Separate and Unequal: *Hukou*, School Segregation, and Migrant Children's Education in Urban China

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Abstract

This paper examines *hukou*-based school segregation (measured by both unevenness and exposure) and its impact on the gap in academic achievement between migrant and local students in urban China. Based on the analysis of data from a nationally representative school-based survey (the Chinese Educational Panel Survey), we show that, while migrant children perform significantly worse than urban local children in general, the achievement gap is particularly wider in cities where school segregation based on *hukou* status is severe, largely due to the uneven distribution of migrants in lower-quality schools with more exposure to negative peer influence. Analyses based on school fixed-effect models and the instrumental variable approach further reveal that a high level of exposure to migrant children has a negative causal effect on the academic achievement of both migrant and local students. These findings have important implications for policies on the social inclusion of migrant children in Chinese cities.

Introduction

Internal migration in China has reached an unprecedented scale since the late 1990s. Migrants are increasingly heading for cities and coastal regions, and many are bringing their families with a plan to stay for the long term (Duan and Liang 2004). Migration has contributed significantly to China's rapidly growing urban population, and the number of school-age children moving with their parents has increased dramatically in destination cities (Wu and Zhang 2015). According to estimates from the 2010 population census, there are nearly 36 million migrant children in China, among which 40 percent are at school age (6 to 14 years old) (ACWF 2013). Consequently, the provision of educational opportunities for migrant children has become an important issue for education policymakers and the public at large (Duan and Zhou 2005; Liang and Chen 2007; Liang, Guo and Duan 2008).

While numerous studies have revealed the socioeconomic disadvantages of rural migrants in urban labor markets and pointed to the institutional barriers associated with the *hukou* system in China as the reason for their disadvantages (e.g., Knight, Song, and Jia 1999; Lu and Wang 2014; Meng and Zhang 2001; Wang, Zuo and Ruan 2001), scholars have recently started paying attention to the well-being of children affected by migration (Liang and Chen 2007; Lu and Zhou 2013). Wu and Zhang (2015), for instance, found that rural migrant children in cities are even less likely to be enrolled in schools than children who are left behind by their migrant parents in the countryside, because of their lack of local *hukou* status and policy discrimination against migrants. They argue that *hukou* has created special hurdles in socioeconomic attainment not only for adult migrants themselves (Wu 2009), but also for their offspring, especially in regard to their access to educational opportunities in cities. Hence, the public is strongly advocating the social inclusion of migrants, especially with regard to their children's access to local public schools in the destination cities.

Those school-age children who have migrated with their parents tend to have higher rates of school transfer, dropout, and crime, and lower levels of academic achievement, and they identity less with the destination cities (Chen and Feng 2013; Guo 2002; Liang and Chen 2007; Liang, Guo and Duan 2008; Lu 2007; Lu and Zhou 2013; Wu and Zhang 2015). They are concentrated in schools set up especially for migrants and more likely to be grade repeaters (Xie, Niu and Xie 2011). The sociological explanations for migrant children's disadvantages, nevertheless, remain

unclear (Wu and Zhang 2015). Can the children's poor academic performance be attributed solely to their parents' socioeconomic disadvantages? What role does *hukou* exclusion play in generating such disparities?

In this paper, we show that those migrant children who have moved into cities but kept their *hukou* status unchanged continue to experience social exclusion and school segregation. In fact, whether a child holds a local *hukou* status in urban China is a crucial criterion for enrollment in local public schools. Without local *hukou*, migrant children are either denied access to local schools, or forced to enroll in low-quality private schools in the cities. Despite the fact that many local city governments have launched various policies to accelerate the assimilation process, evidence suggests that high-quality schools continue to be beyond the reach of migrant children without local *hukou*. Hence, *hukou*-based school segregation could play an important role in generating migrant children's disadvantages in academic performance relative to urban local children.

Due to the lack of nationwide school-level data, previous studies on migrant children, which were either based on ethnographic observation (Goodburn 2009; Hu and Szente 2010; Tan 2010) or focused on the analysis of census data with limited information on school outcomes (Guo 2002; Liang and Chen 2007; Wu and Zhang 2015), failed to uncover a systematic pattern of the schooling process that migrant children experienced in urban settings. Based on data from the Chinese Educational Panel Survey (CEPS) in 2014, we attempt to examine to what extent and through what mechanisms migrant students are unevenly distributed across local schools, and to reveal how the school segregation process leads to the poor academic performance of migrant students relative to local students in urban China.

The remainder of the paper is organized as follows. Section 2 reviews the pertinent literature on school segregation and students' academic performance, mainly based on race in the United States, and shows how they may inform our studies of *hukou*-based school segregation in Chinese cities. Section 3 describes the data, variables and methods used in the empirical investigation. Section 4 presents findings of the three inter-related issues: the effect of school segregation on the achievement gap between migrant and local students, the origin and mechanisms of school segregation, and the effect of migrant exposure on students' academic achievement. Finally, we draw conclusions and discuss the implications of our empirical findings for policies concerning migrants.

School Segregation and Inequality in Academic Performance

Sociological studies of educational inequality have long paid attention to school segregation, especially racial segregation in the United States (Card and Rothstein 2007; Coleman et al. 1966; Hanushek, Kain and Rivkin 2002; Schofield 1995; Wortman and Bryant 1985). Racial segregation was justified by the Plessy vs. Ferguson decision in 1896 under the doctrine of "separate but equal," which was overturned by the Supreme Court in 1954 based on the Brown vs. Board of Education of Topeka decision (Reardon and Owens 2014). The seminal Coleman Report released in 1966 provided solid evidence that race-integrated schools would boost black students' academic achievement without sacrificing that of white students. Consequently, starting from the early 1970s, the court ordered a large wave of forced busing and integration for the purpose of racial desegregation. While the effectiveness of the desegregation policy has been questioned, numerous studies have indeed provided evidence suggesting that blacks' access to desegregated schools contributed to the narrowing gap in test scores between blacks and whites by boosting blacks' achievement (Vigdor and Ludwig 2008) and reducing their high school dropout rate (Guryan 2004), and benefiting them in the long-run in terms of outcomes such as higher earnings, better health, and lower incarceration rates (Johnson 2011).

School segregation affects educational inequality through a variety of channels, among which school quality and peer influence are two conceptually different mechanisms often mentioned by scholars (Boozer, Krueger and Wolkon 1992; Card and Rothstein 2007; Coleman et al. 1966; Hoxby 2000; Johnson 2011). These two effects can co-exist, because members of a disadvantaged group may be assigned to low-quality schools where they may also be exposed to negative peer influence. It is also difficult to differentiate between the two segregation effects empirically because students may be placed into different schools based on self-selection, ability tracking system, and a myriad of other non-random sorting processes (Jencks and Mayer 1990).

Moreover, scholars have not reached a consensus on how to measure school segregation, which is a complex concept consisting of multiple dimensions (Fiel 2013; Massey and Denton 1988; Reardon and Owens 2014; Vigdor and Ludwig 2008).[1] We discuss two such dimensions in this paper: unevenness and exposure. While unevenness (or imbalance) refers to the differential distribution of two (or multiple) social groups among units in a region, exposure refers to the

[1] According to Massey and Denton (1988), segregation can be measured by from five aspects: unevenness, exposure, concentration, centralization, and clustering.

degree of potential contact, or the possibility of interaction between the minority and majority group members within a social or geographic unit (Massey and Denton 1988).

The two segregation measures are based on different assumptions on the mechanism in which segregation plays its role. The use of the unevenness measure assumes that segregation operates by exposing students to different school resources and environments (Reardon and Owens 2014), whereas the exposure measure assumes that segregation affects students' academic performance through peer influence. We employ both measures to demonstrate the two mechanisms through which segregation could affect the gap in academic performance between migrant and local children in the context of urban China.

Hukou-based School Segregation and Migrant Children's Education in China

The perspective of racial school segregation and the relevant literature in the United States could inform our investigation of *hukou*-based school segregation in urban China. The rural-urban disparities in China based on *hukou* status resemble the racial inequalities in the United States to a large extent, in the sense that (1) both are ascriptive attributes given at birth; (2) both stratify the general population into unequal social categories, and most essentially (3) both are closely related to access to resources and opportunities in their respective societies.[2]

In light of the fact that migrants are increasingly bringing their school-age children to cities with them, Wu and Zhang (2015) found that not only were migrant children in urban areas disadvantaged in access to school compared to local children in both origins and destinations, they were also less likely to be enrolled in schools than children who were left behind by their migrant parents in the countryside. The researchers pointed to the institutional hurdle posed by the *hukou* system as the reason for migrant children's disadvantages. Hence, the public is strongly advocating the provision of educational opportunities to those migrant children without local *hukou*, and recent years have witnessed a series of reforms on the *hukou* system by the Chinese government to accommodate the increasing numbers of migrants and their demands for public services, including equal educational opportunities for their children.

Notwithstanding these changes, the central government does not dictate education policy, but rather gives "policy recommendations" to local authorities (Goodburn 2009). For instance, a

[2] For most people, *hukou* status is inherited from either the father or the mother. While *hukou* status can also be achieved through one's own effort (Wu and Treiman 2007), this process does not apply to junior high school students who are the focus of our analysis.

major policy document issued by the State Council of the People's Republic of China in 2001recommends that local governments provide nine-year compulsory education for migrant children through the public school system. [3] Many local governments have thus adjusted their *hukou* policies to allow more migrant children to attend school in their cities. However, most migrant children continue to be disadvantaged in access to local schools.

First, those migrant parents who wish to bring their school-age children with them to the cities and enroll them in local schools face additional barriers. As Goodburn (2009) revealed in a case study, before they would officially admit a migrant child, most public schools in Beijing would ask for a total of eight documents: the parents' identification cards, temporary residence permits, employment permits, health certificates, population planning certificates, social insurance certificates, guardianship certificates or birth certificates, and the child's health certificate. Many migrants simply cannot provide these documents. This may explain why migrant children have a lower rate of school enrollment than their local counterparts in cities (Liang and Chen 2007; Liang, Guo and Duan 2008; Wu and Zhang 2015).

Second, even among those migrant students who are admitted to local schools, they are likely to be relegated to low-quality schools. In many cities, there are schools set up specifically for migrant children. But these schools are often unregistered or below standard. While most unregistered or sub-standard migrant schools have either been shut down, or incorporated into the public school system or converted to subsidized schools during the recent policy adjustment (Chan and Buckingham 2008; Liang, Guo and Duan 2008; Lu and Zhou 2013), migrant children continue to be concentrated in sub-standard schools.

School segregation could affect children's academic performance and subjective well-being, thus yielding important consequences for the educational disparities between migrant and local children. Based on analysis of data from a panel survey of public and migrant primary schools in a Beijing district, Lu and Zhou (2013) found poorer achievement and greater loneliness among migrant children who attended migrant schools than comparable migrant students enrolled in urban public schools. However, their analyses are based on data from a single district in Beijing, and limited to the contrast between migrant children in public schools and those in migrant schools.

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[3] "*Guowuyuan guanyu jichu jiaoyu gaige yu fazhan de jueding*" ("State Council's Decisions on Reforms and Development of Basic Education"), 29 May 2001. For more details, visit http://www.edu.cn/20010907/3000665.shtml.

Finally, the school segregation pertaining to *hukou* may vary by regional context, where school-age migrant children are treated differently in school admission policies. Why are some cities more willing to integrate migrants into the local public school system, while others deliberately separate them from local students? In a social closure perspective, school segregation is a mode of exclusion that emerges from group-based competition for resources leading to educational inequality (Fiel 2013). To guarantee educational resources for local students (especially urban local students), some counties employ more discriminatory policies that prevent non-local students from entering privileged schools, so that these non-local students have no choice but to attend substandard schools with far less resources and poorer learning environments. Another theory is known as maximum maintained inequality (MMI), which asserts that the effect of family background will decline at those educational transitions for which the attendance rates of privileged classes are saturated (Raftery and Hout 1993). In this regard, while local parents will try their best to ensure their children's access to better schools, their incentive to do so is reduced if there are enough educational resources to go around, and their children are close to securing a place in better schools. Therefore, the level of segregation would drop as the competition for resources between locals and migrants becomes less fierce. Both of the theories can explain why some cities have adopted more restrictive policies, while others seem to be more accommodating towards migrant students.

In the paper, we will take advantage of the school-based national survey recently conducted to examine more rigorously and systematically the relationship between school segregation and educational inequality in urban China.

Data, Variables, and Methods

Data

Our empirical analysis employs data from the Chinese Education Panel Survey (CEPS), a school-based national survey with a multi-stage stratified PPS (probability proportional to size) sampling design that focuses on junior high school students in China. The first wave of data collection was completed in July 2014, with the original sample covering nearly 20,000 students in 28 county-level jurisdictions. Since this paper is mainly focused on the academic achievement gap between local students and migrant students, we restrict our analytical sample to those students in urban districts with a relatively large fraction (>10%) of migrant population. After

list-wise deletion of missing data on selected variables, we are left with 9,870 students from 70 schools in 18 urban districts/county-level cities for analysis. In addition to the dichotomous division between local and migrant students, we also classify students into four subgroups based on their place (local or migrant) and type (rural or urban) of *hukou* registration. As a result, our final sample contains urban locals (4,714), rural locals (2,506), urban migrants (936), and rural migrants (1,714) for analysis.[4]

Key Variables

The major outcome variable in this paper is the cognitive ability test score, derived from a 15-minute in-class assessment designed to measure students' reasoning abilities in three subject areas that are strongly linked to academic success at school: verbal, numerical, and graphical. The scores are standardized with a mean of 0 and standard deviation of 1, and thus are comparable across schools and regions.

To measure the extent to which migrant students are unevenly distributed in local schools, we first employ the index of dissimilarity (D index), a conventional measure of segregation.[5] Alternatively, we also take advantage of Theil's information theory index (H index), since it can simultaneously handle multiple groups (Reardon and Firebaugh 2002).[6] Note that given the way the district/county and schools are sampled, the segregation index calculated here may not reflect the level of school segregation within a particular county, but it does reflect the level of segregation among students within sampled schools.

Figure 1 presents an overview of the relationship between school segregation and the academic achievement gap between migrant and local students. As can be seen from the figure, migrants perform worse in more segregated districts/cities, whereas the fitted line for local students is almost flat, suggesting no systematic relationship can be identified. Migrant exposure is measured by the share of migrant children in the student population.

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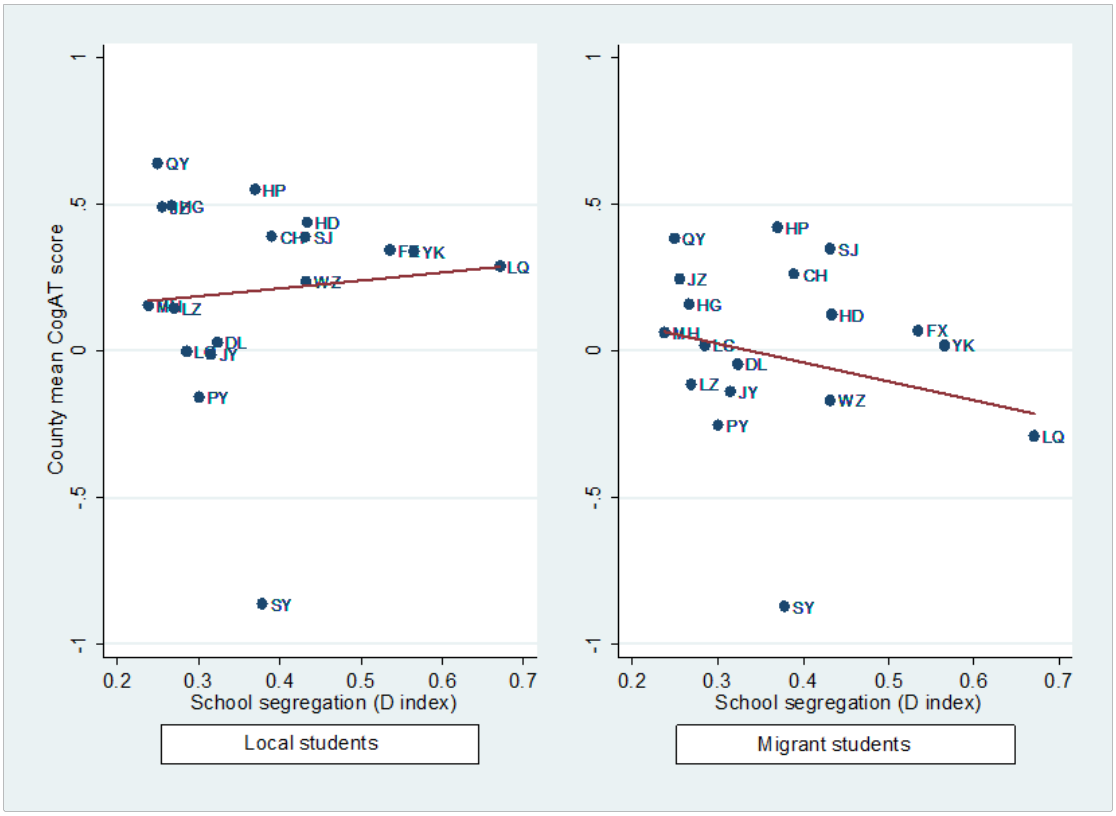
[4] Here, migrants refer to those who hold a non-local *hukou*, but excluding person-*hukou* separation between districts within the same city. For instance, in a surveyed district of Beijing, students who hold a Beijing *hukou* of a different district will still be considered a local.

[5] The D index ranges from 0 to 100, indicating that the percentage of migrant (or local) children who would have to attend a different school to achieve a perfect balance in terms of *hukou* composition at the school level.

[6] For both the D index and the H index, the smallest unit of analysis is class, suggesting that we are calculating the total segregation, which consists of both between-school segregation within the same district/city and between-class segregation within the same school.

Figure 1. Relationships between School Segregation and Local and Migrant Students' Academic Achievements



Other Variables

Scholars have often pointed to the role of school quality and peer influence in explaining the effect of school segregation on academic performance (Boozer, Krueger and Wolkon 1992; Card and Rothstein 2007; Coleman et al. 1966; Hoxby 2000; Johnson 2011). Given the difficulty of measuring these two factors empirically, we employ several alternative measures. We use three variables to proxy for school quality. The first is the subjective ranking of the school within the county (bottom=1, lower-middle=2, middle=3, upper-middle=4, top=5) by the schoolmaster; the second is the average education of the students' parents at school level (bottom=1, lower-middle=2, middle=3, upper-middle=4, top=5); the last is the school's geographic location in the county/district (downtown=1, suburbs=2, outskirts=3, town=4, rural areas or others=5). These three ordinal measures are treated as continuous variables in the following analysis.

Not only are migrant children often allocated to sub-standard schools, they are also more likely to be exposed to negative peer influence within these schools. We measure peer influence with three proxies. The first is an index constructed from 10 items on the misbehavior of friends

as reported by the students, which is standardized with a mean of 0 and a standard deviation of 1. The second proxy is school climate, an index constructed based on schoolmasters' evaluation, which is also standardized (see the Appendix). The third proxy is community climate, which aims to capture the influence of the community around school (i.e., how many juvenile delinquency cases are there in the community around school? None=1, few=2, many=3, a lot=4). For all the three proxies, higher values indicate that the student is exposed to more negative peer influence.

Due to the selective nature of migration, the quality of migrant students may vary dramatically across counties/districts.[7] Therefore, the selectivity effect may be confounded with the effect of school segregation, because the uneven distribution of migrants in low-quality schools may simply be a reflection of their disadvantaged family background and prior achievement, rather than a result of school segregation *per se*. Therefore, we control for a series of family characteristics, including parental education (1 if college and 0 otherwise), number of parents at home (0, 1, 2), number of siblings (1, 2, 3, 4, 5, 6+), residential location within the county/city (downtown=1, suburbs=2, outskirts=3, town=4, rural areas or others=5).[8] We also use books at home (very few=1, few=2, so-so=3, many=4, a lot=5) to capture the influence of family's cultural capital. Students' individual characteristics such as gender (male=1), age (a continuous variable), and ethnicity (minority=1) are also included in the models as control variables.

Table 1 presents descriptive statistics of the selected variables by *hukou* status. As the first row shows, there is substantial difference in cognitive ability test scores among students with different *hukou* status. The best performers are urban locals, followed by rural locals, whereas both urban and rural migrants lag behind. In other words, while there is an obvious urban-rural division in terms of family resources, the achievement gap exists mainly between locals and migrants. Furthermore, migrant students are overrepresented in lower quality schools with worse peer influence. Most of the differences are statistically significant ($p<.01$).

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[7] For instance, migrants in large cities such as Beijing and Shanghai may be positively selected compared to migrants in other cities, in terms of family background, personal abilities, among others.

[8] As some scholars argue that neighborhood segregation matters more than school segregation (Card and Rothstein 2007; Vigdor and Ludwig 2008), we add the residential location variable as an important control variable to ensure the effect of school segregation is not confounded with that of residential segregation.

Table 1. Descriptive Statistics of Selected Variables by *Hukou* Status

	Hukou status				F-test (Prob > F)		
	Urban Locals (UL)	Rural Locals (RL)	Urban Migrants (UM)	Rural Migrants (RM)	UL-RL	UL-UM	UL-RM
Dependent variable							
CogAT Score	0.183 (0.904)	-0.063 (0.795)	-0.161 (0.808)	-0.282 (0.817)	0.000	0.000	0.000
School quality							
School rank	4.176 (0.754)	3.931 (0.621)	3.944 (0.843)	3.668 (0.937)	0.000	0.000	0.000
Average parental education	2.746 (0.646)	2.375 (0.769)	2.574 (0.648)	2.413 (0.622)	0.000	0.000	0.000
School location	1.656 (1.159)	3.412 (1.442)	1.916 (1.176)	2.283 (1.309)	0.000	0.000	0.000
Peer influence							
Negative friend influence	-0.695 (5.922)	-0.070 (6.315)	0.113 (6.325)	1.115 (6.930)	0.008	0.044	0.000
Negative school climate	-0.248 (0.342)	-0.060 (0.461)	-0.096 (0.431)	-0.008 (0.440)	0.000	0.000	0.000
Negative community climate	2.127 (0.453)	1.995 (0.527)	2.340 (0.508)	2.309 (0.514)	0.000	0.000	0.000
Family characteristics							
Parental education (college=1)	0.470 (0.499)	0.044 (0.206)	0.279 (0.449)	0.049 (0.215)	0.000	0.000	0.000
No. of parents at home	1.776 (0.535)	1.732 (0.610)	1.736 (0.600)	1.773 (0.569)	0.051	0.292	0.918
No. of siblings	0.409 (0.730)	0.800 (0.708)	0.794 (0.886)	1.153 (0.960)	0.000	0.000	0.000
Residence location	1.776 (1.289)	4.048 (1.447)	2.055 (1.403)	2.750 (1.662)	0.000	0.001	0.000
Books at home	3.663 (1.152)	3.054 (1.096)	3.430 (1.206)	2.994 (1.129)	0.000	0.002	0.000
Individual characteristics							
Male	0.515 (0.500)	0.483 (0.500)	0.567 (0.496)	0.524 (0.500)	0.082	0.078	0.718
Age	13.83 (1.146)	13.80 (1.191)	13.82 (1.232)	14.14 (1.305)	0.429	0.830	0.000
Minority	0.071 (0.257)	0.028 (0.166)	0.101 (0.302)	0.081 (0.272)	0.000	0.049	0.385
N	4,802	2,522	848	1,698			

Notes: Data are weighted, standard deviations in parentheses. The total sample size is 9,870.

Empirical Findings

The Effect of School Segregation on the Migrant-Local Achievement Gap

The first step of our analysis is to demonstrate the existence of a substantial achievement gap between migrants and locals. Table 2 presents the OLS results. Model 1 shows the effects of *hukou* status without any controls, and Model 2 adds county-level fixed-effects to partial out the average differences in academic achievement across regions. Model 3 introduces individual

characteristics as control variables, and shows that all of the other three groups are significantly disadvantaged in achievement compared to urban locals within the same county/district. However, after family backgrounds are taken into account in Model 4, rural locals' disadvantage is fully explained, whereas urban and rural migrants' disadvantages remain highly significant. This suggests that migrant students' underperformance cannot be fully explained by their individual-level characteristics and disadvantages in family socioeconomic backgrounds. Other things being equal, both urban migrants and rural migrants score significantly lower than urban locals, by nearly 0.16 and 0.09 standard deviations, respectively. A plausible reason for the slightly better performance of rural migrants than urban migrants is that they are highly selected; that is, it would incur a larger economic burden on rural migrants than on urban migrants to bring their children with them to the cities and enroll them in urban public schools, so their children must be exceptional performers to begin with.

Table 2. OLS Regression Models Predicting Academic Achievement

	Dependent variable: CogAT Score			
	(1)	(2)	(3)	(4)
Hukou status (ref. urban locals)				
Rural locals	-0.243**	-0.257***	-0.254***	-0.040
	(0.094)	(0.064)	(0.064)	(0.039)
Urban migrants	-0.312***	-0.214***	-0.212***	-0.155***
	(0.098)	(0.060)	(0.059)	(0.045)
Rural migrants	-0.461***	-0.248***	-0.241***	-0.089**
	(0.114)	(0.061)	(0.060)	(0.038)
Individual characteristics	No	No	Yes	Yes
Family characteristics	No	No	No	Yes
County fixed-effects	No	Yes	Yes	Yes
Constant	0.180	0.456***	0.871***	0.328
	(0.110)	(0.163)	(0.326)	(0.313)
R-squared	0.038	0.253	0.255	0.290
N	9,870	9,870	9,870	9,870

Notes: Data are weighted; robust standard errors clustered at the school level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics include sex, age, ethnicity; family characteristics include parental education, number of parents at home, number of siblings, residential location within the county, and books at home.

We then proceed to investigate how the achievement gap between locals and migrants varies by the level of school segregation across regions. Table 3 presents the results. We employ two different ways of coding *hukou* status: the first is the four-type classification, the second is the simple migrant-local dichotomy (meanwhile controlling for *hukou* registration type). Correspondingly, we use the H index for the former and the D index for the latter.

Table 3. OLS Regression Models Predicting the Effects of School Segregation on Academic Achievement Gap

	Dependent variable: CogAT Score					
	(1)	(2)	(3)	(4)	(5)	(6)
School segregation						
H index	3.008*	3.001*	2.976**			
	(1.583)	(1.591)	(1.259)			
H index × rural local	-0.719	-0.853	-0.020			
	(1.449)	(1.402)	(1.021)			
H index × urban migrants	-2.493**	-2.479**	-1.949**			
	(1.051)	(1.020)	(0.765)			
H index × rural migrants	-2.292**	-2.198**	-1.353**			
	(1.026)	(0.992)	(0.652)			
D index				3.144*	3.167*	3.328**
				(1.873)	(1.877)	(1.491)
D index × Migrants				-0.676*	-0.625*	-0.499*
				(0.364)	(0.349)	(0.298)
Hukou status (ref. urban locals)						
Rural locals	-0.135	-0.106	-0.052			
	(0.249)	(0.239)	(0.181)			
Urban migrants	0.214	0.213	0.177			
	(0.191)	(0.183)	(0.140)			
Rural migrants	0.138	0.128	0.135			
	(0.175)	(0.168)	(0.103)			
Migrants				0.152	0.138	0.079
				(0.125)	(0.121)	(0.108)
Urban *hukou*				0.206***	0.203***	0.012
				(0.052)	(0.053)	(0.029)
Individual characteristics	No	Yes	Yes	No	Yes	Yes
Family characteristics	No	No	Yes	No	No	Yes
County fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.083	0.336	-0.211	-0.904	-0.518	-0.909*
	(0.163)	(0.335)	(0.318)	(0.547)	(0.635)	(0.538)
R-squared	0.256	0.258	0.291	0.252	0.254	0.290
N	9,870	9,870	9,870	9,870	9,870	9,870

Notes: Data are weighted; robust standard errors clustered at the school level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics include sex, age, ethnicity; family characteristics include parental education, number of parents at home, number of siblings, residential location within the county, and books at home. The H index is Theil's information theory index, and the D index is the index of dissimilarity.

Results in Table 3 consistently show that, irrespective of the model specifications, the achievement gap is significantly larger for migrant students in more segregated regions. For instance, holding constant the effect of individual and family backgrounds, a shift from a nearly completely integrated (H index=0) county to a highly segregated (H index=1) county would increase the achievement gap (compared to urban locals) by 1.9 standard deviations for urban migrants, and nearly 1.4 standard deviations for rural migrants. Similarly, an increase in the dissimilarity index from 0 to 1 is associated with a nearly 0.5 jump in the standard deviation of the achievement gap between local and migrant students.

We further employ a hierarchical linear model to replicate the preceding analyses. The magnitudes of the coefficients are similar.[9] Hence, our results are robust to different model specifications and strongly suggest a large segregation effect.

Table 4. HLM Regression Models Predicting the Effects of School Segregation on Academic Achievement Gap

	Dependent variable: CogAT Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Micro-macro interactive coefficients						
School segregation						
H index			7.849***			
			(2.682)			
H index × rural locals			-0.138			
			(0.564)			
H index × urban migrants			-1.658***			
			(0.341)			
H index × rural migrants			-1.234***			
			(0.469)			
D index						4.381*
						(2.633)
D index × Migrants						-0.586*
						(0.338)
Micro-level coefficients						
Hukou status (ref. urban locals)						
Rural locals	-0.233***	-0.033	-0.015			
	(0.075)	(0.034)	(0.086)			
Urban migrants	-0.222***	-0.148***	0.144***			
	(0.070)	(0.046)	(0.040)			
Rural migrants	-0.258***	-0.084*	0.129**			
	(0.086)	(0.045)	(0.057)			
Migrants				-0.099	-0.105**	0.108
				(0.065)	(0.053)	(0.124)
Urban *hukou*				0.188***	0.010	0.010
				(0.060)	(0.018)	(0.017)
Individual characteristics	No	Yes	Yes	No	Yes	Yes
Family characteristics	No	Yes	Yes	No	Yes	Yes
Constant	0.144	0.287	-1.150***	-0.065	0.273	-1.270
	(0.205)	(0.400)	(0.165)	(0.181)	(0.418)	(1.045)
N	9,870	9,870	9,870	9,870	9,870	9,870

Notes: Data are weighted; robust standard errors clustered at the school level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics include sex, age, ethnicity; family characteristics include parental education, number of parents at home, number of siblings, residential location within the county, and books at home. The H index is Theil's information theory index, and the D index is the index of dissimilarity.

[9] Specifically, we allow the *hukou* status coefficients to vary systematically across counties with the segregation index, and allow the coefficients of other control variables to vary randomly across counties.

Economists typically adopt three strategies to address the issues of endogenous sorting and selection bias. The first strategy is to employ either experiment or quasi-experiment to exploit the exogenous variation in exposure (Angrist and Lang 2004; Guryan 2004). The second strategy is to eliminate sorting bias through aggregation (Card and Rothstein 2007; Cutler and Glaeser 1997). The last strategy is to exploit cohort variation within the same school (Gould, Lavy and Paserman 2009; Hanushek, Kain and Rivkin 2002; Hoxby 2000). We employ the last identification strategy in this paper, assuming that the sorting is based on permanent school characteristics and unrelated to cohort-specific composition differentials. Hence, the contrasts between cohorts within the same school could help to identify the causal effect of exposure.

More specifically, we exploit the variation in the percentage of migrant students in different grades—Grade 7 and Grade 9—within the same school to capture the exposure effect.[1] Specifically, the migrant exposure variable is computed as

$$\text{Grade migrant percentage} = 100 \times \frac{number\ of\ migrants\ in\ a\ grade}{number\ of\ migrants\ in\ a\ grade + number\ of\ locals\ in\ a\ grade}$$

In addition to individual and family characteristics, we control for some aggregate-level variables that could confound the effect of those variables we are interested in, including the total number of students in the grade, the number of migrant students attending the school, the educational achievements of the parents of students in the grade, and gender composition in the grade. Table 6 reports the school fixed-effect models predicting the effects of migrant exposure on students' academic achievement.

We first run the model for the entire sample, and then replicate the analysis separately for the local and migrant subsamples. The significant negative coefficients suggest an adverse effect of migrant exposure on students' academic achievement. However, the migrant exposure effect

[1] A better strategy, of course, would be to exploit the variation in adjacent cohorts' peer composition within a grade within the same school (Hoxby 2000). However, CEPS did not collect such data. Our compromise is justified by the fact that cognitive tests, which assess students' aptitude to use their knowledge and skills, rather than focus on the extent to which these students have mastered a specific school curriculum, are comparable across grades after taking into account the effect of age and other individual characteristics, as well as the average difference in test scores between Grade 7 and Grade 9 students within the same school. While some may argue that most of the exposure effect is generated at the class level, students may not be randomly placed into classes within a grade, and thus we decided not to use class-level variations.

seems to be much smaller than the segregation effect at the county level. This is reasonable considering the greater homogeneity of the student population within the same school (Vigdor, Jacob, and Ludwig 2008). Net of other factors, an increase of 10 percent in the percentage of migrant students will reduce the test score by 0.11 standard deviations for a local student and by 0.07 standard deviations for a migrant student.

Table 6. OLS Regression Models Predicting the Effects of Migrant Exposure on Academic Achievement

	Dependent variable: CogAT					
	All		Locals		Migrants	
	(1)	(2)	(3)	(4)	(5)	(6)
Migrant exposure						
Grade migrant percentage	-0.008***	-0.011***	-0.008**	-0.011***	-0.005*	-0.007*
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Aggregate-level controls						
Grade student number	-0.002	-0.004	-0.002	-0.005	-0.000	0.001
	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)	(0.004)
School migrant number	0.032*	0.034	0.030	0.033	0.039***	0.025
	(0.017)	(0.027)	(0.020)	(0.030)	(0.014)	(0.024)
Grade parental education		0.001		0.002		-0.003
		(0.006)		(0.006)		(0.005)
Grade sex composition		0.002		0.002		-0.003
		(0.006)		(0.007)		(0.004)
Individual characteristics	No	Yes	No	Yes	No	Yes
Family characteristics	No	Yes	No	Yes	No	Yes
School fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.137	0.236	-0.026	0.337	-0.639	0.440
	(0.775)	(1.354)	(0.909)	(1.507)	(0.595)	(1.071)
R-squared	0.311	0.333	0.288	0.317	0.372	0.380
N	9,870	9,870	7,220	7,220	2,650	2,650

Notes: Data are weighted; robust standard errors clustered at the school level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics include sex, age, ethnicity; family characteristics include parental education, number of parents at home, number of siblings, residential location within the county, and books at home.

The above analysis is based on the assumption that the variation in the percentage of migrant students in a certain grade within the same school can be regarded as an exogenous factor as long as we control for aggregate-level characteristics. However, it is still possible that the placement of migrants across grades within the school is not be entirely random, given the high rate of grade retention among migrants. If schools or parents deliberately hold migrant children back so

that more are placed in the grade with better (or worse) students than in other grade, then our results would still be biased.

Therefore, we employ the instrumental variable approach to address this concern. We use the predicted fraction of migrants based on students' date of birth to instrument the actual percentage of migrant students in a grade, because this information is not subject to a school's or parents' endogenous decisions of grade placement. Specifically, we first calculate the mean age of locals for a certain grade (which represents the typical age of an average student if he or she is making normal progress in school). Only those students whose age falls within one standard deviation of this mean age are treated as a member of this grade. Accordingly, the IV is calculated using the following formula:

$$\mathrm{IV} = 100 \times \frac{predicted\ number\ of\ migrants\ in\ a\ grade}{predictednumber\ of\ migrants\ in\ a\ grade + predictednumber\ of\ locals\ in\ a\ grade}$$

The exclusion restriction assumption of this IV is that, conditional on the actual number of migrants in a school and the total number of students in a grade, the difference in the predicted proportion of migrants across grades can be seen as random and thus should not affect the outcome of interest. The balancing tests confirmed this assumption, showing that the predicted percentage of migrant students in a grade is uncorrelated with individual and family characteristics of students, after controlling for other factors.

Table 7 presents the 2SLS estimations for the effect of migrant exposure on local and migrant students' achievements. While the first-stage results are not presented here, the Shea partial R^2 suggests a strong correlation between our IV and the variable of interest; that is, the IV can explain over 70 percent of the variation in the migrant exposure variable.

Overall, the coefficients estimated via the IV approach shown in Table 7 are larger and more significant than those obtained via OLS regression, indicating that the OLS estimates are biased downward because of the endogenous retention of migrants within a school. Other things being equal, an exogenous increase of 10 percent in the percentage of migrant students will reduce the test score by 0.14 standard deviations for a local student and 0.10 standard deviations for a migrant student. Therefore, these results consistently show a significantly negative effect of exposure to migrant peers on the academic performance of both local and migrant students.

Table 7. 2SLS Models Predicting the Effects of Migrant Exposure on Academic Achievement with the Predicted Percentage of Migrant Students in A Grade as the Instrument

	Dependent variable: CogAT					
	All		Locals		Migrants	
	(1)	(2)	(3)	(4)	(5)	(6)
Migrant exposure						
Grade migrant percentage	-0.012***	-0.013***	-0.013***	-0.014***	-0.007*	-0.010**
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
[Shea Partial R^2, First-stage F]	[0.719, 29.11]	[0.726, 26.56]	[0.756, 48.94]	[0.770, 45.90]	[0.636, 12.03]	[0.627, 11.37]
Aggregate-level controls						
Grade student number	-0.001	-0.004	-0.001	-0.005	0.000	0.001
	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.004)
School migrant number	0.041**	0.038	0.039*	0.036	0.048***	0.031
	(0.020)	(0.027)	(0.022)	(0.029)	(0.018)	(0.025)
Grade parental education		0.001		0.001		-0.003
		(0.006)		(0.006)		(0.005)
Grade sex composition		0.003		0.003		-0.002
		(0.006)		(0.007)		(0.004)
Individual characteristics	No	Yes	No	Yes	No	Yes
Family characteristics	No	Yes	No	Yes	No	Yes
School fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.343	0.233	-0.220	0.342	-0.890	0.411
	(0.825)	(1.343)	(0.959)	(1.491)	(0.611)	(1.074)
R-squared	0.311	0.333	0.287	0.316	0.372	0.380
N	9,870	9,870	7,220	7,220	2,650	2,650

Notes: Data are weighted; robust standard errors clustered at the school level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics include sex, age, ethnicity; family characteristics include parental education, number of parents at home, number of siblings, residential location within the county, and books at home

Conclusions and Discussion

This paper examines *hukou*-based school segregation (measured by both unevenness and exposure) among Chinese junior high school students and its impact on the rural-urban gaps in academic achievement. Based on data from a nationally representative school-based survey (the Chinese Educational Panel Survey), we found that a high level of school segregation benefits local students (especially urban locals) but harms migrant students. School segregation affects students' academic performance through the influence of both school quality and peers. In cities where competition for educational resources is fiercer, migrant children are relegated to more disadvantaged schools where they are more likely to be exposed to negative peer influence.

Moreover, by adopting an instrumental variable approach, we estimated the causal effect of migrant exposure on both local and migrant students' academic achievement. Since migrant students are disproportionally located in those schools with a higher concentration of migrants, they suffer more from the adverse effect of migrant exposure at the aggregate level. More broadly speaking, this dimension of segregation also contributes to the achievement gap between migrant and local students. Hence, we conclude that China's educational system renders migrant children disadvantaged in learning outcomes through large-scale *hukou*-based school segregation. The two dimensions of the school segregation, i.e., unevenness and exposure, both contribute to the sizable disparities in academic performance between migrant children and local students in urban China.

Why do local governments adopt such segregation policies towards migrant children without local *hukou*? In China, local governments are expected by the central government to provide nine-year compulsory education for all children, including migrant children, through the public school system. However, when educational resources are scarce and locals and migrants are vying for the same pool of resources, local governments would have stronger incentives to adopt such segregation policies to protect the benefits of residents with local *hukou*. As a result, places in privileged local schools are almost exclusively occupied by locals, whereas migrants are relegated to sub-standard schools with very little resources and poor learning environment. Not surprisingly, *hukou*-based school segregation has exacerbated migrants' disadvantages in academic achievement in urban China.

The result that a high level of migrant exposure hurts both local and migrant children needs to be carefully interpreted. It could be due to a school's lack of capacities and resources to

assimilate migrants and to meet their special needs. Indeed, because migrant students are far more likely to be in those schools with a high concentration of migrants, they suffer more from this adverse exposure effect, which contributes to the large gap in academic achievement between migrant and local children. As education becomes increasingly important for socioeconomic mobility in the modern society, the underperformance of migrant children in junior high schools are likely to have detrimental and cumulative impacts on their subsequent education transitions and other outcomes in the long run.

The migrant children in the data we analyzed are likely to be positively selected. In the school-based survey, migrant children not attending schools are not covered, and neither are those in unregistered migrant schools. Therefore, the level of school segregation and the disadvantages of migrant children could be even more severe than observed from the available data.

Notwithstanding that migrant children face serious challenges in access to equal educational opportunities in cities because they have no local *hukou*, a simple abolishment of the *hukou* system may not be the magic wand that could solve all problems (Zheng and Wu 2013). As long as resource competition exists, migrant children will still be marginalized in the local school system in their destination cities. There is a still a long way to go to ensure equal access to quality schools for all in the Chinese urban public school system.

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Appendix: Item Parameters for Constructed Variables of Negative Peer Influence

Negative friend influence

Among your best friends, how many of them meet the situation described in following statements? (Answered by students)

	Statement	None	Seldom	Many
1	Have excellent academic performance	1	2	3
2	Study very hard	1	2	3
3	Want to go to college	1	2	3
4	Have poor school attendance record	1	2	3
5	Have been punished for breaches of school discipline	1	2	3
6	Have physically fought with other students	1	2	3
7	Have smoked or drank alcohol	1	2	3
8	Always go to internet cafes and game rooms	1	2	3
9	Have engaged in teenage love	1	2	3
10	Have dropped out of school	1	2	3

Note: Statements 1, 2, and 3 are negatively scored items. The others are positively scored items.

Negative school climate

During the past week, how many times have the following situations occurred in your school? (Answered by schoolmasters)

	Statement	None	1-4 times	5-10 times	Over 10 times
1	Students got into physical fights	1	2	3	4
2	Students vandalized public property	1	2	3	4
3	Students smoked	1	2	3	4
4	Students drank alcohol	1	2	3	4
5	Gang activities within and outside school	1	2	3	4
6	Poor discipline in classrooms	1	2	3	4
7	Teachers scolded students	1	2	3	4
8	Teachers carried out corporal punishments on students.	1	2	3	4