children's achievement (Bryant et al., 2006; Li & Qiu, 2016). According to such studies, we use occupation status and education level to measure socioeconomic status (Guveli et al., 2016; Li & Qiu, 2016). G1 variables, which are treated as exogeneous variables in the applied model, include grandfathers' and grandmothers' socioeconomic information. The variables measured include the grandfather's education level, occupation type, and migration status and the grandmother's education level, occupation type, and migration status.

Grandparents' education levels were coded as 0="elementary school or less", 1="junior high school", and 2="senior high school or above". Occupation types were coded as 0="no jobs", 1="agricultural jobs", and 2="other jobs". Migration status was coded as 0="no migration" and 1="migrated previously or currently migrating". These variables were treated as categorical variables. Education level and occupation type have been commonly used to measure individuals' socioeconomic status in previous research (Bradley & Corwyn, 2002). Parental migration status has been identified as a significant factor that influences children's education (Antman, 2012) and was thus controlled in the current study.

The G2 variables considered include parents' age, gender, and socioeconomic status in the proximal and distal past. Age (in years) was treated as a continuous variable. Gender was coded as 0="male" and 1="female". G2 proximal socioeconomic status includes parents' education level and main occupation type. Parents' education levels were coded as done for the grandparents. We used an approach to Dang (2015) to categorize occupation types, which categorized into four types: general workers (i.e., "assembly line worker", "other production worker", "logistics service staff", "waiter", "security guard", "cleaning staff", and "construction worker"), skilled workers (i.e., "skilled worker", "quality inspector", and "driver"), lower- and middle-level management staff (i.e., "team leader", "clerk", "foreman", "lower- or middle-level management staff", and "salesperson"), and other (i.e., "agricultural, forestry, pastoral or fishery worker"

and "other"). G2 distal socioeconomic status was indexed by parents' academic performance in their class at the highest learning stage when they were still students and whether they dropped out or were engaged in child labour before reaching the age of 15. Parents' academic performance when they were still students was coded as 0 = "poor", 1 = "average", and 2 = "good". Whether parents were engaged in jobs before they were 15 years old was coded as 1 = "work before 15 years of age" and 0 = "work after 15 years of age". Due to missing values for the variable measuring one's age upon starting one's first job, the variable that measures one's age upon starting one's first job and one's age upon starting one's current job were combined to categorize parents who had jobs before reaching 15 years of age. (One respondent reported starting his/her first job in 1889, which may have been intended as 1989, and another respondent reported starting his/her current job in 2104, which may been intended as 2014 or 2004. Both respondents are included in the data analysis). Remittances for the last year and costs of childrearing, children's health care, and children's education in the last year (a value of 99,999 was considered invalid) were also controlled in the models. Both variables were naturally log transformed and added to a value of "1" to use the log function (for respondents with remittances and costs valued at zero).

The G3 variables include a child's age, gender, migration status, learning stage, school type, and academic performance. Age (in years) was measured as a continuous variable, and gender was coded as 0 = "male" and 1 = "female". Children's migration statuses were differentiated based on children's current residences as follows: (1) children left behind in their hometowns (i.e., living in their hometowns while their parents migrate) and (2) children who were migrating during the survey period (i.e., living with their migrant parents, living in the same city as their migrant parents, or living in other places). Children's learning stages are recoded as 0 = "elementary school or less", 1 = "junior high school", and 2 = "senior high school or above". For children's educational outcomes, we used parents' rated academic performance. Academic performance was measured with "What is the child's academic performance?" and coded as 0 = "undetermined", 1 = "poor", 2 = "average", and 3 = "good". Children's academic performance was tested as the endogenous variable in the model. Children's school types were coded as 0 = "private school", 1 = "public school", and 2 = "undetermined".

Family income and the number of family members were controlled in the models examining how G1 and G2 influence G3, as previous research has included these two variables to test how parents' characteristics influence their children's academic achievement (Davis-Kean, 2005). The total family income in the last year was adjusted by the number of family members plus one (i.e., the number of family members and the respondent) and then naturally log transformed, and a value of "1" was added to adjusted family income to use the log function, as there were respondents whose family income was valued at zero. Family members included nuclear and economic community family members. Both variables were measured as continuous variables. Different control variables were included in different models. In the models testing how G1 influences G2, only the G1 and G2 variables were controlled. In the models testing how G1 and G2 influence the G3, G1, G2, and G3 variables, current family-level information was controlled.

Analytic Strategy

The data provide information on first-born, second-youngest, and youngest children. We appended the data of first-born, second-youngest, and youngest child to obtain a larger sample before conducting further analysis. First, a descriptive analysis was conducted to identify the general features of the studied grandparents, migrant workers, and migrant workers' children. Then, ordered logistic regression models were applied via Stata 16 (StataCorp, 2019). G2 academic performance, G2 education level, and G3 academic performance were considered to be ordered variables; thus, ordered logistic regression models were employed. The models tested how G1 education level and occupation status influence G2 educational outcomes and how G1 and G2 educational outcomes and occupation status influence G3 academic performance across the valid sample (with children's migration status used as a control variable), and then these variables were conducted among left-behind and migrant children, respectively.

Results

Results of the Descriptive Analysis

The valid number of tetrads including grandfathers, grandmothers, parents, and children was measured as 767. Table 3 shows the general characteristics of the children, parents, grandfathers, and grandmothers studied. The mean age of the children was 11.841 years [standard deviation (SD) = 3.705, 6–18]. More than half of the children were male ($N = 427$, 55.67%), had migrated ($N = 409$, 53.32%), and were in elementary school or below ($N = 433$, 56.45%). Most of the children were attending public schools ($N = 598$, 77.97%). More than half of the children ($N = 420$, 54.76%) and parents ($N = 447$, 58.28%) had average academic performance. More than half of the parents had a junior high school education ($N = 436$, 56.84%). Most of the grandfathers ($N = 526$, 68.58%) and grandmothers ($N = 667$, 86.96%) had an elementary school education or less.

Results of the Ordered Logistic Regression Models

Table 4 shows how the G1 education level and occupation status directly influence the G2 academic performance and education level ($N = 767$). For G2 academic performance, compared to G1 grandfathers with no job, for G1 grandfathers with agricultural (odds ratio (OR) = 2.493, $p < 0.05$) and other jobs ($OR = 2.592$, $p < 0.05$), it was more likely for G2 individuals to have better academic performance, while the relationship between G1 grandmothers' occupation status and G2 academic performance was not found to be significant. These results support H1a but do not support H1e. Compared to G1 grandmothers with an elementary school education or less, grandmothers with a junior high school education ($OR = 1.738$, $p < 0.05$) were more

Table 3 Background characteristics of the children, parents, and grandparents

Variables	Mean (SD)/frequency (%)
G3 variables	
Children's academic performance	
Not clear about it	13 (1.69%)
Bad	53 (6.91%)
Average	420 (54.76%)
Good	281 (36.64%)
Children's age (Min = 6, Max = 18)	11.841 (3.705)
Children's gender	
Male	427 (55.67%)
Female	340 (44.33%)
Children's migration status	
Being left behind	358 (46.68%)
Migrating	409 (53.32%)
Children's learning stage	
Elementary school or less	433 (56.45%)
Junior high school	193 (25.16%)
Senior high school or above	141 (18.38%)
Children's school type	
Private schools	145 (18.90%)
Public schools	598 (77.97%)
Don't know	24 (3.13%)
G2 variables	
Parents' academic performance when they were still students	
Bad	153 (19.95%)
Average	447 (58.28%)
Good	167 (21.77%)
Parents' education level	
Elementary school or less	193 (25.16%)
Junior high school	436 (56.84%)
Senior high school or above	138 (17.99%)
Whether parents were engaged in a job before 15 years old	
Work after 15 years old	725 (94.52%)
Work before 15 years old	42 (5.48%)
Parents' age (Min = 24, Max = 58)	38.851 (5.343)
Parents' gender	
Male	341 (44.46%)
Female	426 (55.54%)
Parents' occupation type	
General workers	507 (66.10%)
Skilled workers	115 (14.99%)
Lower-level and middle-level management staff	96 (12.52%)
Other types	49 (6.39%)

Table 3 (continued)

Variables	Mean (SD)/frequency (%)
Remittance in the last year (Min = 0, Max = 150,000)	12540.81 (15942.79)
Remittance in the last year (ln transformed) (Min = 0, Max = 11.918)	6.393 (4.437)
Cost on children's life, rearing, health care, education in the last year (Min = 0, Max = 80,000)	12330.1 (10,306)
Cost on children's life, rearing, health care, education in the last year (ln transformed) (Min = 0, Max = 11.290)	8.982 (1.358)
G1 variables	
Grandfathers' education level	
Elementary school or less	526 (68.58%)
Junior high school	165 (21.51%)
Senior high school or above	76 (9.91%)
Grandfathers' occupation status	
No jobs	62 (8.08%)
Agricultural jobs	603 (78.62%)
Other jobs	102 (13.30%)
Grandfathers' migration status	
Have never migrated	596 (77.71%)
Migrated before or currently migrating	171 (22.29%)
Grandmothers' education level	
Elementary school or less	667 (86.96%)
Junior high school	89 (11.60%)
Senior high school or above	11 (1.43%)
Grandmothers' occupation status	
No jobs	74 (9.65%)
Agricultural jobs	669 (87.22%)
Other jobs	24 (3.13%)
Grandmothers' migration status	
Have never migrated	690 (89.96%)
Migrated before or currently migrating	77 (10.04%)
Family-level variables	
Number of family members (Min = 1, Max = 16)	4.478 (1.301)
Family income adjusted by number of family members plus one (Min = 0, Max = 50,000)	9043.616 (6303.89)
Family income adjusted by number of family members plus one (ln transformed) (Min = 0, Max = 10.820)	8.885 (.766)

likely to have better academic performance, while there was no significant difference between G1 grandfathers' education levels and G2 academic performance. These results support H1 g but do not support H1c.

For G2 education level, compared to G1 grandparents with an elementary school education or less, for grandfathers with a senior high school education or above ($OR = 2.446$, $p < 0.01$) and grandmothers with a junior ($OR = 2.189$, $p < 0.01$) or

Table 4 How G1 variables influence G2 academic performance and education level

	(1) Parents' academic performance	(2) Parents' education level
Parents' age	1.017	0.930***
	(0.014)	(0.015)
Parents' gender	1.000	1.000
	(.)	(.)
Female	0.937	0.330***
	(0.138)	(0.053)
Grandfathers' education level	1.000	1.000
	(.)	(.)
Junior high school	1.065	1.342
	(0.202)	(0.267)
Senior high school or above	1.092	2.446**
	(0.285)	(0.669)
Grandfathers' occupation status	1.000	1.000
	(.)	(.)
Agricultural jobs	2.493*	0.779
	(1.051)	(0.353)
Other jobs	2.592*	1.075
	(1.056)	(0.475)
Grandfathers' migration status	1.000	1.000
	(.)	(.)
Migrated before or currently migrating	1.326	0.669[!]
	(0.297)	(0.155)
Grandmothers' education level	1.000	1.000
	(.)	(.)
Junior high school	1.738*	2.189**
	(0.419)	(0.544)
Senior high school or above	0.922	4.459*
	(0.589)	(3.083)
Grandmothers' occupation status	1.000	1.000
	(.)	(.)
Agricultural jobs	0.517[!]	0.299**
	(0.199)	(0.125)
Other jobs	0.545	0.260*
	(0.268)	(0.146)
Grandmothers' migration status	1.000	1.000
	(.)	(.)
Migrated before or currently migrating	1.057	1.063
	(0.318)	(0.337)
Parents' academic performance		1.000
		(.)

Table 4 (continued)

	(1) Parents' academic performance	(2) Parents' education level
Average		3.466***
		(0.685)
Good		9.341***
		(2.319)
Whether parents were engaged in a job before 15 years old		1.000
		(.)
Work before 15 years old		0.551!
		(0.190)
/		
cut1	0.688	0.009***
	(0.442)	(0.006)
cut2	10.452***	0.233*
	(6.783)	(0.163)
N	767	767
Pseudo R^2	0.012	0.150

Exponentiated coefficients; standard errors in parentheses

!$p<0.1$, *$p<0.05$, **$p<0.01$, ***$p<0.001$

senior high school education or above ($OR=4.459$, $p<0.05$), it was more likely for G2 individuals to have a better education level. These results support H1d and H1h. Compared to grandmothers with no job, for grandmothers with agricultural ($OR=0.299$, $p<0.01$) and other jobs ($OR=0.260$, $p<0.05$), G2 individuals were less likely to have a higher education level, while the relationship between grandfathers' occupation status and G2 education levels was not found to be significant. These results do not support H1b and H1f. Compared to parents with poor academic performance, those with average ($OR=3.466$, $p<0.001$) and good ($OR=9.341$, $p<0.001$) performance were more likely to have a higher education level. These results support H2a. A summary of the results of the hypotheses test is provided in Table 1.

Table 5 shows how G1 education levels and occupation status and G2 academic performance, education levels, and occupation status influence G3 academic performance across the valid sample ($N=767$) with migration status controlled. Model (1) shown in Table 5 only includes children's variables, G1 variables, and family-level variables; Model (2) in Table 5 includes children's variables, G2 variables, and family-level variables; and Model (3) includes children's variables, G1 and G2 variables, and family-level variables. For both G1 and G2 variables, in Model (3), grandparents' education level and occupation status are not significantly linked to G3 children's academic performance. These results do not support H3a, H3b, H3c, or H3d. In Models (2) and (3), both G2 parents' academic performance while students

Table 5 How G1 and G2 variables influence G3 Children's academic performance among the whole valid sample

	(1)	(2)	(3)
Children's age	0.903**	0.908*	0.907*
	(0.032)	(0.034)	(0.035)
Children's gender	1.000	1.000	1.000
	(.)	(.)	(.)
Female	1.920***	1.994***	2.061***
	(0.286)	(0.304)	(0.318)
Children's learning stage	1.000	1.000	1.000
	(.)	(.)	(.)
Junior high school	0.866	0.837	0.841
	(0.209)	(0.205)	(0.207)
Senior high school or above	1.738[!]	1.682	1.673
	(0.572)	(0.560)	(0.563)
Children's school type	1.000	1.000	1.000
	(.)	(.)	(.)
Public schools	1.694**	1.500*	1.498*
	(0.330)	(0.296)	(0.299)
Don't know	1.302	1.164	1.101
	(0.565)	(0.519)	(0.488)
Children's migration status	1.000	1.000	1.000
	(.)	(.)	(.)
Migrating	1.238	1.112	1.102
	(0.192)	(0.183)	(0.186)
Grandfathers' education level	1.000		1.000
	(.)		(.)
Junior high school	0.835		0.790
	(0.160)		(0.156)
Senior high school or above	1.602[!]		1.527
	(0.442)		(0.438)
Grandfathers' occupation status	1.000		1.000
	(.)		(.)
Agricultural jobs	1.069		0.890
	(0.451)		(0.389)
Other jobs	1.092		0.866
	(0.452)		(0.372)
Grandfathers' migration status	1.000		1.000
	(.)		(.)
Migrated before or currently migrating	1.043		1.010
	(0.235)		(0.236)
Grandmothers' education level	1.000		1.000
	(.)		(.)
Junior high school	1.656*		1.447

Table 5 (continued)

	(1)	(2)	(3)
	(0.408)		(0.369)
Senior high school or above	0.372		0.319[1]
	(0.227)		(0.202)
Grandmothers' occupation status	1.000		1.000
	(.)		(.)
Agricultural jobs	0.588		0.751
	(0.228)		(0.304)
Other jobs	0.517		0.729
	(0.269)		(0.402)
Grandmothers' migration status	1.000		1.000
	(.)		(.)
Migrated before or currently migrating	1.277		1.468
	(0.388)		(0.475)
Number of family members	0.959	0.986	0.977
	(0.056)	(0.060)	(0.060)
Family income adjusted by number of family members plus one (ln transformed)	1.315**	1.339**	1.316**
	(0.124)	(0.130)	(0.130)
Parents' academic performance		1.000	1.000
		(.)	(.)
Average		1.758**	1.827**
		(0.357)	(0.378)
Good		3.628***	3.721***
		(0.908)	(0.949)
Whether parents were engaged in a job before 15 years old		1.000	1.000
		(.)	(.)
Work before 15 years old		1.034	1.063
		(0.357)	(0.378)
Parents' education level		1.000	1.000
		(.)	(.)
Junior high school		1.757**	1.705**
		(0.336)	(0.332)
Senior high school or above		2.425***	2.257**
		(0.626)	(0.612)
Parents' age		1.010	1.010
		(0.018)	(0.018)
Parents' gender		1.000	1.000
		(.)	(.)
Female		1.189	1.226
		(0.201)	(0.211)
Parents' occupation type		1.000	1.000
		(.)	(.)

Table 5 (continued)

	(1)	(2)	(3)
Skilled workers		1.158	1.171
		(0.258)	(0.264)
Lower-level and middle-level management staff		0.953	0.913
		(0.225)	(0.219)
Other types		0.700	0.595
		(0.222)	(0.197)
Remittance (ln transformed)		0.988	0.991
		(0.018)	(0.018)
Cost on children (ln transformed)		1.011	1.012
		(0.059)	(0.059)
/			
cut1	0.068**	0.496	0.295
	(0.070)	(0.652)	(0.399)
cut2	0.388	2.884	1.718
	(0.390)	(3.748)	(2.301)
cut3	8.921*	75.086***	46.560**
	(8.987)	(98.412)	(62.801)
N	767	767	767
Pseudo R^2	0.052	0.080	0.090

Exponentiated coefficients; standard errors in parentheses

$^{!}p<0.1$, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

and parents' education levels are significantly linked to G3 children's academic performance. Compared to G2 parents with poor academic performance, G2 parents with average ($OR=1.758$, $p<0.01$; $OR=1.827$, $p<0.01$) and good academic performance ($OR=3.628$, $p<0.001$; $OR=3.721$, $p<0.001$) are more likely to have better academic performance. In Models (2) and (3), compared to G2 parents with an elementary school education or less, for G2 parents with a junior high school education ($OR=1.757$, $p<0.01$; $OR=1.705$, $p<0.01$) or senior high school education or above ($OR=2.425$, $p<0.001$; $OR=2.257$, $p<0.01$), G3 children are more likely to have better academic performance. These results support H2b and H1j. Parents' occupation status was not found to be significantly linked to G3 academic performance. These results do not support H1i. A summary of the results of the hypothesis tests is provided in Tables 1 and 2.

Table 6 shows how G1 education level and occupation status and G2 academic performance, education levels, and occupation status influence G3 academic performance among left-behind ($N=358$) and migrant children ($N=409$). Models (1)–(3) in Table 6 show the results for left-behind children, and Models (4)–(6) show the results for migrant children. Without including G2 parents' variables in Model (4), for G1 grandmothers with a junior high school education ($OR=2.153$, $p<0.05$), G3 migrant children are more likely to have better academic performance. Except for grandmothers' junior high school education levels, the G1

Table 6 How G1 and G2 variables influence G3 Children's academic performance among left-behind children and migrant children respectively

	(1)	(2)	(3)	(4)	(5)	(6)
	Left-behind children			Migrant children		
Children's age	0.916!	0.882*	0.906!	0.902*	0.920	0.910!
	(0.049)	(0.050)	(0.053)	(0.046)	(0.050)	(0.050)
Children's gender	1.000	1.000	1.000	1.000	1.000	1.000
	(.)	(.)	(.)	(.)	(.)	(.)
Female	1.634*	1.607*	1.691*	2.255***	2.380***	2.517***
	(0.366)	(0.374)	(0.404)	(0.472)	(0.506)	(0.551)
Children's learning stage	1.000	1.000	1.000	1.000	1.000	1.000
	(.)	(.)	(.)	(.)	(.)	(.)
Junior high school	0.966	0.902	0.776	0.637	0.649	0.623
	(0.338)	(0.328)	(0.292)	(0.222)	(0.225)	(0.220)
Senior high school or above	1.482	1.482	1.136	1.845	2.151!	2.155
	(0.731)	(0.753)	(0.604)	(0.855)	(0.998)	(1.024)
Children's school type	1.000	1.000	1.000	1.000	1.000	1.000
	(.)	(.)	(.)	(.)	(.)	(.)
Public schools	0.911	0.797	0.802	2.527***	2.346**	2.364**
	(0.288)	(0.259)	(0.267)	(0.643)	(0.613)	(0.634)
Don't know	1.008	0.707	0.712	1.643	1.506	1.497
	(1.018)	(0.737)	(0.754)	(0.814)	(0.780)	(0.778)
Grandfathers' education level	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Junior high school	0.973		0.682	0.774		0.937
	(0.283)		(0.217)	(0.205)		(0.262)
Senior high school or above	1.059		1.012	1.650		1.796

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Left-behind children			Migrant children		
	(0.515)		(0.515)	(0.579)		(0.667)
Grandfathers' occupation status	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Agricultural jobs	1.012		1.113	1.038		0.705
	(0.658)		(0.787)	(0.620)		(0.437)
Other jobs	0.694		0.694	1.463		1.089
	(0.492)		(0.524)	(0.820)		(0.633)
Grandfathers' migration status	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Migrated before or currently migrating	1.347		1.068	0.782		0.794
	(0.451)		(0.385)	(0.249)		(0.270)
Grandmothers' education level	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Junior high school	1.107		1.092	2.153*		1.688
	(0.541)		(0.559)	(0.661)		(0.548)
Senior high school or above	0.209		0.137!	0.665		0.741
	(0.205)		(0.143)	(0.526)		(0.626)
Grandmothers' occupation status	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Agricultural jobs	0.611		0.594	0.632		1.029
	(0.382)		(0.401)	(0.334)		(0.579)
Other jobs	0.188!		0.137*	1.001		1.921
	(0.162)		(0.124)	(0.686)		(1.437)

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Left-behind children			Migrant children		
Grandmothers' migration status	1.000		1.000	1.000		1.000
	(.)		(.)	(.)		(.)
Migrated before or currently migrating	0.947		1.520	1.813		1.635
	(0.426)		(0.769)	(0.778)		(0.754)
Number of family members	1.002	1.030	1.036	0.981	0.975	0.986
	(0.081)	(0.089)	(0.092)	(0.086)	(0.089)	(0.093)
Family income adjusted by number of family members plus one (ln transformed)	1.415*	1.436*	1.435*	1.252[1]	1.278*	1.257[1]
	(0.233)	(0.249)	(0.260)	(0.147)	(0.155)	(0.156)
Parents' academic performance		1.000	1.000		1.000	1.000
		(.)	(.)		(.)	(.)
Average		1.358	1.593		2.641**	2.633**
		(0.373)	(0.457)		(0.827)	(0.847)
Good		4.029***	4.510***		4.830***	4.960***
		(1.552)	(1.799)		(1.761)	(1.858)
Whether parents were engaged in a job before 15 years old		1.000	1.000		1.000	1.000
		(.)	(.)		(.)	(.)
Work before 15 years old		0.924	0.843		1.328	1.341
		(0.483)	(0.444)		(0.641)	(0.683)
Parents' education level		1.000	1.000		1.000	1.000
		(.)	(.)		(.)	(.)
Junior high school		2.001*	2.144**		1.750*	1.733[1]
		(0.559)	(0.619)		(0.482)	(0.497)

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Left-behind children			Migrant children		
Senior high school or above		2.155[!]	2.673*		2.699**	2.216*
		(0.940)	(1.223)		(0.916)	(0.814)
Parents' age		1.030	1.027		0.989	0.995
		(0.028)	(0.029)		(0.024)	(0.026)
Parents' gender		1.000	1.000		1.000	1.000
		(.)	(.)		(.)	(.)
Female		1.737*	1.731*		0.707	0.668
		(0.442)	(0.457)		(0.173)	(0.170)
Parents' occupation type		1.000	1.000		1.000	1.000
		(.)	(.)		(.)	(.)
Skilled workers		1.819[!]	1.778[!]		0.571	0.574
		(0.555)	(0.562)		(0.200)	(0.204)
Lower-level and middle-level management staff		0.606	0.634		1.117	1.125
		(0.281)	(0.294)		(0.324)	(0.336)
Other types		0.213*	0.168**		0.928	0.789
		(0.130)	(0.114)		(0.359)	(0.320)
Remittance (ln transformed)		1.000	0.979		0.987	0.997
		(0.029)	(0.030)		(0.024)	(0.025)
Cost on children (ln transformed)		1.011	1.003		0.993	1.020
		(0.086)	(0.086)		(0.083)	(0.088)
/						
cut1	0.067	0.794	0.481	0.070*	0.217	0.227
	(0.112)	(1.742)	(1.109)	(0.094)	(0.368)	(0.402)

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Left-behind children			Migrant children		
cut2	0.520	6.116	3.826	0.320	1.023	1.077
	(0.843)	(13.256)	(8.707)	(0.424)	(1.721)	(1.897)
cut3	12.876	180.497*	128.011*	7.981	29.539*	33.594*
	(20.999)	(394.800)	(293.875)	(10.588)	(50.019)	(59.579)
N	358	358	358	409	409	409
Pseudo R^2	0.045	0.088	0.112	0.084	0.112	0.130

Exponentiated coefficients; standard errors in parentheses

$^{!}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

education level and occupation status variables are not significantly linked to G3 academic performance for either left-behind or migrant children in Models (1) and (4) in Table 6.

In models that include G2 parents' variables, G2 parents' academic performance while students and parents' education levels are significantly linked to G3 children's academic performance among left-behind and migrant children. For left-behind children, in Models (2) and (3) in Table 6, compared to G2 parents with poor academic performance, for G2 parents with good academic performance ($OR = 4.029$, $p < 0.001$; $OR = 4.510$, $p < 0.001$), G3 children are more likely to have better academic performance. Compared to G2 parents with an elementary school education or below, G2 parents with a junior high school education ($OR = 2.001$, $p < 0.05$; $OR = 2.144$, $p < 0.01$) or senior high school education or above ($OR = 2.155$, $p < 0.1$; $OR = 2.673$, $p < 0.05$) are more likely to have better academic performance. Similarly, for migrant children, in Models (5) and (6) in Table 6, compared to G2 parents with poor academic performance, for G2 parents with average ($OR = 2.641$, $p < 0.01$; $OR = 2.633$, $p < 0.01$) or good academic performance ($OR = 4.830$, $p < 0.001$; $OR = 4.960$, $p < 0.001$), G3 children are more likely to have better academic performance. Compared to G2 parents with an elementary school education or below, G2 parents with a junior high school education ($OR = 1.750$, $p < 0.05$; $OR = 1.733$, $p < 0.1$) or senior high school education or above ($OR = 2.699$, $p < 0.01$; $OR = 2.216$, $p < 0.05$) are more likely to have better academic performance. These results support H4b and H4c. Thus, that after controlling for G1 grandparents' variables, G2 parents' education levels and academic performance are still significantly linked to G3 children's academic performance for left-behind and migrant children, while G2 parents with average academic performance have a positive influence on migrant children's academic performance. Compared to G2 parents working general workers, for parents with other occupations ($OR = 0.213$, $p < 0.05$ in Model (2); $OR = 0.168$, $p < 0.01$ in Model (3)), left-behind children are less likely to have better academic performance, while the result is not significant for migrant children. This result partially supports H4a. In Model (3), with the addition of parental variables, for grandmothers with other jobs ($OR = 0.137$, $p < 0.05$), G3 left-behind children are less likely to have better academic performance, while the result is was not significant for migrant children in Model (6). Other variables for the grandmother's education, the grandfather's occupation status and education levels are not significantly linked to G3 academic performance for either left-behind children or migrant children. These results do not support H5a, H5b, H5c, or H5d. A summary of the results of the hypothesis tests is provided in Table 2.

In addition, among left-behind children, those with more family income adjusted by the number of family members plus one ($OR = 1.435$, $p < 0.05$) and for which the mother completed the questionnaire ($OR = 1.731$, $p < 0.05$) were more likely to have better academic performance in Model (3), while among migrant children, those who studied in public schools were more likely to have better academic performance ($OR = 2.364$, $p < 0.01$) in Model (6). Among migrant and left-behind children, girls were more likely to have better academic performance ($OR = 1.691$, $p < 0.05$ in Model (3); $OR = 2.517$, $p < 0.001$ in Model (6)).

Discussion and Conclusion

The purpose of this study was to examine how grandparents' socioeconomic status and parental proximal and distal socioeconomic status influence the academic performance of migrant workers' children and whether grandparents' socioeconomic status and parental socioeconomic status have different impacts on the academic performance of migrant and left-behind children. Using data from a large-scale questionnaire survey conducted in a total of 13 districts and cities in 7 provinces, this study tested five sets of hypotheses regarding the relationships between grandparents' socioeconomic status, parental proximal and distal socioeconomic status and the academic performance of migrant and left-behind children. The findings show that the reproduction model of socioeconomic status can explain the reproduction of education among migrant workers' children in China and that educational outcomes across the studied three generations can be transmitted. G1 grandparents' socioeconomic status is positively linked to G2 academic performance and education levels, and G2 parental academic performance and education levels have a positive influence on G3 academic performance. Generally, parents' distal academic performance and education levels play an important role in G3 academic performance, while the relationship is not significant between grandparents' socioeconomic status and G3 academic performance. However, the influence of grandmothers' and parents' socioeconomic status is different between migrant and left-behind children. Grandmothers' and parents' occupation statuses only have a significant impact on left-behind children. Economic resources and caring play an important role in the academic performance of left-behind children. The educational reproduction of migrant workers' children has different logics among migrant and left-behind children. Migrant children mainly rely on the reproduction of parents' socioeconomic status. For left-behind children, a multigenerational production logic is involved in their educational reproduction; parents contribute to the first round of reproduction, and grandparents shape the second round of reproduction. These findings identify the important roles of migrant children living with their grandparents and grandmothers' occupation status in the reproduction of migrant workers' children's academic performance.

As one of our most significant findings, when controlling for parents' education and employment (Table 5), grandparents' educational level does not have a significant influence on the academic performance of migrant workers' children. This result is consistent with previous research (Erola & Moisio, 2007) showing that after controlling for parents' social class, grandchildren's social class is independent of grandparents' social class. A further analysis found that grandmothers' occupation status only influences the educational attainment of left-behind children and not that of migrant children. Migrant children's grandmothers may not live with them and thus may only provide have an influence on their education. This result is consistent with the findings of some previous studies (Zeng & Xie, 2014) exploring the importance of coresident grandparents for left-behind children. However, grandmothers' occupation statuses are negatively associated

with left-behind children's academic performance. This finding supports the argument that grandparents' supervision of left-behind children is not sufficient (Huang et al., 2015). For grandmothers who have other jobs, G3 left-behind children are less likely to have better academic performance. These grandmothers may not have time to provide sufficient care for their grandchildren. While grandmothers are traditionally the main care providers in rural families and no formal child care provision is available in rural China, in rural areas, disadvantaged older people usually tend to work to make a living. Studies of mothers who work outside the home have found that they have less time available for child care, which may limit their roles as cultural socializers, and children and young adults have been found to spend much less time with their mothers than in previous generations (Kalmijn, 1994).

This study shows that G2 parental distal academic performance and education level are correlated with the academic performance of migrant workers' children, while parental occupation status is only correlated with the academic performance of left-behind children. Additionally, G2 distal academic performance significantly influences migrant workers' own education level. Consistent with the interactionist perspective, a reciprocal process exists whereby early socioeconomic status(SES) predicts how children's personal characteristics can influence their SES in adulthood. The model proposes intergenerational continuity from G1 to G2 SES and from G1 to G2 family dynamics (Conger et al., 2010). As most migrant workers are poorly educated (Han et al., 2011; Ma et al., 2018) while most migrant children cannot enter public schools and can only attend lower-quality schools for migrant children (Chen & Wang, 2013), this may lead to the reproduction of educational disadvantages among migrant families. Moreover, G2 distal academic performance and education level significantly influence the academic performance of migrant and left-behind children, which is consistent with previous literature (Guo, 2011; Zhou et al., 2015). Parental absence is also associated with children's academic performance. Interestingly, we found that parental occupation status only influences the academic performance of left-behind children. Compared to G2 parents working as general workers, parents of left-behind children working in other professions to have better academic performance. This result is in line with the findings of previous studies (Hu, 2013; Mu & De Brauw, 2015) regarding the importance of economic resources for left-behind children. "Other" parental occupations refer to lower occupation levels with less income. A reduction of family economic resources will affect the value of remittances, thus reducing educational investments in left-behind children and affecting their academic performance. Previous studies on remittances have found that remittances increase economic resources and are correlated with active participation in parenting for left-behind children (Arguillas & Williams, 2010).

It is important to discuss control variables found to be significant in the models. The findings given in Table 5 show that the child's gender, parent's gender, school type, and family income levels are significantly related to the academic performance of migrant workers' children. Among migrant and left-behind children, girls outperform boys in academic performance. Migrant parents usually place much stricter controls on their daughters than on their sons (Sarroub, 2001). Such control may heighten girls' motivation to achieve strong academic performance.

Compared to those for fathers, mothers' academic performance and occupational status are positively associated with left-behind children's academic performance. This result is inconsistent with the argument that parental absence is adversely associated with children's well-being (Zhou et al., 2020). It may be that since only data for parents who completed the questionnaires were included in the study, we cannot compare the influence of both parents. School type, especially studying at a public school, was only significantly related to migrant children's academic performance. For migrant children, public schools are usually associated with better educational resources. The previous literature shows that when controlling for other factors, migrant children who are educated at migrant-only schools report poorer achievement and higher degrees of loneliness than similar migrant students enrolled at regular urban public schools (Lu & Zhou, 2013). When given access to better educational resources, migrant students may be able to significantly improve their performance (Lai et al., 2014). Family incomes are only significantly related to left-behind children's academic performance. Previous research has found a positive relationship between parental migration and the academic performance of left-behind children. This may occur through mechanisms such as encouraging greater investment in left-behind children (Bai et al., 2018). Economic resources are important for left-behind children.

Our research findings largely support the ecological model of adolescent development. Factors at different ecological levels influence adolescent development; some factors protect adolescents from heightened risks, and other factors increase the probability of problematic behaviours (Shek & Siu, 2019). First, parental distal academic performance and education levels can be regarded as encouraging positive adolescent development, including adolescents' academic performance. Second, grandmothers and parents employed in other occupations can be risk factors for left-behind children. Third, in addition to socioeconomic predictors (i.e., social address models), impacts on academic performance across three generations must be considered. Fourth, in addition to family socioeconomic characteristics, other personal factors also play important roles in the academic performance of adolescents. Children's genders and school types play significant predictive roles in their academic performance. Policy and social services should be designed to promote migrant and left-behind children's development. In terms of social services, evidence-based practice is necessary to determine whether intervention programs are effective and beneficial for adolescents (Leung & Fung, 2021). Positive youth development (PYD) programs should be introduced to promote youths' multiple psychosocial competencies and facilitate the stock of internal and external developmental assets (Shek, 2006), especially in terms of family social capital, peer social capital and school social capital (Li et al., 2017). PYD programs should be introduced into rural and urban areas of China (Zhou et al., 2020) to help migrant and left-behind children develop multiple psychosocial competencies and to utilize protective factors and cope with risk factors. When designing PYD programs, we must pay more attention to left-behind children with grandmothers and parents in other occupations, as these may be the most vulnerable children in rural China. In addition, parent–child relationships are very important for child and adolescent psychosocial development. A

strong parent–child relationship is conducive to academic achievement, and good academic achievement is conducive to happiness (Leung et al., 2021). Perceived parental behavioural control processes, parent–child relational qualities, and psychological well-being were found to be poorer in nonintact families than in intact families over time (Shek, 2008). These results identify a need to adopt strategies to enhance the parent–child relationships of left-behind children. When considering policies for migrant children, we recommend that measures offer migrant children better access to urban public schools and reduce the negative effects of parents' socioeconomic status on migrant children's academic performance. For left-behind children, we also recommend the design of special policies to improve education in rural China and the design special social work programs to improve grandparents' care or the provision of other high-quality care institutions.

This study has some limitations. First, to obtain a larger valid sample size, we appended data for first-born, second-youngest, and youngest children. As some families have more than 3 children, these appended data may not represent the full spectrum of migrant workers' children. In addition, children occupy different learning stages, and it may thus be more difficult to achieve better academic performance at higher learning stages. Thus, caution should be taken when interpreting the outcomes of comparing academic performance among children. Second, our data were collected from the second generation; that is, migrant workers answered questions about their parents and children in the survey. Although migrant workers know some information about their family members, they may make mistakes regarding other people's information, and a better approach would involve interviewing grandparents and children directly. However, in reality, it is quite difficult to apply such an approach, as individuals across the three generations may not live in the same place. In addition, for G2 academic performance, parents may not fully recall how they performed as students. In addition, only data for parents who completed the questionnaires were included in the survey. Thus, we did not consider information from all parents or parents' socioeconomic status, which may also have influenced their children's academic performance. Third, the survey did not ask about grandparents' incomes and education levels, occupation types, and migration statuses when G2 were still students. Thus, grandparents' incomes were not included as an indicator of socioeconomic status, and grandparents' education levels, occupation types, and migration statuses during the survey period were employed to substitute for information on G2 while they were still students. Fourth, as we did not know the parents' ages during their schooling periods, the parents' ages during the survey period were used to substitute for their ages during the schooling period and were controlled in the paths examining how G1 education level influences G2 academic rank and education levels. Fifth, as we tested many hypotheses, inflated Type 1 errors are likely. Finally, the effect sizes of some significant findings are not strong, potentially because we studied migrant families, in which most parents have average academic performance and low education levels and children also have average academic performance. It is thus difficult for such children to achieve better academic performance.

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Declarations

Conflict of interest We have no conflicts of interest to disclose.

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