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To What Extent Do Migrant Children Affect Local Children in Urban China: A Study of Cognitive and Non-cognitive Classroom Peer Effects

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Abstract. Recognising the multitude of social barriers to equal educational opportunities faced by Chinese rural-to-urban migrant children, this paper examines the peer effects of migrant children on local children in urban public schools. Using the two-wave panel data from the China Education Panel Survey collected over the academic years 2013-2014 and 2014-2015, we examine to what extent are urban local children's cognitive and non-cognitive outcomes affected by class proportions of rural-to-urban migrant children. With a final sample of 3,613 individuals, we employ an identification strategy that utilises class-level random assignment and school fixed effects to separate social effects from contextual and correlated effects. We find no significant peer effects on urban local children's cognitive outcomes measured by Chinese, mathematics, English and cognitive ability scores. Except for the positive peer effects on urban local children's confidence in their future, we find no significant peer effects on urban local children's non-cognitive outcomes.

Keywords: Peer effects, Internal migration, Migrant children, Education, China

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1. Introduction

In recent decades, China witnessed unprecedented rates of economic growth and development enabled by the massive internal movement of rural-to-urban migrant workers. Migrant workers[1] who temporarily move to urban areas are provided with greater opportunities but are also limited by their *Hukou* household registration status (Chan and Buckingham, 2008). Acting as an internal "passport" system, China's Hukou system binds a citizen's rights and benefits entitlements to their place of Hukou registration, often their place of birth. By not having their Hukou registered in urban areas, migrant workers are subject to various institutional barriers. Migrant workers are often left without the entitlement to many social benefits, such as housing, health care, and in particular, their children's nine-year free compulsory education (Liang and Chen, 2007; Chan and Buckingham, 2008; Hu and Szente, 2010; Zhou and Cheung, 2017). On the other hand, by not being registered in urban areas, migrant workers and their children are also subject to various social barriers (Wong, Li and Song, 2005; Afridi et al., 2015; Sun et al. 2016). As a consequence, migrant workers are forced into the dilemma of whether or not to bring their children to the destination.

Children who are left in their hometowns, usually in rural regions, are known as *left-behind children*, and are often left without sufficient supervision and are generally worse off in many welfare measures (Lee and Park, 2010; Hu, 2013; Zhang et al., 2014; Shi et al., 2016; Hu et al., 2018). On the other hand, children who follow their parents to the destinations, commonly in urban areas, are known as *migrant children*.

Unlike their left-behind counter-parts, migrant children stay together with their parents. However, migrant children who temporarily move from rural to urban areas are also subject to numerous institutional and social barriers related to their education in urban areas (Liang and Chen, 2007; Hu and Szente, 2010; Montgomery, 2012; Liu, Liu and Yu, 2017; Zhou and Cheung, 2017). As a result, these institutional and social barriers have limited rural-to-urban migrant children in obtaining equal educational opportunities. That said, while many institutional barriers have been addressed by recent policy reforms, the social barriers have persisted. A major part of these social barriers has revolved around concerns over rural-to-urban migrant children's negative spillover effects, or peer effects, on urban local children in urban public schools.

Therefore, to address the social barriers to equal educational opportunity for rural-to-urban migrant children, this study seeks to examine the peer effects of rural-to-urban migrant children on the cognitive and non-cognitive outcomes of urban local children. Specifically, the following questions are addressed:

[1] While internal migrant workers can refer to any person who migrates from one area to another within a country for the purpose of work (rural-to-rural, urban-to-urban, rural-to-urban, and urban-to-rural), the majority of Chinese internal migrant worker are rural-to-urban temporary migrant children (China Labour Bulletin, 2019), often from lower socioeconomic backgrounds (Chan and Buckingham, 2008).

i) To what extent are urban local children's cognitive schooling outcomes affected by class proportions of rural-to-urban migrant children? and

ii) To what extent are urban local children's non-cognitive schooling outcomes affected by class proportions of rural-to-urban migrant children?

For the purpose of this study, we define cognitive outcomes as the schooling outcomes measured by the test scores in Chinese, mathematics and English along with composite cognitive ability. We define non-cognitive schooling outcomes as positive and negative mental outcomes related to school engagement measured in terms of emotional well-being and confidence (Sun et al., 2015).

Further, while migrant children commonly refer to any child who migrates with their parents, *rural-to-urban migrant children* are not only overrepresented among migrant children but are also found to be central to the question of migrant children's peer effects (Liang et al., 2019). Therefore, in this study, we refer to rural-to-urban migrant children as migrant children, unless otherwise made explicit. In consequence, we refer to *urban local children* as local children and their parents as local parents, unless otherwise made explicit.

This study contributes to the matter of migrant children's education in several ways. First, by examining migrant-to-local peer effects, this study contributes to the discussion on the social barriers to equal educational opportunity faced by migrant children. Second, this study contributes evidence to the literature on cognitive peer effects of migrant children, where the four existing studies have found somewhat inconsistent evidence. Our study most resembles that of Liang et al. (2019) who studied the cognitive peer effects of migrant children using the same data as this paper. In distinction, we examine the non-cognitive peer effects with the same cohort and utilise class-level random assignment as the core of our identification strategy. At last, to the best of our knowledge, this is the first study that examines non-cognitive peer effects of migrant children on local children in China.

In order to examine the peer effects between rural-to-urban migrant children and urban local children, we use ordinary least squares (OLS) regressions to relate class-level rural-to-urban migrant ratios to individual cognitive and non-cognitive outcomes. To address sample selection biases as well as Manski's *reflection problem*, we i) utilise class-level random assignment within schools, and ii) control for school fixed effects.

In this study, we make use of data from the China Education Panel Survey (CEPS), a large-scale and longitudinal survey containing nationally representative data on individuals' cognitive and non-cognitive outcomes as well as various background characteristics. The survey collected responses in two waves, the academic year (2013-2014) as the baseline, and the following academic year (2014-2015) as the second wave. After applying our various sample specifications, our final sample consists of 3,613 students within 92 classes, 51 public schools across 23 counties. Of the

3,613 observations, we identify 451 rural-to-urban migrant children, 383 urban-to-urban migrant children and 2,779 urban local children.

The results of this study suggest that the proportion of rural-to-urban migrant children has no significant effects on urban local children's cognitive outcomes, neither in Chinese, mathematics, English nor cognitive ability. Moreover, out of our total six measures of non-cognitive outcomes, we only find significant positive peer effects in one, namely the confidence indicator measured by the local children's confidence in their future. For our remaining five non-cognitive outcomes, the results do not suggest that local children are affected by any peer effects, positive or negative.

In the broader economic context, we study the educational prospects of migrant children because it not only illustrates China's current socio-economic state, but also provides a better understanding of China's future economic development in terms of human capital, poverty alleviation and the potential consequences of an ageing population. According to China's National Bureau of Statistics, approximately 103 million children (38%) of all Chinese children in 2019 were children of migrant workers. Of this cohort, 34.4 million (33.4%) were identified as migrant children, and 68.8 million (66.6%) were identified as left-behind children (NBS, 2020*).*

The rest of the paper is organised as follows. Section 2 provides a thorough background on the migrant children and the institutional and social barriers that limit their education. Section 3 presents a literature overview of previous research concerning the cognitive and non-cognitive peer effects of migrant children. Section 4 describes our conceptual framework and final hypotheses. Thereafter, section 5 presents our data and methodology used to examine the classroom peer effects between rural-to-urban migrant children and urban local children. Section 6 presents our empirical results. Section 7 provides discussions on the results, limitations of our study and contributions of our findings. We conclude this paper in section 8 and provide suggestions on future research.

2. Background

This section aims to provide an overview of the institutional and social barriers that limit the migrant children's access to equal educational opportunity. To understand the root of these barriers, we first explain China's Hukou system.

2.1. Hukou system and the floating population in China

Created in 1958, the *Hukou* household registration system is a core institution used to regulate and control the flow of internal mobility and migration in mainland China (Chan and Buckingham, 2008). Designed as an internal "passport' system, the Hukou system today serves as an important determinant of citizens' rights and entitlements to social benefits, such as housing, health care, and the nine-year free compulsory education for children (Liang and Chen, 2007; Chan and Buckingham, 2008; Hu and Szente, 2010; Montgomery, 2012; Zhou and Cheung, 2017). A citizen's Hukou status is ascribed at birth and registered to a *place of Hukou registration* and a *Hukou type* (Wu and Treiman, 2004; Montgomery, 2012). The place of Hukou registration is determined based on the mother or father's permanent residence address. The Hukou type that has been categorised as agricultural was predominantly held by rural citizens, the type that has been categorised as non-agricultural was predominantly held by urban citizens. In essence, an individual's Hukou type determines the social benefits available to them, and the place of Hukou registration determines where they should receive them.

For decades, the non-agricultural Hukou type has been sought after as it entitles the bearer to a greater array of state-provided socio-economic benefits (Chan and Buckingham, 2008). At the same time, China witnessed unprecedented rates of economic growth and development, fueled by surging levels of urbanisation and internal migration (Cao et al., 2018). Under the Hukou system, mobility in China can be sorted into *formal migration* and *floating migration* (Chan and Buckingham, 2008). *Formal migration,* or Hukou migration, requires a legal change in place of Hukou registration and therefore transfers the citizen's rights and entitlements to the destination. *Floating migration*, or non-Hukou migration, is regarded as a temporary movement where the citizen's rights and entitlements remain in their origin province or county. Since 1978, the mobility in China has been dominated by the floating of rural migrant workers, fuelling the economic development localised in the country's urban areas (Cui and Cohen, 2015). Rural-to-urban migrant workers earn significant higher income compared to their rural counterparts, and have therefore benefited from temporarily moving to developed urban economies (Cao et al., 2018). Yet, despite decades of Hukou reforms, it has been difficult for average migrant worker families to formally migrate their Hukou to the urban areas (Wu and Treiman, 2004; Cui and Cohen, 2015). This means that many migrant worker families are left without their rights and entitlements, and are forced to work and live marginalised.

Furthermore, the economic discrimination based on Hukou has not only been a major contributor to China's socio-economic inequality (Liu, 2004; Hao and Yu, 2017), it has also bred a growing

social stigma, discrimination and marginalisation (Wong, Li and Song, 2005; Afridi et al., 2015; Sun et al. 2016) subjecting the floating population. Thus, while the Hukou system has served vital functions for mobility control and resource allocation, it has also posed various limitations and barriers to migrant workers and their children.

When temporarily moving to urban areas, migrant workers often need to decide whether or not to bring along their children. This has been regarded as a difficult decision because migrant children who temporarily move to urban areas face numerous institutional and social barriers to equal educational opportunities. While this study aims to address the social barriers, the institutional barriers are vital to the understanding of migrant children's education and will, therefore, be thoroughly presented below.

2.2. Institutional barriers to equal educational opportunities

In terms of equal educational opportunities, migrant children mainly face three institutional barriers. First, because of their Hukou status, migrant children are unentitled to the nine-year state-funded compulsory education offered in the urban areas (Wang et al., 2017). Stipulated by law, China's nine-year compulsory education is offered by public schools spread across counties and districts, where the state education budget is allocated based on Hukou-registered school-aged children (Montgomery, 2012; Chen and Feng, 2013). Therefore, under normal circumstances, local governments lack the financial and administrative resources to accommodate the educational needs of migrant children (Montgomery, 2012; Chen and Feng, 2019). Prior to recent reforms, public schools only admit students who reside within the school's district and possess local Hukou registered in the county the school belongs to (Wang et al., 2017). Historically, varying exceptions are made by county authorities. However, migrant children who wish to enter public schools are often subject to hefty "out-of-district" fees and are required an array of official documents and certificates (Goodburn, 2009; Montgomery, 2012; Chen and Feng, 2019). These exceptions are also often limited by the state-budgeted spots in each school.

Second, because of Hukou-specific restrictions on higher education entrance exams, migrant children are limited from entering higher education in urban areas (Xiong, 2017; Wu and Ge, 2017; Chen, Feng and Han, 2019a). Across the nation, most counties impose Hukou-specific restrictions on the high school and college entrance exams. Migrant children who intend to receive high school and college education must return to their places of Hukou registration to take the entrance exams. As a consequence, migrant children have not only been forced to prematurely interrupt their school attendance in urban areas, but are also academically worse off because they perceive unfair prospects to urban higher education (Guo and Zhao, 2019).

Third, because of the restricted access to public schools, migrant children have no choice but to attend private migrant schools that are found to lack in general teaching quality, school facilities and government subsidies (Goodburn, 2009; Chen, Feng and Han, 2019b). Private migrant schools have

emerged across the country's urban areas in response to the excess demand for migrant children's education. However, migrant children enrolled in migrant schools have been found academically worse off compared to fellow migrant children enrolled in urban public schools (Chen and Feng, 2013; Chen, Feng and Han, 2019a) as well as to their rural counterparts enrolled in rural public schools (Wang et al., 2017). That said, the academic attainment gap between migrant and urban local children has also been found significantly reduced when migrant children are enrolled in public schools (Chen and Feng, 2013; Lai et al., 2014). Therefore, scholars have advocated that lowering of institutional barriers to public schools is vital to providing equal educational opportunity for migrant children.

Amidst the institutional barriers subjecting migrant children, Chinese policymakers have received wide criticism and pressure to take action. The government has in response made continuous efforts of Hukou-related reforms to reduce the educational inequality subjecting migrant children (Cui and Cohen, 2015). This stream of Hukou reforms can be divided into four phases; 1978–1991, 1992–2000, 2000–2013, and 2014–2016 (Zhang et al., 2019).

The first changes in the traditional Hukou system were made after 1978 when outside investments and involvement were opened up to China's economy. These changes allowed for more relaxed rules against internal migration and allowed job access for migrant parents (Cui and Cohen, 2015). The second phase started in 1996 when public schools became obligated to admit migrant children given that they hold temporary residence permits. However, average migrant children came from working families that were unlikely to obtain such permits, and thus remained unable to attend public schools. It was not until the third phase in the 2000s that the public saw tangible changes in the Hukou system (Ming, 2014). In 2001, a policy document established that home and host local governments shared the financial and administrative responsibilities over migrant children's education (Zhou and Cheung, 2017). However, this establishment has been implemented to varying extents across the counties. Due to uncertain costs associated with the implementation, public schools were also forced to charge migrant children with higher fees. The policymakers recognised the financial discrimination, and eventually illegalised the charging of discriminatory tuition fees in 2008 (Ming, 2014).

Finally, in 2014, the central government implemented the "National New-type Urbanisation Plan (2014-2020)" (NNUP), which proposed a unified Hukou system. The new plan aimed to provide equal opportunities of education for at least 99% of the migrant children (Wang et al. 2015). However, the NNUP failed to address the children's rights to post-compulsory higher education, and it remains uncertain if the plan will be completed.

Nonetheless, despite the four phases of reforms, many migrant children are still subject to persisting institutional barriers in the form of hidden "out-of-district" fees and requirements for additional official documents and certifications. Because these persistent institutional barriers are difficult to

overcome, many migrant children remain unable to obtain equal educational opportunities (Zhou and Cheung, 2017; Chen, Feng and Han, 2019b). Although the institutional barriers faced by migrant children have been the centre of previous literature and policy reforms, it is equally important to highlight the social barriers faced by migrant children enrolled in public schools.

2.3. Social barriers to equal educational opportunities

In terms of equal educational opportunity, migrant children are mainly troubled by two kinds of social barriers. First, migrant children enrolled in public schools have been found discriminated against by their teachers and local peers (Afridi et al., 2015; Sun et al., 2015, Li and Jiang, 2018). On one hand, migrant children may be targeted for simply having a migrant status and a lower socio-economic background. Migrant children may subsequently lose their sense of belonging, become stereotyped and be subject to social exclusion by the local peers. On the other hand, some migrant children enrolled in public schools may also be treated differently for their odd manners, poorer concentration and poorer academic results. Regardless of the reason, this discrimination have proved to negatively impact the relationship between migrant children and their teacher and local peers. Migrant children excluded and discriminated against in public schools have also been found with poorer mental health and academic attainment (Afridi et al., 2015; Sun et al., 2015, Yiu, 2016).

Second, through the discrimination by urban local parents, migrant children are also deprived of having local peers and access to higher quality public schools (Chen and Feng, 2013; Liu, Liu and Yu, 2017; Wang et al., 2018). With lower barriers coupled with a growing migrant population, urban public schools have witnessed a notable increase in the number of enrolled migrant children. Fearing negative spillover effects on their children, local parents have since raised great concerns over the influx of migrant children. In parts of the country, local parents have been found to avoid public schools that enrol many migrant children (Liu, Liu and Yu, 2017). Moreover, by not enrolling their children in certain public schools, local parents may also reduce the level of state funding available to those schools. As a result, migrant children are left in public schools with much fewer local peers, insufficient funding and poorer teaching quality (Liu, Liu and Yu, 2017). In some extreme cases, migrant children have no choice but to be placed in migrant-populated "pseudo" public schools that are not equitable to common public schools. In this respect, the local parents' fear of negative spillover effects, passive deprive migrant children of equal educational opportunities.

In summary, despite the efforts that have been made to provide migrant children with equal educational opportunities, many institutional and social barriers persist. We recognise that compared to institutional barriers, there has been limited progress made to resolve various social barriers (Liu, Liu and Yu, 2017; Guo and Zhao, 2019). The objective of this study is therefore to address the social barriers to equal educational opportunity for migrant children. Specifically, we seek to examine the peer effects of rural-to-urban migrant children on urban local children in urban public schools.

3. Literature Review

This study relates to two pools of existing literature that concern the question of the cognitive and non-cognitive peer effects of internal migrant children in China. This section presents previous literature concerning cognitive and non-cognitive peer effects of migrant children and concludes with how this study contributes to existing literature.

3.1. Cognitive peer effects of migrant children

First, this study builds on the small pool of literature that addresses the cognitive peer effects of Chinese migrant children. At present, there is a wealth of literature on the academic attainment of international migrant children and how it relates to that of the native children in developed countries. In these studies, a pattern of negative spillover effects from immigrant peers on native students has been evident (Ohinata and van Ours, 2013). However, the knowledge of internal migrant peer effects is limited (Chen and Feng, 2019; Liang et al., 2019).

In 2018, three separate studies were conducted with inconsistent findings. Chen and Feng (2019) focused on the peer effects among fourth-grade students in Shanghai and found that exposure to higher school- or class-level proportions of migrant children does not generate negative cognitive peer effects. However, previous evidence has suggested that older adolescents are more susceptible to peer influence (Li et al., 2013; Nie et al., 2015). Using the baseline wave of the China Education Panel Survey (CEPS), Hu (2018) studied the cognitive peer effects of migrant children among seventh and ninth-grade students. The study found that proportions of migrant children have large and negative effects on the academic performance of local children and that the negative spillover effects are concentrated on male local children in larger cities. Using the same dataset, Wang et al. (2018) recognised that newly admitted seventh-grade students had not been sufficiently subject to social influence. The study therefore focused on the cognitive peer effects among ninth-grade students and found that class-level proportions of migrant children have small and positive effects on local children's test scores in Chinese, but no significant effects on mathematics and English test scores. To reduce selection biases, Hu (2018) and Wang et al. (2018) both made use of the class-level random assignment and tested the randomisation on the class and school level.

In the following year, Liang et al. (2019) used the baseline and second wave of CEPS to study the cognitive peer effects of migrant children. The study differentiated between rural-to-urban and urban-to-urban migrant children and conducted an OLS analysis regressing cognitive and subject test scores on class proportions of migrant children. Instead of using the random class assignment to address selection biases, the study used the baseline wave test scores as value-added components and controlled for school fixed effects. The study found that rural-to-urban migrant children have negative peer effects on the academic attainment of urban local children, particularly in low- and

middle-ranked schools, and that the urban-to-urban migrant children had no significant negative peer effects.

3.2. Non-cognitive peer effects of migrant children

Second, this study builds on the limited literature focusing on non-cognitive peer effects of migrant children. To date, the literature has substantial evidence that peer effects among children and adolescents mediate various externalised behavioural and social problems such as substance use and delinquency (Nakajima, 2007; Monahan et al, 2014), sexual behaviour (Ali and Dwyer, 2011), risk-taking and aggressive behaviour (Cohen and Prinstein, 2006; Gioia, 2017; Riberio and Zachrisson, 2019). Studies of spillover effects related to behavioural and social outcomes have been motivated by growing evidence that children in schools tend to spread negative social and behavioural problems to peers. Using US nationally representative pre-school data, Neidell and Waldfogel (2010) found significant and robust spillover effects on mathematics and reading outcomes, but statistically insignificant effects on various behavioural and social outcomes. However, given that the authors used preschool data, the insignificant results may be explained by the findings that older adolescents are more susceptible to peer influence (Li et al., 2013; Nie et al., 2015).

To the best of our knowledge, there are little to none studies that directly address the non-cognitive peer effects of migrant children. Nonetheless, current studies in China have found evidence for distinct differences in non-cognitive outcomes between migrant and local children. Hu et. al (2018) estimated the prevalence of behavioural problems among left-behind children, migrant children and local children in China, and compared the risks of behavioural problems among the types of children. The study found that there is indeed a difference in behavioural problems between the different types of children; left-behind children and migrant children were more likely to have internalising and externalising behaviour problems. Meanwhile, local children were less likely vulnerable to behavioural problems. The authors also found that peer relationships were significantly associated with the well-being of migrant and left-behind children.

Further, current studies have also specifically examined the differences in non-cognitive outcomes between migrant and local children enrolled in urban public schools. In their meta-analysis, Sun et al. (2015) selected 25 studies on health outcomes of migrant children. The analysis found that migrant children in public schools have greater mental health problems and lower levels of well-being compared to local children. Yiu (2016) further problematised how the psychological issues of migrant children in public schools may be due to uncaring teachers who exclude and hold prejudices against them. Lastly, Gao et al. (2015) did not find evidence that migrant children enrolled in public schools have less behavioural problems compared to their local peers. However, the authors suggested that the lack of differences may be due to the process of interaction, adaptation and assimilation between migrant children and their local peers.

To summarise, the current literature has evidenced that there are significant differences in non-cognitive outcomes between migrant and local children enrolled in urban public schools. In the case where no significant differences were found, the authors suggested peer influence as an explanation.

3.3. Contribution to research

This study contributes to the existing literature in several ways. First, this study contributes evidence to the literature on cognitive peer effects of migrant children, where the existing evidence has been somewhat inconsistent. Second, to the best of our knowledge, this is the first study that examines non-cognitive peer effects of migrant children on fellow migrant and local children in China. Lastly, in distinction from Liang et al. (2019) who also studied the cognitive peer effects of migrant children using the same data as this paper, we study the cognitive peer effects by employing another set of sample specifications, explore the non-cognitive peer effects with the same cohort, and employ an alternative identification strategy that utilises class-level random assignment.

4. Conceptual Framework and Hypotheses

The following section develops our conceptual framework by first elaborating on the fundamental assumptions of our study, then explaining our identification strategy to estimate the peer effects among classroom peers. Apart from previous literature within migrant peer effects, our conceptual framework is built on Manski's (1993) conceptualisation of peer effects in terms of social, correlative, and contextual effects. This section concludes with the proposed hypotheses for this study.

4.1. Group heterogeneity and peer influence

We base our conceptual framework on a set of basic assumptions that i) migrant and local children enrolled in public schools have different attributes, ii) these attributes are directly or indirectly associated with cognitive and non-cognitive schooling outcomes, and iii) these attributes spillover primarily through within-class interactions - classroom peer effects.

Being exposed to different circumstances before entering middle school, migrant children and local children are expected to have different attributes upon entry. Different circumstances can take form in household interactions, pre-middle school academic experiences, living standards, migration experiences and more. In the case of migrant and local children, we assume that the two groups are systematically exposed to different sets of circumstances which lead to different sets of attributes for each group.

This assumption is supported by a wealth of literature on the systematic differences between migrant and local children. Compared to local children, migrant children are consistently found to come

from families with lower income levels, lower parental educational attainment, fewer family interactions and a higher number of siblings (Duan et al., 2014; Chen and Feng, 2019). These characteristics are found to associate with attributes such as educational aspiration, contentiousness, ability, concentration and more. On the other hand, compared to local children, migrant children are also found with internalised and externalised behavioural problems (Gao et al., 2015; Hu et al., 2018; Lu et al., 2019).

Furthermore, we assume that the different attributes are directly or indirectly associated with cognitive and non-cognitive schooling outcomes. Evidence for this assumption is covered in existing literature, and will not be in focus for this study. While some attributes serve as determinants of either cognitive or non-cognitive schooling outcomes, a majority serve as determinants for both. Cognitive and non-cognitive schooling outcomes are also found to be determinants of each other (Vignoles and Meschi, 2010).

Finally, we assume that the attributes of one group of children can spill over to another group within the same classroom. Supposed that migrant children are equipped with attributes that lead to lower cognitive and non-cognitive outcomes. Then, by placing migrant children in classrooms with local children, the local children are more likely to develop similar attributes and to attain worse outcomes. In the same way, suppose that migrant children are instead equipped with attributes that lead to higher cognitive and non-cognitive outcomes. Then, by placing migrant children in classrooms with local children, local children are more likely to develop such attributes and to attain better outcomes.

To determine to what extent such peer effects impact local children, we have to first address any potential selection bias within our sample. One form of selection bias is endogenous school sorting, which arises when families with high achieving students, independent of migrant status, send their children to public schools of higher quality. As previously noted, for many local parents, this may imply choosing public schools with less migrant children. Such endogenous school sorting distorts the level of true and observable peer effects as it reduces between-school heterogeneity.

Another form of selection bias is endogenous class sorting, which occurs when schools assign classes based on endogenous factors. An example is sorting based on test scores, in which case higher- and lower-achieving students are assigned to classes with respective peers. Such endogenous class sorting may also distort the level of true and observable classroom peer effects.

Moving forward, we use a framework commonly used in peer effects literature to outline our identification strategy that identifies peer effects and addresses the potential selection biases.

4.2. Social, contextual and correlated effects

To identify peer effects, international studies within peer effects have made use of a three-dimensional framework proposed by Charles F. Manski. According to Manski (1993), peer effects within peer groups are often entangled between three separate channels of outcome variation: *social (endogenous) effects, contextual effects,* and *correlated effects*. To estimate the social effects, an individual's behaviour influenced by the group they belong to, one has to control for i) the individual's behaviour explained by the group's average behaviour due to common exogenous factors (contextual effect), and ii) the individual's behaviour explained by the group's average behaviour due to common external shocks (correlated effect). Manski coined this entanglement, *the reflection problem*.

This study set out to examine the social effects that relate class proportions of rural-to-urban migrant children to urban local children's cognitive and non-cognitive outcomes. *Social effects*, also known as endogenous effects, refer to the variations in individuals' behaviour due to interactions within the peer group, in simple terms, the variations that are related to the group's behaviour. In this study, social effects would take form in, ceteris paribus, variations in an urban local child's behaviour due to variations in the average behaviour of classes with a certain class-level migrant composition. Subsequently, the variation in the urban local child's behaviour due to social effects would reflect in the variation in their own cognitive and non-cognitive outcomes.

Such social effects can occur through various mechanisms, such as i) motivational, concentration and other academic behaviours that can be transferred between peers, ii) teachers' teaching styles and attitudes adjusted to class-level migrant compositions, iii) classroom climates, as well as, iv) the formation of friendship groups. If migrant children's academic or social behaviours are generally worse than that of local children, then higher migrant ratios would predict more negative spillover effects on the local children. Given that such mechanisms of social effects have been examined in previous studies (Hu, 2018; Wang et al., 2018; Liang et al., 2019), we will not empirically identify or examine them.

Contextual effects are attributed to the exogenous factors, i.e. background characteristics, of a peer group and how they affect individuals' behaviour. An example would be that students from families with similar socioeconomic backgrounds end up having similar academic and emotional outcomes. Assuming that migrant children have migrant worker parents who are relatively less educated, we would predict that they receive less guidance and expectations from their parents in regards to academic achievements. This would cause the student to experience comparatively less support and motivation resulting in poorer academic outcomes. Similarly, assuming that local children have local parents who receive relatively better employment terms thanks to their Hukou status, we would then predict that they receive more care and companionship from their parents. As a consequence, the

student experiences more support and security, resulting in better emotional outcomes. In both cases, the outcome of each student is independent of how they had interacted with their peer group.

According to Manski (1993), to separate the social effects from contextual effects, one needs to possess knowledge of exogenous factors that define the different peer groups. In other words, one needs to control for heterogeneity, within and between peer clusters. In our study, we cluster the classroom peer groups on the school level.

To control within-school heterogeneity, studies in peer effects commonly control for individual and family background characteristics. Further, scholars such as Liang et al. (2019) have used lagged scores to address the unobserved heterogeneity. Such lagged scores capture individual heterogeneity endowed in the individuals' previous outcomes. For example, given that an individual has attended a better primary school, one may expect that the quality of the primary school would partly reflect in the individual's cognitive scores upon entering middle school. In the case of estimating peer effects, lagged scores can be used to control for unobserved heterogeneity before the peer group formation.

In this study, we are fortunate to use schools that randomly assign newly admitted students to classes. If students are randomly assigned to classes, the class proportion of migrant children should also be randomised within schools. As a result, we expect that within-school heterogeneity is randomised and that within-school contextual effects are eliminated. Because students are randomly assigned to classes, we also do not expect the selection bias due to endogenous class sorting.

Further, contextual effects also may be attributed to between-school heterogeneity. To control for between-school heterogeneity, we adopt school fixed effects controls. Effectively, school fixed effects also address the selection bias due to endogenous school sorting.

Correlated effects refer to correlations in variations of individuals' outcomes because they are subject to similar environments and circumstances, or identical environmental shocks. For instance, students who have a specific kind of homeroom teacher attain better academic scores. In this instance, students in the same classes may be attaining higher academic scores, not because of how they interact within the peer group, but because they all receive guidance from the same teacher. Given that such shared shocks are difficult to observe, it is typically hard to seperate correlated effects with the social effects due to interactions within peer groups. Are individuals doing better because they sit in the same classroom, or because they sit with their class peers?

To separate the social effects from correlated effects, previous studies such as Wang et al. (2018) and Liang et al. (2019) have controlled for various classroom and teacher characteristics. In this study, we again make use of class-level random assignment to control for any correlated effects. With randomly assigned classes, we expect that correlated shocks are randomised and that correlated effects are also eliminated.

In conclusion, by making use of the class-level random assignment and school fixed effects, we control for correlated and contextual effects and isolate the social effects that relate class proportions of rural-to-urban migrant children to urban local children's outcomes. Finally, we recognise that our identification strategy relies much on the within-school randomisation of class-level migrant composition. Therefore, we will test the validity of the randomisation in Section 5.

4.3. Rural-to-urban migrant children and urban local children

To fulfil our objective, we restrict our study to the peer effects of rural-to-urban migrant children on urban local peers. While internal migrant children can refer to any child who migrates from one area to another within a country, possible scenarios being rural-to-rural, urban-to-urban, rural-to-urban, or urban-to-rural, the majority of China's migrant children are temporary rural-to-urban migrant children (NBS, 2020).

We exclude rural-to-rural and urban-to-rural migrant children as they are relatively uncommon cases. Based on findings from previous literature, we also exclude urban-to-urban migrant children as they have been found to have similar attributes to urban local children and have not appeared to be significantly engaged in classroom peer effects with urban local children. Lastly, given that the question of interest is the migrant children's access and barriers to public schools, we restrict our study to only public schools.

All in all, our study examines the peer effects of rural-to-urban migrant children on urban local children in public schools located in urban areas.

4.4. Hypotheses

Based on our conceptual framework and previous literature, our final hypotheses are formulated as:

Hypothesis 1: Urban local children's cognitive outcomes are either positively or negatively affected by class-level rural-to-urban migrant ratios.

$$H_0 : \beta_j = 0 \qquad H_1 : \beta_j \neq 0 \qquad (1)$$

Hypothesis 2: Urban local children's non-cognitive outcomes are either positively or negatively affected by class-level rural-to-urban migrant ratios.

$$H_0 : \pi_j = 0 \qquad H_1 : \pi_j \neq 0 \qquad (2)$$

5. Data and Methodology

This section provides a summary of the data used in this study, followed by presenting our econometric model and an overview of the various components. Further, it presents the descriptive statistics of our outcome and control variables. This section concludes with an examination of the validity of the identification strategy.

5.1. Data and sample specification

In this study, we use panel data from the China Education Panel Survey (CEPS) conducted by the National Survey Research Center at Renmin University of China together with 19 local universities and institutions of the China Social Survey Network (CSSN) system (NSRC, 2015). CEPS is a large-scale, longitudinal, and nationally representative survey that contains information on individuals' educational outcome as well as contextual factors such as individual, household, and school characteristics. CEPS individually surveyed students, parents, homeroom teachers, subject teachers and respective school principals. To date, the survey has collected responses in two waves, with seventh- and ninth-graders during the academic year (2013-2014) as the baseline, and the eighth-graders in the consecutive academic year (2014-2015) as the second wave. Ninth-graders were not included in the second wave as they had graduated middle school. The original sample includes approximately 20,000 students across 438 classes, 112 schools, in 28 county-level units in mainland China.

To study responses as panel data, we exclude the baseline ninth-graders from our sample selection. Further, we omit observations from private ordinary, private migrant and rural public schools, leaving the sample with only urban public schools as motivated by our research objective. Moreover, per our identification strategy, we restrict the sample selection to schools where students were randomly assigned to classes when entering seventh-grade and where no further reassignments to classes have occurred. The remaining sample only includes schools with randomised class-level compositions.

All in all, this results in a final sample of 3,613 students within 92 classes, 51 public schools across 23 counties. Of the 3,613 observations, we identify 451 rural-to-urban migrant children, 383 urban-to-urban migrant children, and 2,779 urban local children.

5.2. Econometric model

To determine to what extent the variation in local children is explained by the variation in class-level migrant ratios, we begin with the following baseline OLS models:

$$cognitive_{itcs}^{w2} = \beta_0 + \beta_1 MigRatio_{ics}^{w2} + \psi_s + \varepsilon_{ics} \quad (3)$$

$$noncognitive_{itcs}^{w2} = \pi_0 + \pi_1 MigRatio_{ics}^{w2} + \psi_s + \varepsilon_{ics} \quad (4)$$

where *i* denotes individuals, *t* denotes the type of child (rural-to-urban migrant or urban local), *c* denotes classes, and *s* denotes schools. $cognitive_{itcs}^{w2}$ refers to the second wave cognitive outcomes of student *i,* of type *t,* in class *c* and school *s*. $noncognitive_{itcs}^{w2}$ refers to the second wave non-cognitive outcomes of student *i,* of type *t,* in class *c* and school *s*. The main explanatory variable $MigRatio_{ics}^{w2}$ refers to the second wave percentage of rural-to-urban migrant children in class c. ψ_s refers to the school fixed effects. While school fixed effects are mainly part of our identification strategy, we include them in all of our specifications because i) classes are randomised within schools, and ii) the dependent variables are standardised on school level, see more in section 5.6. ε_{ics} is the error term clustered on the school level, which controls for heteroskedasticity, within-school correlations in the error term. The coefficients of interest, β_1 and π_1, capture the effects on urban local children's cognitive and non-cognitive outcomes, respectively, by variating the class proportion of rural-to-urban migrant children.

To further increase the precision of our estimates, we introduce lagged scores and individual and family characteristics. The lagged scores, $cognitive_{ics}^{w1}$ and $noncognitive_{ics}^{w1}$, refer to the baseline wave cognitive and non-cognitive outcomes of student *i,* of type *t ,* in class *c* and school *s*, respectively. The control variable, I_{ics}, is a vector variable for various individual and family characteristics of student *i,* of type *t ,* in class *c* and school *s*. Finally, we estimate the following final OLS models:

$$cognitive_{itcs}^{w2} = \beta_0 + \beta_1 MigRatio_{ics}^{w2} + \beta_2 cognitive_{ics}^{w1} + \gamma I_{ics} + \psi_s + \varepsilon_{ics} \quad (5)$$

$$noncognitive_{itcs}^{w2} = \pi_0 + \pi_1 MigRatio_{ics}^{w2} + \pi_2 noncognitive_{ics}^{w1} + \gamma I_{ics} + \psi_s + \varepsilon_{ics} \quad (6)$$

5.3. Dependent variables

5.3.1. Cognitive outcome variable

The cognitive outcomes, $cognitive_{itcs}^{w2}$, refer to the student's academic performance which is measured by i) the students' mid-term test scores during the Autumn semester: Chinese, mathematics and English, as well as ii) a composite cognitive ability test. We consider the three subjects as adequate measures of cognitive outcome as they are the main subjects tested when applying to public senior high schools. The test scores are standardised by schools to adjust for between-school differences in score scales and grading standards. Individual test scores are subtracted by within-school mean scores and divided by within-school standard deviations. Further, the standardised test scores are adjusted to a mean of 70 and standard deviations of 10 unit scores to have interpretable scores throughout our analysis. The standardised composite cognitive ability

variable computed by CEPS is based on the three-parameter-logistic (3PL) item response theory model[2]. A positive β_1 coefficient for the cognitive outcomes is interpreted as positive peer effects.

5.3.2. Non-cognitive outcome variables

The non-cognitive outcomes, $noncognitive_{itcs}^{w2}$, measure the students' subjective well-being, using survey questions where the students responded how they had been feeling during the last seven days, including whether they had been unhappy, depressed, sad or feeling blue. The students responded on a five-point scale where "1" indicated "never" and "5" "always". When interpreting the results of these non-cognitive outcomes, negative π_1 coefficients would indicate positive peer effects and vice versa. Further, we also consider the responses on whether the students are confident in their future or not as well as the highest educational level they expect themselves to achieve. These non-cognitive measures act as confidence indicators for individual educational aspirations. The π_1 coefficients of the latter two non-cognitive outcomes are interpreted oppositely compared to the former four; if the coefficients are negative, the peer effects are also negative. To ease interpretability, all non-cognitive measures have also been standardised by schools with a mean of zero and a standard deviation of one.

5.4. Explanatory variables

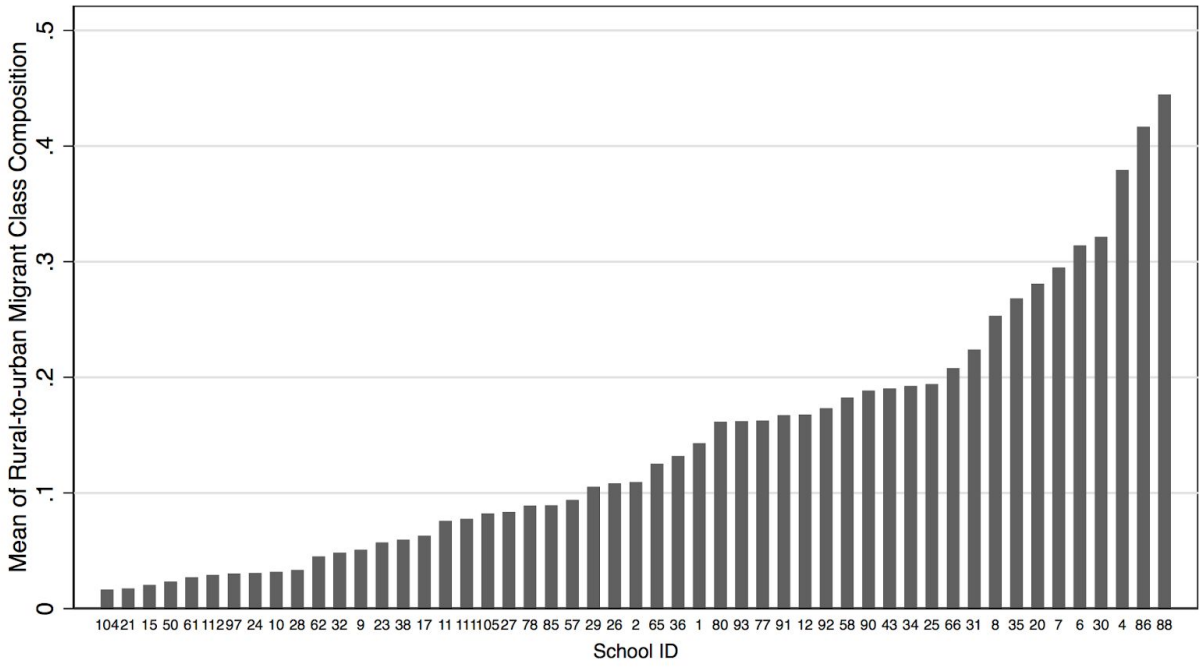
The main explanatory variable, $MigRatio_{ics}^{w2}$, measures the class-level rural-to-urban migrant ratio and is computed in several steps. First, we identify all migrant children and local children based on the student reported migration status in the survey. For students who have not reported their migration status, we identify those students who are not registered in the local county as migrant children. Second, we distinguish between whether the student is currently residing in a rural location or not. A rural location is defined as "Towns outside of the city/town" and "Rural areas" whereas the definition of an urban area is "Center of the city/town", "Outskirts of the city/town" and "Rural-urban fringe zone of the city/town". By making this decision, we can separate urban local children from rural-to-urban migrant children. Thus, from our sample, we identify rural-to-urban migrant children as any individual who i) have a migrant status, ii) hold an agricultural-type Hukou, and iii) reside in an urban location. Based on this information, we generate the rural-to-urban migrant children ratio relative to all students within each class. The interpretation of the coefficient is that a 100 percentage point increase in the proportion of migrant children in the class would lead to β_1 unit scores (π_1 standard deviation) increase in cognitive (non-cognitive) outcomes.

When estimating our final models, we omit any urban public schools with more than 80% rural-to-urban migrant children, as they are anomalies and could be regarded as "pseudo" public schools. We also omit classes where there are no rural-to-urban migrant children since there are no

[2] The standardised cognitive test score is a test designed by CEPS that measures individual cognitive ability in i) language, ii) geometry, and iii) calculation and logic. The test comprises 20 questions that measure individual cognitive ability with national and international comparability.

possible peer effects where there are no such migrant peers in the class. While this does not mean that urban local children in the omitted classes are not exposed to other types of migrant peers, urban-to-urban migrant children, it does leave us with the section of the sample where the peer effects of rural-to-urban migrant children could be observed. These two omissions reduced our final sample by observations from three schools. In our final sample, the observed variation in rural-to-urban migrant ratios has a mean of 12.66% and a standard deviation of 10.18% (see figure 1).

Figure 1: Distribution of class-level migrant composition across schools



Note: Data retrieved from CEPS

5.5. Lagged score components

The lagged score components, $cognitive_{ics}^{w1}$ and $noncognitive_{ics}^{w1}$, can be used to capture the individual educational endowment before the data collection. By including distinct lagged scores for respective specifications, one can control for historical inputs and inheritable endowments, and thereby attempting to control for any unobserved heterogeneity among observations (Todd and Wolpin, 2003). However, by utilising class-level random assignment, we do not need lagged scores to control for unobserved heterogeneity. Yet, we include the lagged score components in our specifications to increase precision and reduce the standard errors of our core estimates.

5.6. Control variables

Similar to the lagged score components, we do not need to control for background characteristics as we already utilise the class-level random assignment in our data. Again, we have chosen to include the background characteristics in our model to increase precision and reduce the standard errors.

For individual characteristics included in the vector variable, I_{ics}, we include a dummy variable for gender, a numeric variable for age, a dummy variable for whether or not the individual is the only child in the family, and a dummy variable for whether or not the individual is of an ethnic minority. For family characteristics included in the vector variable, I_{ics}, we include a set of dummy variables for each level of the mother and father's education, and a variable measuring the family's economical situation computed by CEPS. For school fixed effects specification, ψ_s, we include a dummy variable for each distinct school in the sample.

5.7. Descriptive statistics

Table 1 below displays the descriptive statistics for our cognitive and non-cognitive outcome variables for rural-to-urban migrant and urban local children respectively. In wave one, we find that the average English test scores and the composite cognitive ability are significantly higher for local children than that of migrant children. Yet, in wave two, the differences are no longer significant.

When observing the non-cognitive outcomes we find that rural-to-urban migrant children in wave two have significantly higher average scores in Feeling Blue, Unhappy and Sorrowful. In this case, a higher score translates into a more negative non-cognitive outcome. Thus, compared to local children, migrant children are worse off in three out of four non-cognitive outcomes measuring emotional well-being.

Moreover, we observe that the rural-to-urban migrant children's mean scores in the two confidence indicators, Confidence and Educational Expectations, are significantly lower than urban local children. In this case, lower scores are interpreted as lower non-cognitive outcomes. Thus, compared to local children, migrant children are worse off in the two confidence indicators.

At last in terms of subject test scores, these statistics do not support the assumption of contrasting attributes and outcomes between rural-to-urban migrant children and urban local children. However, this could be attributed to selection bias due to endogenous school sorting since the descriptive statistics does not include school fixed effects.

Table 1: Descriptive statistics for outcome variables

	(1) Rural-to-urban Migrant			(2) Urban Local			t-test Difference
Dependent Variable	N	Mean	SE	N	Mean	SE	(1)-(2)
Cognitive Outcomes							
Chinese (W1)	451	70.430	(0.441)	2779	69.983	(0.192)	0.447
Chinese (W2)	451	69.874	(0.484)	2779	70.052	(0.190)	-0.178
Mathematics (W1)	451	70.036	(0.486)	2779	70.099	(0.188)	-0.063
Mathematics (W2)	451	69.802	(0.480)	2779	70.135	(0.188)	-0.333
English (W1)	451	68.973	(0.487)	2779	70.191	(0.189)	-1.217*
English (W2)	451	69.257	(0.479)	2779	70.145	(0.189)	-0.888
Cognitive (W1)	451	70.598	(0.408)	2779	72.095	(0.155)	-1.497**
Cognitive (W2)	448	73.815	(0.359)	2758	74.566	(0.145)	-0.751
Non-cognitive Outcomes							
Feeling Blue (W1)	451	0.076	(0.046)	2779	-0.018	(0.019)	0.094
Feeling Blue (W2)	451	0.090	(0.048)	2779	-0.019	(0.019)	0.108*
Unhappy (W1)	451	0.072	(0.046)	2779	-0.025	(0.019)	0.097
Unhappy (W2)	451	0.090	(0.048)	2779	-0.020	(0.019)	0.111*
Not Enjoying Life (W1)	451	0.063	(0.046)	2779	-0.023	(0.019)	0.086
Not Enjoying Life (W2)	451	0.053	(0.048)	2779	-0.021	(0.019)	0.074
Sorrowful (W1)	451	0.060	(0.048)	2779	-0.022	(0.019)	0.082
Sorrowful (W2)	451	0.112	(0.047)	2779	-0.030	(0.019)	0.141**
Confidence (W1)	451	-0.135	(0.048)	2779	0.021	(0.019)	-0.157**
Confidence (W2)	451	-0.116	(0.045)	2779	0.013	(0.019)	-0.129*
Educational Expectations (W1)	451	-0.160	(0.052)	2779	0.025	(0.018)	-0.185**
Educational Expectations (W2)	451	-0.094	(0.049)	2779	0.010	(0.019)	-0.104*

Notes: The cognitive outcomes have been standardised with a mean of 70 and standard deviation of 10. The non-cognitive outcomes have been standardised with a mean of 0 and standard deviation of 1.
The value displayed for t-tests are the differences in the means across the groups.
**, and * indicate significance at the 0.01 and 0.05 critical level.

In Table 2, we present the descriptive statistics for our control variables for rural-to-urban migrant and urban local children respectively. Here, we find significant differences between the two groups of children.

First, we find that the mean age of rural-to-urban migrant children is significantly higher than that of urban local children. This supports the common observation that migrant children are generally older than their local peers due to their migration experience.

Table 2: Descriptive statistics for control variables

	(1) Rural-to-urban Migrant			(2) Urban Local			t-test Difference
Control Variable	N	Mean	SE	N	Mean	SE	(1)-(2)
Individual Characteristics							
Female	451	0.501	(0.024)	2779	0.496	(0.009)	0.005
Age (W2)	439	13.540	(0.034)	2720	13.418	(0.011)	0.122**
Minority	451	0.064	(0.012)	2779	0.082	(0.005)	-0.018
Only Child	451	0.339	(0.022)	2779	0.629	(0.009)	-0.290**
Family Characteristics							
Mother's Educational Level							
None	451	0.029	(0.008)	2779	0.019	(0.003)	0.009
Finished elementary school	451	0.200	(0.019)	2779	0.111	(0.006)	0.088**
Junior high school degree	451	0.537	(0.024)	2779	0.327	(0.009)	0.209**
Technical secondary school	451	0.060	(0.011)	2779	0.098	(0.006)	-0.038**
Vocational high school degree	451	0.011	(0.005)	2779	0.025	(0.003)	-0.014
Senior high school degree	451	0.115	(0.015)	2779	0.167	(0.007)	-0.051**
Junior college degree	451	0.024	(0.007)	2779	0.103	(0.006)	-0.079**
Bachelor degree	451	0.018	(0.006)	2779	0.129	(0.006)	-0.111**
Master degree or higher	451	0.002	(0.002)	2779	0.019	(0.003)	-0.017**
Father's Educational Level							
None	451	0.000	(0.000)	2779	0.004	(0.001)	-0.004
Finished elementary school	451	0.151	(0.017)	2779	0.083	(0.005)	0.068**
Junior high school degree	451	0.528	(0.024)	2779	0.317	(0.009)	0.210**
Technical secondary school	451	0.038	(0.009)	2779	0.089	(0.005)	-0.051**
Vocational high school degree	451	0.024	(0.007)	2779	0.025	(0.003)	-0.001
Senior high school degree	451	0.182	(0.018)	2779	0.188	(0.007)	-0.006
Junior college degree	451	0.038	(0.009)	2779	0.104	(0.006)	-0.066**
Bachelor degree	451	0.033	(0.008)	2779	0.160	(0.007)	-0.127**
Master degree or higher	451	0.002	(0.002)	2779	0.030	(0.003)	-0.027**
Family Economic Status	450	2.902	(0.024)	2774	2.940	(0.010)	-0.038

Notes: The way to interpret these variables is described in section 5.6

The value displayed for t-tests are the differences in the means across the groups.

**, and * indicate significance at the 0.01 and 0.5 critical level.

Second, we observe that migrant children are on average significantly less likely to be the only child of their families. This observation is also in line with the fact that the enforcement of the past one-child policy was less stringent in many rural areas.

Third, in terms of parental educational level, we find that migrant children's parents are more likely to be less educated. Compared to local mothers and fathers (45.7% and 40.4%), migrant mothers and fathers are more likely to only obtain a junior high school degree (76.6% and 67.9%). Accordingly, we also find that migrant children's parents are less likely to have higher education. Compared to local mothers and fathers (25.1% and 29.4%), migrant mothers and fathers are more less likely to obtain a degree beyond senior high school (4.4% and 7.3%).

At last, we observe that rural-to-urban migrant children and urban local children do not significantly differ in terms of gender distribution, ethnic minority distribution and family economic status.

5.8. Validity of the identification strategy

To conclude this section, we examine the validity of our identification strategy discussed in the conceptual framework. To begin, we examine randomisation in our identification strategy. If the schools in our sample employ class-level random assignment, then within-school class-level migrant composition should be uncorrelated with unobserved factors such as individual and family characteristics, that may affect our various outcome variables. To test that this is valid, we first perform a balancing test to examine if variations in the proportion of rural-to-urban migrant children are associated with variations in individual or family characteristics. In other words, this tests multicollinearity.

Table 3 displays statistics on the balancing tests of reporting OLS and school fixed effects estimates from separate regressions of the various individual and family characteristics on the proportion of rural-to-urban migrant children

By observing the table, we find few statistically significant differences after controlling for school fixed effects. Thus we can conclude that variations in observable characteristics are uncorrelated with the observed within-school variation in class-level migrant composition.

Table 3: Balancing test of the proportion of rural-to-urban migrant children

	(1) OLS		(2) School fixed effects	
Variables	Estimates	SE	Estimates	SE
Female	0.019	(0.063)	-0.145	(0.137)
Age (W2)	-0.110	(0.361)	-0.193	(0.288)
Minority	-0.237	(0.253)	-0.074	(0.080)
Only Child	-0.211	(0.335)	-0.428*	(0.176)
Mother's Educational Level				
None	-0.058	(0.082)	-0.003	(0.027)
Finished elementary school	0.104	(0.205)	0.236	(0.180)
Junior high school degree	0.327	(0.205)	0.196	(0.236)
Technical secondary school	-0.027	(0.079)	-0.069	(0.146)
Vocational high school degree	0.005	(0.025)	0.0191	(0.076)
Senior high school degree	0.062	(0.092)	-0.033	(0.179)
Junior college degree	-0.119	(0.085)	-0.0403	(0.107)
Bachelor degree	-0.267*	(0.116)	-0.314*	(0.156)
Master degree or higher	-0.039	(0.033)	0.0269	(0.053)
Father's Educational Level				
None	-0.009	(0.007)	-0.006	(0.015)
Finished elementary school	0.075	(0.141)	0.219	(0.196)
Junior high school degree	0.278	(0.228)	0.419	(0.209)
Technical secondary school	-0.024	(0.067)	-0.195*	(0.087)
Vocational high school degree	0.012	(0.034)	-0.032	(0.069)
Senior high school degree	0.027	(0.072)	-0.045	(0.170)
Junior college degree	-0.085	(0.081)	-0.187	(0.145)
Bachelor degree	-0.238	(0.141)	-0.140	(0.121)
Master degree or higher	-0.049	(0.041)	-0.016	(0.060)
Family Economic Status	0.399	(0.240)	0.176	(0.217)

Notes: Robust standard errors clustered at the school level are reported in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Moving on, by restricting our sample to random assigning schools, we assume such public schools do not differ significantly from non-randomly assigning schools. To test this implicit assumption, we perform a balancing test in order to compare randomly assigning public schools to non-randomly assigning public schools in urban areas.

The sample displayed in Table 4, differs from our actual final sample. For the purpose of this test, we have only omitted observations from i) non-public schools, ii) public schools in rural areas, iii)

schools that have classes with a rural-to-urban migrant ratio of either zero or more than 80% and iv) ninth graders of wave one.

Table 4: Balancing test of the characteristics of randomly assigning schools against non-randomly assigning schools

	(1) Non-randomly Assigning Schools			(2) Randomly Assigning Schools			t-test Difference
Variable	N	Mean	SE	N	Mean	SE	(1)-(2)
Individual Characteristics							
Female	658	0.476	(0.019)	4206	0.486	(0.008)	-0.010
Age (W2)	650	13.457	(0.023)	4108	13.463	(0.010)	-0.006
Only Child	658	0.614	(0.019)	4206	0.566	(0.008)	0.048*
Minority	658	0.053	(0.009)	4206	0.085	(0.004)	-0.031**
Rural-to-urban Migrant	658	0.078	(0.010)	4206	0.131	(0.005)	-0.054**
Family Characteristics							
Mother's Educational Level							
None	658	0.015	(0.005)	4206	0.024	(0.002)	-0.009
Finished elementary school	658	0.093	(0.011)	4206	0.129	(0.005)	-0.036**
Junior high school degree	658	0.381	(0.019)	4206	0.352	(0.007)	0.030
Technical secondary school	658	0.106	(0.012)	4206	0.093	(0.004)	0.013
Vocational high school degree	658	0.026	(0.006)	4206	0.022	(0.002)	0.003
Senior high school degree	658	0.170	(0.015)	4206	0.160	(0.006)	0.010
Junior college degree	658	0.106	(0.012)	4206	0.090	(0.004)	0.016
Bachelor degree	658	0.094	(0.011)	4206	0.110	(0.005)	-0.015
Master degree or higher	658	0.006	(0.003)	4206	0.016	(0.002)	-0.010*
Father's Educational Level							
None	658	0.006	(0.003)	4206	0.005	(0.001)	0.001
Finished elementary school	658	0.074	(0.010)	4206	0.097	(0.005)	-0.022
Junior high school degree	658	0.301	(0.018)	4206	0.342	(0.007)	-0.041*
Technical secondary school	658	0.122	(0.013)	4206	0.083	(0.004)	0.039**
Vocational high school degree	658	0.029	(0.007)	4206	0.027	(0.002)	0.002
Senior high school degree	658	0.220	(0.016)	4206	0.187	(0.006)	0.033*
Junior college degree	658	0.126	(0.013)	4206	0.091	(0.004)	0.035**
Bachelor degree	658	0.103	(0.012)	4206	0.140	(0.005)	-0.037**
Master degree or higher	658	0.017	(0.005)	4206	0.025	(0.002)	-0.008
Family Economic Status	657	2.901	(0.020)	4195	2.929	(0.008)	-0.028

School Characteristics							
School Ranking (W2)	7	0.332	(0.351)	53	-0.066	(0.136)	0.398
Neighbourhood (W2)							
Center of the city/town	7	0.857	(0.143)	53	0.698	(0.064)	0.159
Outskirts of the city/town	7	0.143	(0.143)	53	0.057	(0.032)	0.086
Rural-urban fringe zone of the city/town	7	0.000	(0.000)	53	0.208	(0.056)	-0.208
General School Facilities	7	-0.345	(0.504)	53	0.038	(0.133)	-0.383
Government Funding for Non-local Students							
Yes, and the quota is the same as local students'	7	0.429	(0.202)	53	0.698	(0.064)	-0.270
Yes, but the quota is less than local students'	7	0.143	(0.143)	53	0.000	(0.000)	0.143**
No	7	0.000	(0.000)	53	0.075	(0.037)	-0.075
We do not enroll students from non-local counties	7	0.286	(0.184)	53	0.113	(0.044)	0.173

Notes: The variable *School Ranking* is a 4-option multiple choice (1-below average, 4-among the best) standardised to mean of 0 and standard deviation of 1. The variable *General School Facilities* is a sum of ten school facility dummy variables (1-equipped, 0-not equipped) standardised to mean of 0 and standard deviation of 1.
The value displayed for t-tests are the differences in the means across the groups.
**, and * indicate significance at the 0.01 and 0.05 critical level.

Table 4 compares the descriptive statistics of the individual, family and school characteristics of randomly and non-randomly assigning schools.

We note that randomly and non-randomly assigning schools differ in several mean individual characteristics. Compared to randomly assigning schools, non-randomly assigning schools are on average found to have a significantly lower proportion of minorities, significantly less rural-to-urban migrant children, and significantly more students that are the only child in the family.

While randomly and non-randomly assigning schools differ in a few parental educational levels, we find no apparent pattern in the differences.

To examine differences in the school characteristics, we focus the balancing tests to individual schools, as opposed to individual observations in each school. With only public schools located in urban areas, we examine seven non-randomly assigning schools and 53 randomly assigning schools. Here, we find no significant differences in the school characteristics between the two types of schools except for the difference in the mean for government funding for non-local students, where the school principals had answered: "Yes, but the quota is less than that of the local students". However, because the mean of the answer derives from one school, i.e. there is only one single school reporting to have less quota for non-local students, we consider the difference an anomaly.

In conclusion, after conducting two separate tests, we are able to validate the randomisation used in our identification strategy. We proceed to present our core results.

6. Results

This section presents the core estimates of our main regressions. For each outcome variable, we estimate first the baseline OLS model including school fixed effects, then the final OLS model with full specifications. When offering numeric interpretations, we use a 10 percentage point increase in rural-to-urban migrant ratios because it approximates to one standard deviation (10.18%) in the observed variation.

Table 5 reports the estimated coefficients of the rural-to-urban migrant ratio on the four cognitive outcome variables for urban local children.

Table 5: Cognitive outcomes on the proportion of rural-to-urban migrant children ratio[3]

	Chinese		Mathematics		English		Cognitive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rural-to-urban Migrant Ratio	-12.810	-5.706	-7.575	-2.223	-2.251	3.129	-4.931	-1.444
	(8.253)	(5.371)	(10.20)	(4.458)	(10.610)	(3.426)	(4.691)	(3.966)
Lagged Score	-	yes	-	yes	-	yes	-	yes
Individual Characteristics	-	yes	-	yes	-	yes	-	yes
Family Characteristics	-	yes	-	yes	-	yes	-	yes
School Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes	yes	yes	yes	yes
r2	0.00828	0.536	0.00959	0.571	0.00673	0.710	0.206	0.367
N	2779	2714	2779	2714	2779	2714	2758	2693

The dependent variables have been standardised with a mean of 70 points and standard deviation of 10 points
Cluster robust standard errors displayed in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

In Table 5, we observe that the signs of all the estimated coefficients for Chinese, mathematics and cognitive ability indicate negative peer effects of rural-to-urban migrant children on urban local children. For instance, a 10 percentage point increase in the rural-to-urban migrant ratio suggests a 0.5706 point decrease in urban local children's Chinese test scores (column 2). On the other hand, while the baseline estimated coefficient on English (column 5) also indicated negative peer effects, the final estimated coefficient on English (column 6) suggested positive effects.

However, none of the estimates are statistically significant and therefore we cannot draw any conclusive remarks that there are any peer effects, either positive or negative. We are not able to

[3] See Table A1 in the appendix for the complete outcome table

reject our first null hypotheses ($H_0 : \beta_j = 0$) that urban local children's cognitive outcomes are not affected by class-level rural-to-urban migrant ratios.

Furthermore, we note that the estimated results differ between the baseline and final OLS estimates. As previously explained, we have only chosen to include control variables and lagged scores in order to reduce standard errors and increase the precision of estimates. However, we find that the estimated coefficients for the cognitive outcomes appear to be biased in the baseline OLS estimates. While we do recognise that the biases are not particularly significant and that the standard errors are in fact reduced in the final OLS estimates, we also consider that this may be attributed to certain methodological limitations.

Table 6.A reports the estimated coefficients of the rural-to-urban migrant children ratio on the first four non-cognitive outcomes, namely the ones measuring the current emotional well-being of the students.

Table 6.A: Non-cognitive outcomes on the proportion of rural-to-urban migrant children ratio[4]

	Feeling Blue		Unhappy		Not Enjoying Life		Sorrowful	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rural-to-urban Migrant Ratio	-0.644	-0.498	-0.654	-0.878	-0.858	-0.996	-0.430	-0.520
	(0.620)	(0.533)	(0.819)	(0.685)	(0.636)	(0.523)	(0.488)	(0.420)
Lagged Score	-	yes	-	yes	-	yes	-	yes
Individual Characteristics	-	yes	-	yes	-	yes	-	yes
Family Characteristics	-	yes	-	yes	-	yes	-	yes
School Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes	yes	yes	yes	yes
r2	0.00627	0.121	0.00619	0.124	0.00472	0.129	0.00557	0.129
N	2779	2714	2779	2714	2779	2714	2779	2714

The dependent variables have been standardised with a mean of 0 and standard deviation of 1.
Cluster robust standard errors displayed in parentheses
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

In Table 6.A, we observe that the signs of all the estimated coefficients for the four non-cognitive outcomes indicate negative peer effects of rural-to-urban migrant children on urban local children. For instance, when interpreting the estimates of Feeling Blue (column 2), a 10 percentage points increase in the rural-to-urban migrant ratio predicts a 0.0498 standard deviation decrease in the

[4] See Table A2.A in the appendix for the complete outcome table

extent urban local children have been feeling blue the last seven days. Intuitively, this means that there are positive peer effects on the local children's non-cognitive outcome, measured by the individual's sense of feeling blue.

However, again, because none of the estimates are statistically significant, we cannot draw any conclusive remarks that there are any peer effects. With these first four non-cognitive measures, we are not able to reject our second null hypotheses ($H_0 : \pi_j = 0$) that urban local children's non-cognitive outcomes are not affected by class-level rural-to-urban migrant ratios.

Lastly, Table 6.B reports the estimated coefficients of the rural-to-urban migrant ratio on the last two non-cognitive outcomes, serving as confidence indicators.

Table 6.B: Non-cognitive outcomes on the proportion of rural-to-urban migrant children ratio (confidence indicators)[5]

	Confidence		Educational Expectations	
	(1)	(2)	(3)	(4)
Rural-to-urban Migrant Ratio	1.338**	1.486***	0.627	0.735
	(0.430)	(0.392)	(0.580)	(0.432)
Lagged Score	-	yes	-	yes
Individual Characteristics	-	yes	-	yes
Family Characteristics	-	yes	-	yes
School Fixed Effects	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes
r2	0.00678	0.198	0.00593	0.169
N	2779	2714	2779	2714

The dependent variables have been standardised with a mean of 0 and standard deviation of 1.
Cluster robust standard errors displayed in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Finally in Table 6.B, the signs of the estimated coefficients indicate positive peer effects in both variable outcomes. More notably, the final OLS estimated the effects of the children's confidence (column 2) to be statistically significant on a 0.1% critical level. An interpretation of this effect would be that a 10 percentage points increase in rural-to-urban migrant ratio predicts a 0.1486 standard deviation increase in the urban local children's confidence.

However, while this effect may be statistically significant, one may argue that it is not particularly economically significant. Given the observed variation in the dependent variable, one can interpret

[5] See Table A2.B in the appendix for the complete outcome table

that an approximate one standard deviation (10.18%) increase in the rural-to-urban migrant ratio predicts less than one-sixth (or 0.1486) of a standard deviation increase in the urban local children's confidence. In this respect, one may argue that the estimated peer effects do not motivate economic significance. However, the economic significance of this effect may be subject to further discussion.

All in all, the estimates in Table 6.B have differing implications. First, with significant estimated coefficient for confidence (column 2), we can reject the null hypothesis ($H_0 : \pi_j = 0$) with 99.9% confidence. However, considering that the estimated coefficient for educational expectations (column 4) is statically insignificant, we are not able to reject the null hypothesis ($H_0 : \pi_j = 0$). Thus, with the gathered findings from Table 6.A and 6.B, we are not able to reject the null hypothesis ($H_0 : \pi_j = 0$) that the peer effects rural-to-urban migrant children have on urban local children's non-cognitive outcomes are significantly different from zero.

Lastly, we find again that the estimated results differ between the baseline and final OLS estimates in both Table 6.A and 6.B. In the baseline OLS estimate. We find that the estimated coefficients for the non-cognitive outcomes all appear to be biased. While we further recognise that the biases are not at all significant and that the standard errors are consistently reduced in the final OLS estimates, we again consider that this may be attributed to certain methodological limitations.

7. Discussions

On the whole, we do not find significant peer effects on the cognitive and non-cognitive outcomes of urban local children. While most coefficients indicate that the proportion of rural-to-urban migrant children is negatively related to the cognitive outcomes and positively related to the non-cognitive outcomes of local children, the final OLS estimates provide no material evidence for migrant-to-local peer effects. This section will discuss the implication of these findings, how they are related to the existing literature on migrant children's peer effects, the limitations of the study and finally the contributions of our findings.

7.1. Discussion on results

The findings from this study may shed light upon the inconsistent findings by two previous studies on cognitive peer effects of migrant children, namely Hu (2018) and Wang et al. (2018). Similar to these two studies, this study employs an identification strategy utilising class-level random assignment and school fixed effects. However, differing from the two papers, we make use of panel data and include lagged scores in our econometric models. As a result, our findings differ with that of these previous studies and suggest that the social effects are insignificant given the class-level random assignment and school fixed effects.

Hu (2018) found large and negative peer effects on the cognitive outcomes of local children, concentrated on male students in larger cities. An explanation for why we do not find similar results with Hu (2018) is that we have different samples, albeit both use data from CEPS. Using both seventh and ninth grade data in their analysis, Hu (2018) disregards the reality that migrant children enrolled in public schools are under-represented due to the entrance exam institutional barrier. In this study, we are more careful in considering the representativeness of our sample, and could, therefore, expect deviant results.

On the other hand, Wang et al. (2018) found significant positive peer effects on local children's Chinese test scores. Although our findings do not explicitly support theirs, we do observe that the positive peer effects on local children's Chinese test scores are substantially larger than that of the other cognitive outcomes. However, this observation should not be formally recognised since the effects were statistically insignificant. As a result, we may only speculate that the peer effects found by Wang et al. (2018) could have dissipated in the second wave for various reasons.

Using a similar regression specification as Liang et al (2019), we find no significant effects in our study that resemble their findings of negative cognitive peer effects on local children, even though we build on the same raw data. Although Liang et al (2019) do not make use of the class-level random assignment available in CEPS, they assume that by employing school fixed effects, endogenous sorting across classes within school and across schools within the sample is largely solved. However, we argue that controlling for school fixed effects merely addresses endogenous sorting across schools, but not across classes within schools. If classes are non-randomly assigned, children who attain better or worse results upon entry will be grouped with their respective peers. If attainment upon entry is related to the rural-to-urban migrant status, even school fixed effects estimates can be biased. In contrast, we make use of the random assignment to account for endogenous sorting, and also validate that randomly assigning schools are not significantly different from that of the non-randomly assigning ones. Thus, we restrict our sample to only randomly assigning schools, and provide some evidence that there is no consequential selection bias. Therefore, while we do recognise the findings made by Liang et al (2019), we do wish to provide our findings as an adjacent contribution.

Furthermore, because there are little to no studies that address the non-cognitive peer effects of Chinese migrant children, our findings may only lay the foundation for future research. At the same time, we may also compare our findings with the non-cognitive peer effects literature outside of China. Using US data, Neidell and Waldfogel (2010) found no significant spillover effects on local children's non-cognitive outcomes. Previously, we speculate that this could be because the pair studied younger children who have been found less susceptible to peer influence. Therefore, we restricted our sample to older adolescents in an attempt to better capture peer effects. However,

despite addressing this potential sample limitation, we find no material evidence for peer effects on local children's non-cognitive outcomes.

In terms of non-cognitive outcomes, we only find statistically significant peer effects on urban local children's confidence in their future. Although we have discussed how this finding may not be economically significant, we may still speculate over underlying mechanisms to the significant effects. For example, local children who interact with migrant peers may presume that they have greater life prospects, or develop some degrees of hubris. In either case, the interaction with migrant children can have notable effects on the local children's subjective confidence.

Following our results, we cannot reject our null hypotheses that urban local children's cognitive and non-cognitive outcomes are not affected by class-level rural-to-urban migrant ratios. We discuss some potential explanations for not finding any significant peer effects. First, we reason that local parents develop overcompensating behaviours when their children interact with growing numbers of migrant children. This overcompensation may be attributed to the fear of negative spillover effects. This could then take form in stricter parents who direct their children to spend more time studying and doing homework. As a result, this type of overcompensation could mitigate potential negative peer effects on local children's cognitive outcomes, and cause the observed net effects to be zero.

On the other hand, given access to public schools, migrant children or parents may also overcompensate in order to improve future prospects. This explanation is supported by the study of Gao et al. (2015) which did not find evidence that migrant children enrolled in public schools differed in behaviour compared to their local peers.

Ultimately, one could also simply conclude that there are no significant peer effects between rural-to-urban migrant children and urban local children that reflect in cognitive and non-cognitive outcomes. That being said, this study finds no empirical evidence for cognitive and non-cognitive peer effects between rural-to-urban migrant children and urban local children, hence no material support for the social barriers that migrant children face due to local parents' fear of negative spillover effects.

7.2. Limitations of the study

We recognise several limitations to the findings in this study. First, this study could be subject to various data limitations. According to Chen, Feng and Han (2019b), a larger part of migrant children move back to their hometowns during the middle school years in order to prepare for the high-school entrance exam which they are not qualified to take in the urban areas. Migrant children who remain in urban areas throughout the middle schools are either from families with relevant documentation that qualifies the child for the exam, or children who do not plan to further their education past middle school. Migrant children who stay in urban areas until eighth-grade could therefore already be less representative of average migrant children. To examine this potential data limitation, we compare the type and proportion of missing observations at wave two of our initial

eighth-grade sample. In Table A3 in the appendix, we compare the followed-up migrant children with the migrant children who transferred to school and therefore potentially gone back to their hometowns by the second wave of CEPS. Although this comparison does not provide strong evidence to address this data limitation, it does reveal that the characteristics of the two groups do not jointly differ significantly.

Second, this study may be subject to certain methodological limitations. The lagged scores are essentially outcomes measured in wave one of CEPS. In our full OLS models, we include lagged scores to reduce standard errors and increase the precision of the estimated effects. However, because they are measured halfway through seventh-grade, the lagged scores could capture some early social interactions that our models attempt to predict. If that is the case, by including such lagged scores, we introduce a source of bias to our coefficients of interest. In order to test this limitation, we regress our final models with all controls except the lagged scores (Table A4.A and Table A4.B). We observe that without controlling for the lagged scores, the estimated coefficients do not differ significantly from that of the full specification in our core results. We can, therefore, presume that the lagged scores do not introduce endogeneity to our core results.

Lastly, this study may also be subject to a methodological limitation related to the non-cognitive outcome variables. In this study, we measure non-cognitive outcomes with questions that ask for an individual's subjective well-being within the past seven days. First, we recognise that using subjective measures of well-being could often weaken the implication of a study. Second, we acknowledge that because our non-cognitive outcome variables measure well-being within a short time frame, they may be weaker proxies of general well-being. However, it is probably both administratively and financially difficult to attain strong measures of general well-being on a large scale. Third, we note that non-cognitive outcomes used in this study mainly measure internalised well-being and do not adequately measure externalised well-being, however this is a deliberate decision partly motivated by previous international studies focusing on externalised well-being.

7.3. Contribution

First, this study contributes to the literature on migrant children's peer effects. On one hand, the findings of this study contributes to the literature on migrant children's cognitive peer effects. Given the inconsistent findings in this pool of literature, we provide additional evidence that migrant children have no significant peer effects on the cognitive outcome of urban local children. On the other, the findings of this study lay a foundation to the research on migrant children's non-cognitive peer effects. Here, our primary conclusion is that migrant children have no significant peer effects on the non-cognitive outcome of local children.

In a wider perspective, this study has considerable implications on the social barriers to equal educational opportunities faced by migrant children. In the light of our results, we suggest that there are no notable classroom peer effects of rural-to-urban migrant children on urban local children's

cognitive or non-cognitive outcomes. This speaks for the abolishment of social barriers faced by migrant children in various forms of discrimination and social exclusion. To help migrant children obtain equal educational opportunities, more effort is needed to break down the various social barriers. While this may be practically challenging, we believe that enlightening the matter is among the first steps to a long process. Finally, given that migrant children make up a significant portion of China's future population, it is also vital to the country's development to ensure that children are provided with equal educational opportunities.

8. Conclusion

In light of the concerns over negative spillover effects on urban local children, rural-to-urban migrant children have faced numerous social barriers to equal educational opportunities. This paper aims to address these social barriers by examining to what extent urban local children's cognitive and non-cognitive outcomes are affected by rural-to-urban migrant children enrolled in urban public schools. To address the selection bias and Manski's reflection problem, we develop an identification strategy that isolates the classroom social effects by using class-level random assignment and school fixed effects. Based on our conceptual framework, we hypothesise that urban local children's cognitive and non-cognitive outcomes are either positively or negatively affected by class-level rural-to-urban migrant ratios.

However, we find no empirical evidence for cognitive and non-cognitive peer effects between rural-to-urban migrant children and urban local children. As an exception, we find evidence for positive spillover effects on local children's confidence in their future. These results do not empirically support the social barriers centred around fear over negative spillover effects. This speaks for the importance of lowering the social barriers to equal educational opportunity faced by migrant children as they are built on discriminations on no grounds.

The findings of this study have several implications for future research. First of all, we set out to address the social barriers to equal educational opportunity faced by migrant children. We encourage future research to continue building upon the literature on social barriers to emphasise the problem of unequal educational opportunities and the underlying discrimination that migrant children encounter. Moreover, because our study of non-cognitive may be limited by various data and methodological limitations, we encourage future research to further the evidence on non-cognitive peer effects of migrant children. Finally, we recognise that the findings and implications of this study should be further evaluated in future research. We suggest that future studies with access to more comprehensive empirical data continue to examine the peer effects of China's internal migration and identify long-term implications for the children's future and their well-being.

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10. Appendix

Table A1: Cognitive outcomes on the proportion of rural-to-urban migrant children ratio

	Chinese		Mathematics		English		Cognitive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rural-to-urban Migrant Ratio	-12.81	-5.706	-7.575	-2.223	-2.251	3.129	-4.931	-1.444
	(8.253)	(5.371)	(10.20)	(4.458)	(10.610)	(3.426)	(4.691)	(3.966)
Chinese Lagged Score		0.680***						
		(0.020)						
Mathematics Lagged Score				0.742***				
				(0.018)				
English Lagged Score						0.825***		
						(0.015)		
Cognitive Lagged Score								0.390***
								(0.025)
Female		1.987***		0.492		0.996***		0.694**
		(0.317)		(0.361)		(0.284)		(0.245)
Age (W2)		-0.106		-0.323		0.18		-1.006***
		(0.289)		(0.255)		(0.190)		(0.225)
Minority		-1.179		-0.708		-0.234		0.061
		(0.643)		(0.672)		(0.448)		(0.639)
Only Child		0.127		-0.13		-0.481		0.302
		(0.354)		(0.351)		(0.283)		(0.337)
Mother's Educational Level								
None		0		0		0		0
		(.)		(.)		(.)		(.)
Finished elementary school		1.363		-1.517		0.449		0.132
		(0.984)		(0.883)		(0.936)		(0.667)
Junior high school degree		2.066*		-1.171		0.215		0.231
		(0.995)		(0.832)		(0.952)		(0.722)
Technical secondary school		1.697		-0.969		0.899		1.442
		(1.073)		(0.967)		(0.975)		(0.985)
Vocational high school degree		2.681		-0.378		-0.590		0.233
		(1.373)		(1.042)		(1.298)		(1.158)
Senior high school degree		2.498*		-1.463		-0.016		1.217
		(1.012)		(0.854)		(0.973)		(0.874)
Junior college degree		3.005**		-1.175		0.274		1.408
		(1.043)		(0.969)		(0.969)		(0.850)
Bachelor degree		2.343*		-1.235		0.579		1.180
		(1.066)		(1.000)		(0.993)		(0.957)
Master degree or higher		1.584		-0.720		1.426		0.519
		(1.411)		(1.473)		(1.325)		(1.567)
Father's Educational Level								
None		0		0		0		0
		(.)		(.)		(.)		(.)

Finished elementary school		-2.379		1.051		-1.617		1.278
		(2.863)		(2.830)		(1.880)		(2.256)
Junior high school degree		-2.332		1.386		-1.825		1.128
		(2.823)		(2.812)		(1.790)		(2.176)
Technical secondary school		-2.792		0.908		-1.544		1.029
		(2.771)		(2.791)		(1.937)		(2.252)
Vocational high school degree		-3.964		1.032		-1.212		0.726
		(3.100)		(2.699)		(1.996)		(2.401)
Senior high school degree		-2.63		1.127		-1.328		1.316
		(2.836)		(2.730)		(1.832)		(2.172)
Junior college degree		-2.37		2.278		-0.832		1.527
		(2.882)		(2.683)		(1.812)		(2.208)
Bachelor degree		-1.723		2.297		-0.887		1.599
		(2.761)		(2.618)		(1.807)		(2.155)
Master degree or higher		-0.633		1.357		-0.552		1.097
		(2.883)		(2.555)		(1.982)		(2.298)
Family Economic Status		-0.088		-0.693*		-0.404		-0.226
		(0.261)		(0.293)		(0.240)		(0.298)
Constant	71.340***	24.690***	68.780***	21.670***	68.580***	11.290**	76.200***	57.360***
	(1.197)	(5.268)	(1.479)	(4.945)	(1.539)	(3.893)	(0.680)	(4.740)
School Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes	yes	yes	yes	yes
r2	0.00828	0.536	0.00959	0.571	0.00673	0.710	0.206	0.367
N	2779	2714	2779	2714	2779	2714	2758	2693

The dependent variables have been standardised with a mean of 70 and standard deviation of 10.

Cluster robust standard errors displayed in parentheses.

***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Table A2.A: Non-cognitive outcomes on the proportion of rural-to-urban migrant children ratio

	Feeling Blue		Unhappy		Not Enjoying Life		Sorrowful	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rural-to-urban Migrant Ratio	-0.644	-0.498	-0.654	-0.878	-0.858	-0.996	-0.430	-0.520
	(0.620)	(0.533)	(0.819)	(0.685)	(0.636)	(0.523)	(0.488)	(0.420)
Feeling Blue Lagged Score		0.320***						
		(0.021)						
Unhappy Lagged Score				0.323***				
				(0.023)				
Not Enjoying Life Lagged Score						0.336***		
						(0.021)		
Sorrowful Lagged Score								0.333***
								(0.019)
Female		0.109**		0.076		-0.015		0.069
		(0.037)		(0.040)		(0.032)		(0.040)
Age (W2)		-0.003		0.059		0.015		0.014
		(0.038)		(0.035)		(0.030)		(0.033)
Minority		-0.047		0.022		0.099		0.053
		(0.100)		(0.115)		(0.097)		(0.104)
Only Child		-0.084		-0.029		-0.025		-0.005
		(0.042)		(0.044)		(0.045)		(0.037)
Mother's Educational Level								
None		0		0		0		0
		(.)		(.)		(.)		(.)
Finished elementary school		0.132		0.063		0.002		-0.044
		(0.117)		(0.097)		(0.127)		(0.148)
Junior high school degree		0.192		0.158		0.056		0.106
		(0.128)		(0.116)		(0.144)		(0.167)
Technical secondary school		0.267		0.115		0.040		0.069
		(0.141)		(0.137)		(0.161)		(0.174)
Vocational high school degree		0.120		-0.100		-0.049		-0.236
		(0.187)		(0.177)		(0.183)		(0.200)
Senior high school degree		0.279		0.200		0.112		0.131
		(0.139)		(0.130)		(0.171)		(0.168)
Junior college degree		0.286		0.216		0.141		0.077
		(0.145)		(0.139)		(0.175)		(0.187)
Bachelor degree		0.242		0.103		0.044		0.057
		(0.155)		(0.143)		(0.179)		(0.188)
Master degree or higher		0.048		0.006		0.061		-0.064
		(0.203)		(0.199)		(0.228)		(0.221)
Father's Educational Level								
None		0		0		0		0
		(.)		(.)		(.)		(.)
Finished elementary school		0.392		0.404		0.545		0.381
		(0.279)		(0.327)		(0.339)		(0.296)
Junior high school degree		0.307		0.287		0.365		0.166
		(0.269)		(0.295)		(0.287)		(0.278)

Technical secondary school		0.218		0.195		0.359		0.142
		(0.293)		(0.296)		(0.300)		(0.283)
Vocational high school degree		0.118		0.366		0.524		0.387
		(0.299)		(0.341)		(0.311)		(0.260)
Senior high school degree		0.272		0.249		0.371		0.187
		(0.288)		(0.309)		(0.302)		(0.291)
Junior college degree		0.234		0.267		0.382		0.306
		(0.281)		(0.304)		(0.300)		(0.283)
Bachelor degree		0.197		0.299		0.436		0.232
		(0.283)		(0.308)		(0.293)		(0.268)
Master degree or higher		0.304		0.320		0.330		0.110
		(0.321)		(0.334)		(0.332)		(0.281)
Family Economic Status		-0.043		-0.107*		-0.074		-0.067
		(0.049)		(0.045)		(0.046)		(0.044)
Constant	-0.003	-0.361	0.134	-0.776	0.100	-0.37	0.014	-0.339
	(0.090)	(0.666)	(0.119)	(0.591)	(0.092)	(0.566)	(0.071)	(0.561)
School Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes	yes	yes	yes	yes
r2	0.00627	0.121	0.00619	0.124	0.00472	0.129	0.00557	0.129
N	2779	2714	2779	2714	2779	2714	2779	2714

The dependent variables have been standardised with a mean of 0 and standard deviation of 1.

Cluster robust standard errors displayed in parentheses.

***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Table A2.B: Non-cognitive outcomes on the proportion of rural-to-urban migrant children ratio (confidence indicators)

	Confidence		Educational Expectations	
	(1)	(2)	(3)	(4)
Rural-to-urban Migrant Ratio	1.338**	1.486***	0.627	0.735
	(0.430)	(0.392)	(0.580)	(0.432)
Confidence Lagged Score		0.430***		
		(0.017)		
Educational Expectation Lagged Score				0.394***
				(0.023)
Female		0.033		0.027
		(0.036)		(0.037)
Age (W2)		-0.030		-0.013
		(0.034)		(0.031)
Minority		0.074		0.000
		(0.100)		(0.104)
Only Child		-0.020		0.004
		(0.050)		(0.053)
Mother's Educational Level				
None		0		0
		(.)		(.)
Finished elementary school		-0.330		-0.051
		(0.292)		(0.154)
Junior high school degree		-0.253		-0.113
		(0.275)		(0.143)
Technical secondary school		-0.200		0.038
		(0.287)		(0.167)
Vocational high school degree		-0.045		-0.009
		(0.325)		(0.190)
Senior high school degree		-0.185		-0.044
		(0.289)		(0.154)
Junior college degree		-0.082		-0.006
		(0.291)		(0.172)
Bachelor degree		-0.093		0.101
		(0.288)		(0.167)
Master degree or higher		0.043		-0.137
		(0.321)		(0.209)
Father's Educational Level				

None		0		0
		(.)		(.)
Finished elementary school		-0.150		0.454
		(0.266)		(0.233)
Junior high school degree		-0.036		0.421
		(0.265)		(0.227)
Technical secondary school		0.006		0.435
		(0.273)		(0.240)
Vocational high school degree		-0.388		0.366
		(0.259)		(0.248)
Senior high school degree		-0.057		0.475*
		(0.280)		(0.236)
Junior college degree		-0.081		0.449
		(0.277)		(0.235)
Bachelor degree		-0.135		0.456
		(0.267)		(0.238)
Master degree or higher		-0.279		0.710*
		(0.313)		(0.266)
Family Economic Status		0.045		-0.003
		(0.046)		(0.044)
Constant	-0.126*	0.335	-0.245**	-0.512
	(0.062)	(0.659)	(0.084)	(0.517)
School Fixed Effects	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes
r2	0.00678	0.198	0.00593	0.169
N	2779	2714	2779	2714

The dependent variables have been standardised with a mean of 0 and standard deviation of 1.
Cluster robust standard errors displayed in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Table A3: Balancing test of characteristics by follow-up statuses of rural-to-urban migrant children

	(1) Transferred to other junior high school			(2) Followed-up (not transferred)			t-test Difference
Variable	N	Mean	SE	N	Mean	SE	(1)-(2)
Characteristics							
Female	126	0.460	(0.045)	683	0.485	(0.019)	-0.024
Age (W2)	126	13.381	(0.164)	683	13.249	(0.083)	0.132
Only Child	126	0.302	(0.041)	683	0.315	(0.018)	-0.013
Minority	126	0.048	(0.019)	683	0.056	(0.009)	-0.008
Mother's Educational Level							
None	126	0.024	(0.014)	683	0.037	(0.007)	-0.013
Finished elementary school	126	0.246	(0.039)	683	0.227	(0.016)	0.019
Junior high school degree	126	0.484	(0.045)	683	0.515	(0.019)	-0.031
Technical secondary school	126	0.071	(0.023)	683	0.047	(0.008)	0.025
Vocational high school degree	126	0.024	(0.014)	683	0.016	(0.005)	0.008
Senior high school degree	126	0.111	(0.028)	683	0.111	(0.012)	-0.000
Junior college degree	126	0.016	(0.011)	683	0.026	(0.006)	-0.010
Bachelor degree	126	0.008	(0.008)	683	0.016	(0.005)	-0.008
Master degree or higher	126	0.016	(0.011)	683	0.001	(0.001)	0.014**
Father's Educational Level							
None	126	0.000	(0.000)	683	0.003	(0.002)	-0.003
Finished elementary school	126	0.103	(0.027)	683	0.151	(0.014)	-0.048
Junior high school degree	126	0.579	(0.044)	683	0.523	(0.019)	0.057
Technical secondary school	126	0.071	(0.023)	683	0.044	(0.008)	0.028
Vocational high school degree	126	0.016	(0.011)	683	0.026	(0.006)	-0.010
Senior high school degree	126	0.183	(0.035)	683	0.177	(0.015)	0.005
Junior college degree	126	0.016	(0.011)	683	0.035	(0.007)	-0.019
Bachelor degree	126	0.024	(0.014)	683	0.034	(0.007)	-0.010
Master degree or higher	126	0.008	(0.008)	683	0.004	(0.003)	0.004
Family Economic Status	126	2.849	(0.062)	683	2.854	(0.021)	-0.004
F-test of joint significance (F-stat)							0.752
F-test, number of observations							809

The value displayed for t-tests are the differences in the means across the groups.

The value displayed for F-tests are the F-statistics.

**, and * indicate significance at the 0.01 and 0.05 critical level.

Table A4.A: Final OLS estimates for cognitive outcomes with all controls except the lagged scores

	Chinese	Mathematics	English	Cognitive
	(1)	(2)	(3)	(4)
Rural-to-urban Migrant Ratio	-12.23	-6.104	-1.238	-4.534
	(8.023)	(10.490)	(11.090)	(4.700)
Lagged Score	-	-	-	-
Individual Characteristics	yes	yes	yes	yes
Family Characteristics	yes	yes	yes	yes
School Fixed Effects	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes
r2	0.133	0.0438	0.115	0.231
N	2714	2714	2714	2693

The dependent variables have been standardised with a mean of 70 and standard deviation of 10.
Cluster robust standard errors displayed in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level.

Table A4.B: Final OLS estimates for non-cognitive outcomes with all controls except the lagged scores

	Feeling Blue	Unhappy	Not Enjoying Life	Sorrowful	Confidence	Educational Expectations
	(1)	(2)	(3)	(4)	(5)	(6)
Rural-to-urban Migrant Ratio	-0.852	-0.875	-1.129	-0.604	1.586**	0.782
	(0.593)	(0.772)	(0.586)	(0.486)	(0.474)	(0.577)
Lagged Score	-	-	-	-	-	-
Individual Characteristics	yes	yes	yes	yes	yes	yes
Family Characteristics	yes	yes	yes	yes	yes	yes
School Fixed Effects	yes	yes	yes	yes	yes	yes
Cluster robust SE	yes	yes	yes	yes	yes	yes
r2	0.0199	0.0222	0.0172	0.0213	0.0206	0.0264
N	2714	2714	2714	2714	2714	2714

The dependent variables have been standardised with a mean of 0 and standard deviation of 1.
Cluster robust standard errors displayed in parentheses.
***, **, and * indicate significance at the 0.001, 0.01, and 0.05 critical level