Moving for Opportunities? Examining the Public School Attendance and Reading Achievement of Migrant Students in Beijing

by

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Dedication

To my parents,
for their love and support of me.

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ABSTRACT

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Since the early 1990s, privately-run migrant schools have been established to provide affordable education for children of migrant workers who encountered difficulties in receiving compulsory education in urban areas due to China's household registration system. Recent policies promulgated by China's government have gradually eliminated the institutional and economic barriers to equal access to public schools for migrant children; however, few studies have examined whether these new policies are leading to equitable achievement for migrant children.

This study intends to bridge the gaps in previous studies by addressing the following research questions: (1) what is the current magnitude of achievement gap between urban students and migrant students, and does the achievement gap for migrant students differ in public schools and migrant schools? and (2) do migrant students benefit academically from attending public schools, and if so, are public schools effectively narrowing the urban-migrant achievement gap? By making use of a cross-sectional longitudinal dataset collected from 19 elementary schools in a southwestern Beijing school district, I applied three-level hierarchical growth models to estimate the growth trajectories of grade 3 and

5 migrant students. I also combined propensity score matching and hierarchical growth modeling to strengthen the causal inference of school effect in this observational study.

Results showed that urban and migrant schools varied significantly in initial reading achievement level and growth rate. They also indicated that the variation within schools was greater than the variation between schools on initial status. However, almost all variation in growth rate was attributable to between-school heterogeneity. Results also showed the achievement gap between migrant students studying in public schools and migrant students studying in migrant schools expanded at both grades; however, the increase was only significant at grade 5. Moreover, migrant students studying in urban public schools demonstrated comparable growth trajectories in reading achievement at both grades. In other words, attending public schools neither widened nor narrowed the urban-migrant achievement gap. These results suggest some ways that the changes in educational policy might benefit migrant students, but even more evident is the need for additional measures to improve migrant students' opportunities for high quality education.

CHAPTER Ⅰ

Introduction

Social Background of Education for Migrant Children

Urbanization and rural to urban migration

Ever since China first instituted major economic reforms three decades ago, one feature of the rapid social change in China was the unprecedented rural to urban migration (Liang, 2003; Seeborg, Jin, & Zhu, 2000). As the world's most populous country, China is transitioning from a predominately rural society to an urban one. The rural migrant worker population has expanded significantly, increasing from roughly 30 million in 1989 to more than 180 million in 2009 (National Bureau of Statistics of China, 2009). By 2020, it is projected that approximately another 100 to 150 million rural labors will join the rural labor migration (Yang, 2008).

China has been experiencing the largest movement of labor in human history (Lu, 2009), and the migration from rural to urban areas might be attributable to China's rural-urban income disparity (Joseph, Chai, & Karin, 1997). According to the most recent estimates, the per-capita disposable income was 17,175 yuan ($2,514) for urban residents and 5,153 yuan for rural residents in 2009 (National Bureau of Statistics of China, 2010). As a result, the urban-rural income gap encouraged unemployed or low-waged rural laborers to move to the cities in order to take advantage of the bourgeoning market economy and to seek job opportunities and higher wages (Chen et al., 2006; Grey, 2008;

Huang, 2008; Knight & Song, 1999). The migration of one family member increased a household's income per capita by 8.5 to 13.1 percent (Yang, 2005). With the advancement of economic reform and a decline in rural social services, however, few migrant workers were merely moving to cities in order to more money; their tendency to settle in cities became increasingly evident (Lu & Zhang, 2004).

Since the early 1990s, one of the vital changes of the migration pattern was from individual to family migration; increasingly migrant workers brought their families to the cities, including children of school age (Duan & Liang, 2003; Zhou, 2003). The Beijing Migrant Census of 1997 found that 32 percent of the migrant workers in Beijing relocated with their families (China Daily, 2003), and this figure increased to 75 percent in 2005 (Lu & Zhang, 2004). The 2000 Census of China indicated that approximately 19 percent of migrant population was below 18 years of age, amounting to 19.8 million children (Xinhua News Agency, 2005), and 29.9 percent of them were born in cities (CLB, 2009). However, urbanization is not simply a process in which farmers migrate to cities. Instead, it is a complex process that not only requires co-development with whole economic system but also needs to be compatible with conditions of social security, education, health care (Wen, 2006). Unfortunately, millions children of migrant workers have faced severe difficulties in gaining access to education in urban cities (Han, 2004).

Institutional barriers to urban schools

The problem of education for migrant children is mainly framed by China's household registration system (hukou) and a decentralized education financing system. The hukou system in China was enacted and implemented in 1958, dividing the population into rural or urban residents (Cheng & Selden, 1994). Two primary functions

of hukou were to maintain organization and order within the population by preventing mass migration into urban areas (Guo & Iredale, 2004; Wang, 2005) and to adjust the distribution of social resources and necessities (Guang, 2003). With the social and economic reforms in China, the hukou system designed to restrict the population flow weakened. Although rural residents were allowed to migrate to urban cities and temporarily reside there from the late 1970s, this geographical migration did not lead to a change of resident status (Chan, 1994); migrant workers and their families remained rural residents. Consequently, even though they actually worked and resided in cities, they were excluded from many social welfare benefits which their urban counterparts enjoyed, including state subsidized medical care, pension, housing, and education for their children. In this study, migrant children refer to those who live in a city with their family, rather than at rural areas where they are registered as permanent residents, even though some of them were born in a city.

Under the decentralized education financing system, local governments are primarily in charge of allocating education resources and administrating local public schools. Government budget for education is mainly based on the number of children who are registered as permanent residents within the local governments' jurisdiction. Therefore, students must reside within the local school district and must be registered as permanent resident as well in order to attend an urban public school (Liang & Chen, 2007). In contrast, for school-age children without residence registration, their funds for education should be raised by his or her original place of registered residence, and thus the schools in cities do not have extra funds to provide free or low-cost education for migrant children (HRIC, 2002).

The longstanding hukou system and educational financing system did not evolve with the changing dynamics of the labor force; therefore, many migrant children have been denied access to free compulsory education in cities of China. Migrant parents were often aware of the inadequacies of rural schools and desired for their children to have better educational opportunities than they did. Yet the financial obstacles within the new city have made this goal difficult to achieve (Zhu, 2003). In one study, over half of migrant workers in Beijing stated that the main deterrent to bringing their children with them was their inability to afford schooling in Beijing (Sa, 2004). As a result, some parents opted to send their children back to rural areas where they were registered, given the intense and systematic discrimination confronting the migrant workers and their children in cities.

Establishment of migrant schools

In order to fill the education gap resulting from difficulties to enroll in urban public schools and growing demands for affordable education for the children of migrant workers, since the early 1990s, one grassroots response from the migrant communities themselves was the establishment of privately-run migrant schools catering to migrant children in cities. In this paper, migrant schools refer to those schools established at suburban areas of urban cities to provide education at the elementary and secondary level exclusively for migrant children, supported by migrant workers or other social charities (Han, 2004; Kwong, 2005). These migrant schools often operated without official approval and without financial support from local education authorities (Nielsen et al., 2006).

Migrant schools posed a dilemma for the Chinese government. Perhaps for financial and other considerations (e.g., the potential influx of migrant population if their children had equal access to local schools), the government had no strong incentives to provide education for these migrant children. But no government could condemn migrant schools for "illegally" providing education to migrant children when there were few practical alternatives available (Kwong, 2005); migrant schools were on a high moral ground. When it became apparent in the late 1990s that the number of migrant children living in cities with their parents was growing rapidly, a new direction in policy emerged. The new motto was "do not ban, do not recognize, let it run its course (Han, 2004)." The government expected migrant schools to survive or perish on their own.

Policy Responses to Migrant Children's Education

Significance of education for migrant children

The increasing number of migrant children suggests that lack of adequate education for migrant children would not only have a detrimental impact upon migrant children's individual development, but also lead to negative consequences for societal well-being (Buchmann & Hannum, 2001). Equity access in education is fundamental because it is an integral part of human right and social justice that should be fulfilled. The Compulsory Education Law of China (1986, revised 2006) entitles all children between the ages of 6 to 15 to a nine-year compulsory education regardless of gender, race, religious belief and material wealth. Furthermore, the right to education is also guaranteed in a number of international instruments (HRIC, 2002). According to the definition provided in The State of the World's Children Report 2006, migrant children in China were categorized as marginalized and invisible children for being unofficially excluded from public

education, which “clearly affects children’s ability to participate in their communities and societies in both the present and the future” (UNICIEF, 2006).

Extensive historical evidence illustrates that attaining high levels of education was fundamental for the industrialized countries to achieve significant economic growth (Lu, 2007). The impact of education on better health and nutrition, higher earnings, improved productivity and economic growth in developing countries has been also well documented in the research literature (Binder, 1998). So if China wants to maintain sustained, rapid and healthy growth of its economy, it is generally believed that expanding educational opportunities for migrant children is requisite to prepare skilled workers.

Not only the nation’s economic strength but also its social cohesion depends on all children being well educated. Therefore, providing equal educational opportunities for migrant children can play an important part in enhancing social equality and stability. The migrant families lived in the urban areas, but were basically isolated from urban life. This fact might lead to a gap between urban people and migrants in the future (Carr, 2007). On the one hand, when the poor encounter discriminations in their life, the poverty might engender the thirst for changing reality. The availability of equal educational opportunities might help migrant children successfully integrate into mainstream society. On the other hand, the deprivation of a migrant student's constitutional right to an equal educational opportunity is likely to lead to a more radical second generation of migrants, thus exacerbating their conflicts with urban residents. Therefore, an equitable and just social environment might effectively eliminate radicalism and active resistance; the

failure to address these problems will threaten social stability, which is the top priority of China's government at the present time.

The 1998 Measures

As the migrant population in urban cities continued to grow, the Chinese government began to take measures to promote levels of access to, and quality of schooling for migrant children (Wang & Yao, 2003). On March 2, 1998, the Ministry of Education and the Public Security Bureau issued the *Provisional Measures for the Schooling of Migrant Children and Young People* (1998 Measures), which stressed that migrant children should received compulsory education in their place of permanent residence; only children who did not have a guardian could study in their place of domicile. 1998 Measures also urged government of receiving areas to guarantee that migrant children could receive compulsory education in full-time, state-run schools under the status of temporary students. Since the local government was responsible for providing a child whose hukou was registered with nine years of compulsory education free of charge, migrant children were not included in the local budgetary educational expenditure. As a result, urban public schools were allowed to collect additional temporary student fees, which were not imposed on local students, to make up to the shortfall. For example, in Beijing in 1999, in addition to the 300 to 400 yuan miscellaneous fees paid by local students each term, migrant parents had to pay a 480 yuan temporary student fee, a 2,000 yuan education compensation payment and 1,000 yuan school selection fee. Moreover, some prestigious urban public schools demanded over 10,000 yuan (and some as high as 23,000 yuan) in school selection fees from migrant parents (Kowk, 2006).

These fees placed an intolerable burden on migrant families (Wei, 2006). Migrant workers generally took low-paid, no-benefits jobs, which were inferior to those of urban residents. Their average monthly income was around 1000 yuan (People's Daily, 2002). In addition to the discriminatory fees, the 1998 Measures only provided compulsory education for migrant children whose parents processed five or more required permits (e.g., temporary residence permits, work permits, proof of residence, certificates from the place of origin, and household registration booklets). However, up to 90 percent of migrant families were unable to obtain all "five certificates" because the application process was indeed expensive and time-consuming (Human Rights Watch, 2006). Institutional barriers had been woven with low economic status among migrant families. The interplay of social inferiority and economic barriers deprived migrant children of equal access to education (Pan, 2004).

Rapid development of migrant schools

The 1998 Measures stipulated that the education of migrant children could be supplemented by other forms of schooling, and legalized the previously illegal migrant schools. Article 9 provided that enterprises and institutions, social organizations and other social groups or individuals can run local people's schools (*minban xuexiao*) or simplified schools (*jianyi xuexiao*) specially for migrant children and young people with permission from county-level education administration departments in the receiving areas.

Because parents in China valued education for their children, migrant schools mushroomed to meet the large demand of education by low-income migrant families (Han, 2001). In 1999, there were as many as 114 migrant schools running in Beijing, and half of them opened after 1998 (Lu & Zhang, 2004). Compared to public schools, these

migrant schools seemed favorable for migrant children in several respects. First, there was no admission requirement of hukou. Such flexibility allowed school access to many migrant students who did not possess temporary residence or temporary student status papers (Ding, 2004). Second, the education costs were affordable for most migrant families. The fees generally charged at migrant schools were about 300-500 yuan per semester (Froissart, 2003; Han, 2004), and the payment system was much more flexible as well. Third, the school climate in migrant school was more equitable. Previous research revealed that migrant children studying in public schools had a higher level of perceived discrimination due to their low socioeconomic status (Sun, 2008). In contrast, migrant schools were more homogeneous; students all came from migrant households, thus resulting in a less discriminatory school climate. Fourth, many migrant schools adopted the national curriculum. Because migrant families were highly mobile (Han, 2004), using the national curriculum provided continuity for students who transferred in from other provinces, or who moved back to their home provinces (Kwong, 2005).

Compared with Beijing state-run schools, however, migrant schools were also thought to be deficient in many respects. Migrant schools were perceived as having poor infrastructure and teaching facilities, lack of qualified teachers and underdeveloped curriculum, and a disproportionate concentration of poverty and low achievement among students. Specifically, many migrant schools were housed in converted factories that did not meet even basic safety standards. Migrant students had to study in such simple and crude environments (Ding, 2004; Skorstad, 2006). Lack of basic teaching equipment and facilities for health-care and extracurricular activities was also prevalent among migrant schools.

Second, research studies (Ding, 2004; Kwong, 2005) found that few teachers at migrant schools were qualified. Since most migrant schools were privately owned and run for profit, school operators had a tendency to minimize costs at the expense of teacher quality. Teachers in migrant schools generally did not possess teacher credentials or previous teaching experiences. The low wages and heavy teaching burdens also resulted in high teacher turnover rates; a class could have as many as seven different teachers in one semester (Shen, 2006; Han, 2004). Moreover, because of lack of qualified teachers, some courses such as music, physical education and art were rarely offered.

Third, migrant schools had high concentrations of students from low-income households. According to Beijing Municipality's Minimum Social Security for Urban Residents implemented in 2000, the minimum level of per capita income was 280 yuan per month. Using the Beijing standard as reference, more than half of the migrant school students surveyed came from impoverished families below the line of minimum income (Han, 2004). In addition, students in migrant schools were highly mobile, thus leading to a problematic lack of uniformity in age and scholastic standings within classrooms.

1998 Measures also allowed local governments to pass their own measures with regard to the governance of migrant schools. In Beijing, there are 10 municipal districts and 8 counties. The pace of change and approaches to regulating migrant schools varied considerably among districts and counties. Because of inadequate government support and monitoring, many schools for migrant children were unable to meet the minimum standards set by local education authorities (Nielsen et al., 2006). Instead of supporting migrant schools' catering to the educational needs of migrant children, some districts focused on their regulatory role and closed migrant schools for violation of educational

regulations (Lu & Zhang, 2004; Kwong, 2005). In contrast, sympathetic local governments recognized the migrant workers' contribution to the economy; they also had concerns about the number of students not enrolled in schools. Some districts adopted a policy of tolerance but still failed to create a procedure for licensing migrant schools (Institute of Rural Labor Development, 2000).

The 2003 Notice

Thereafter, the central government strived to made continuous efforts to promote equal education in China. *The 2003 Notice of the State Council on Further Strengthening Rural Education* (2003 Notice) made critical changes in its policy documents, as compared to the 1998 Measure, suggesting a change from an exclusive to an inclusive perspective in migrant children's education (Zhou, 2005). The 2003 Notice switched the responsibility for providing education to migrant children from the areas of their hukou registration to the receiving cities. This new measure reinforced the principle of education delivery from the 1998 Measures in which the urban public schools were the major channel for educating rural migrant children. Migrant children were then entitled to attend an urban public school near their neighborhood. In addition, the 2003 Notice pointed out that migrant children and non-migrant urban children should be treated equally—that is, using the same academic standards and educational goals. This was a significant step towards a more inclusive policy of migrant children education.

Furthermore, the 2003 Notice abolished the requirement of extra fees for migrant children. Meanwhile, it stated that municipal governments should provide migrant children with the same rights as local students, and migrant students should not pay more than local students in order to receive a proper education. In order to curb the malpractice

of arbitrary fee collection, the central government further implemented a nationwide "one-fee system" in 2004, under which schools could only collect miscellaneous fees under one title and only once a semester.

Although the Chinese central government urged municipal authorities to eliminate the extra fees imposed on migrant children so that schooling in urban areas was free, most observers were skeptical about how successful the new regulations would be. In order to minimize the potential influx of migrant population, many local governments, especially in coastal cities, delayed the implementation of, or limited the number of children eligible for the benefits from central government policies designed to make education more accessible (Zhu, 2003). For example, Shanghai government hesitated to provide financial aids to migrant children because it might lead to a drastic expansion in the migrant population and was likely to aggravate the burden on the city of Shanghai (Zhu, 2001). In contrast, to open up Beijing's school system, the Beijing Education Commission introduced regulations to eliminate temporary school fees for migrant children, specifying that they should pay the same fees as urban children (China Daily, 2004).

Even if the 2003 Notice had been implemented fully by local governments, urban public schools could not accommodate the growing number of migrant students alone because of the limited space available. Therefore, the number of migrant schools in Beijing kept increasing rapidly every year. Recent media reports stated that by the end of 2003 there were approximately 200 migrant schools in Beijing, enrolling more than 40,000 students (Xinhua News Agency, 2003). The number of migrant schools had increased to 300 by 2004 (Xinhua News Agency, 2004).

Nonetheless, many migrant schools neither went through legal application procedures nor were granted license to operate, and the poor facilities were often cited as grounds for shutting down these migrant schools (Froissart, 2003; Han, 2004). Without the official endorsement, operators of such unlicensed migrant schools usually avoided long-term investments in school facilities. In fact, some of migrant schools received extensive coverage in local and international media, as well as donations from Non-Governmental Organizations (NGOs) and foundations. The contributions of these donors helped to improve the school facilities to meet government requirements (Kwong, 2005). From the early 2000s some Beijing districts began to accredit migrant schools and to issue permits. In September 2004, Xingzhi Migrant School became the first of its kind to get official certification to operate (Daniel, 2005). By now, there are around 300 migrant schools in Beijing, and 60 of them have been granted licenses (China News Weekly, 2010). In some cases local governments even offered aid to licensed migrant schools. However, the low-quality migrant schools that were denied approval must continue to struggle without government supports.

While there is still much effort needed to continue to improve migrant schools, considerable progress has been made in the quality of education provided, and many migrant schools nowadays do offer good facilities and a dedicated teaching staff. Since the operational costs of migrant schools are mainly covered by tuition, competition for attracting more enrolling students spurs operators to improve school quality. For example, bolstering investment in teacher salaries considerably increased the teacher quality in migrant schools. More and more teachers received pre-service teacher training: a recent study of 249 teachers from 13 migrant schools found that more than half teachers

graduated from normal college (Yuan, 2004).

Achievement Gap and School Choice

Education and social mobility

As previous studies have shown, migrant workers in China were disproportionately involved in low-status and low-paid jobs, thus suffering from disadvantaged socioeconomic status. The hardship and suffering in their lives made migrant workers aware of the importance of education and they placed high expectations on their children. Many migrant parents saw education as a way for their child to escape poverty and to gain respect in their new place of residence. Whether the low economic status is transmitted to the next generation largely depends on migrant children's ability to achieve upward mobility as reflected in their educational attainment.

In countries that have experienced rapid economic growth, the benefit of education has become more apparent (Van der Berg, 2008). Several studies found that the economic returns to education were low in 1980s and early 1990s in China (Byron & Manaloto, 1990; Meng & Kidd, 1997). After more than two decades of economic transition from a planned regime to a market regime, the returns to education have risen dramatically, from only 4.0 percent per year of schooling in 1988 to 10.2 percent in 2001(Zhang et al., 2005). Moreover, the returns to education increased at an accelerating rate at the higher education level (Li et al., 2005; Sun, 2004).

At present, hukou designation remains a hereditary status inherited at birth from one's parents, and it is almost impossible for migrant children to alter their hukou status under the current stringent system. Regular channels for hukou conversion from rural to urban include recruitment by a state-owned enterprise, enrollment in an institution of

higher education, promotion to a senior administrative job. Going to college and then obtaining a permanent job in the urban public sector is the most feasible way for migrant children to change their houkou status from rural to urban. This opens up possibilities for social and economic mobility and provides incentives for migrant parents and their children to invest more time and effort in education aiming to break the vicious cycle of poverty.

Academic achievement and access to higher education

In China, in order to keep equal opportunity and fairness, all college applicants need to take the National College Entrance Examination (gaokao). The gaokao covers common school topics such as math, Chinese language arts, history, and science. Although China's higher education is moving towards a direction of diversity, the examination is essentially the sole determinant for admission to virtually all colleges and universities in China. As a result, this examination is highly competitive.

According to the Working Regulations for the Enrollment of Regular High School Students, migrant children have to take the college entrance examination in the place where they have permanent household registration (CLB, 2009). However, discrimination against rural hukou holders in the provision of educational services is intertwined with other structural barriers (Wang, 2005). Most higher education institutions are spatially located in eastern urban centers. The result of this uneven development is that students in rural regions have less access to higher education than those in the urban, coastal areas. On the other hand, the Ministry of Education employs a strict system of hukou-based quotas to allocate available spaces for college admission. Such quotas favor the residents of larger cities so that they can take advantage of this system. Further, the minimum score

for college admission is lower than some other provinces: a student with Beijing hukou can score nearly 150 points lower than a rural student in Shandong province (on a test with a maximum score of 750), but the former is still admitted while the latter is refused. Skewed university admission requirements limit higher educational opportunities available for migrant children and other rural hukou holders, thus decreasing their likelihood of social mobility. To achieve upward mobility, they need to be more competitive than their urban peers in terms of gaokao scores.

With more equitable access to compulsory education, a survey conducted in 2005 revealed that migrant parents were paying more attention to the equal treatment during schooling process and equal opportunities for secondary and higher education (Lei & Yang, 2007). Education is the main channel for social mobility in China (Deng & Treiman, 1997), and a college degree can easily propel a poor migrant student into the middle class. Unfortunately, the regional and class inequalities in China's higher education are drastic. The national average college enrollment rate was 23.3 percent by 2008. However, in large metropolitan areas like Beijing and Shanghai, 47 percent of students who started elementary school went to colleges. In contrast, as few as 1.3 percent rural poor students received higher education (REAP, 2009). Moreover, students from different social backgrounds were likely to study in different types of higher education institutions: urban students had a higher possibility to enter national key universities than their rural counterparts; rural students were likely to attend provincial or local colleges which were relatively poorly staffed and equipped compared to national key universities (Wan, 2006).

Since academic performance measured by National College Entrance Examination is the determinant for entry into colleges, the disparity in higher education opportunities indeed reflects the rural-urban achievement gaps accrued from students' past educational experiences. Vegas and Petrow (2008) pointed out that "Expansion of education opportunities has not markedly reduced income inequality, underdevelopment, and poverty, possibly because of the poor quality of education (p. xxii)." It is well-documented that achievement test scores in early school years are correlated with later labor market outcomes, such as earnings (Farkas & Vicknair, 1996; Johnson & Neal, 1998). Therefore, the quality of education is crucial for escape from poverty (Van der Berg, 2008). The achievement gap has profound consequences for both migrant students and the society: migrant students might be caught in a vicious cycle of low achievement and poverty; given the large number of migrant children in China, whether they can achieve upward mobility also has a great implication for the society as a whole.

The low achievement levels not only deprive migrant students of opportunities to college, but also bring out resistances from urban parents when migrant students strive to study at public schools in cities. Urban parents feared that accepting migrant children in public schools hampered their own child's academic performance (CLB, 2009). Pressure from local parents even forced the authorities to suspend plans for greater school integration. For example, in 1999, migrant children in Wuhan were allowed to attend public schools. However, local parents claimed their children would suffer academically and the plan was terminated eventually (Xinhua, 2006). Apart from resistance from local parents, urban school teachers and administrators were often concerned that accepting migrant children would negatively affect the school performance (Jin, 1996). Some

migrant students were rejected because of their failure to pass qualifying exams administered by public school. In addition, many local authorities preferred to spend education funding on improving the chronically low-performing schools instead of accepting large number of migrant children, as they assumed these children would deteriorate the overall quality of the education provided (Duan & Zhou, 1999). With the existence of stratification of schools along lines of pupil ability in Beijing, access to a high quality elementary school may confer a positional advantage for entry into a high quality high school, which may confer a positional advantage for entry into a high quality college. Therefore, the achievement gaps should be addressed in the early school years.

Parents' considerations of school choice

Although the overall school enrollment rate of migrant children is catching up with the national average, expanded access to public school is only an important first step because ensuring that migrant children can achieve as high as urban students is equally important. Migrant parents, especially those who were engaged in low-paying jobs with low education, expressed a strong desire for equal access to high quality schools for their children. In particular, they believed that education was a crucial way to break the intergenerational transmission of poverty (Zhang & Zhao, 2003). When choosing a school for their child, the first and foremost determinant among migrant families was the quality of the schools. A second important consideration was the cost (Lu & Zhang, 2004).

Migrant parents may choose to leave their children behind in the place of origin and let them receive free compulsory education at rural state-run schools. However, most parents viewed rural schools as under-resourced and under-staffed (CLB, 2009).

Moreover, if children of migrant workers were left behind in the countryside, they had to deal with a variety of problems resulting from long-term separation from their parents, insecurity, anxiety and fear. In addition, parents were unable to supervise and evaluate the quality of education that their children received from schools (HRIC, 2002). There were repeated reports that left-behind children were worse off in terms of educational outcomes as a result of parents' absence (Du & Bai, 1997; Tan et al., 2000).

Despite immense hardships, more and more migrant parents kept their children with them in cities and gave their children a better educational environment if the financial situation of their family allowed them to do so (Lu & Zhang, 2004). The 2000 Census showed that about 56.5 percent of migrant children were living with their parents. The younger the child, the higher the likelihood they lived with parents (CLB, 2009). Although facilities and conditions were simple and crude, 39.1 percent of the migrant parents maintained that migrant schools were better than rural schools (Lu & Zhang, 2004). On the other hand, urban public schools are staffed by qualified teachers, have well-developed curriculum and high-quality school facilities. In a survey, migrant parents ranked their preferences for three choices of school as follows: Beijing public schools, migrant schools in Beijing, and rural schools in their places of origin (Lu & Zhang, 2004).

The migration literature in many other countries suggests that, due to large rural-urban educational disparities, rural families are able to improve children's school performance by settling down in towns and cities where educational opportunities tend to be better and where schools are of higher quality (Verropoulou et al., 2002). Even though it is perhaps that attending a high-quality school contributes significantly to high student achievement, there are some possible reasons why migrant children might be

disadvantaged in a public school system. First, migrant children and their families are both geographically and socially segregated from the local population, thus reinforcing suspicion and misunderstanding between the two groups. This may be why migrant children often face pervasive discrimination and are very conscious of unfair treatment as "second-class citizens" (Pan, 2006; REAP, 2009). For example, the percentage of migrant children claiming they were often discriminated against could reach as high as 76 percent (Lei, 2004). Second, the relationship between migrant children and their teachers is problematic, too. At the present time, public school teachers are not held accountable for academic performance of migrant student in their classrooms. As a result, some teachers paid less attention to migrant children, or just ignored them (Li, 2004; Lu & Zhang, 2004). A study showed that a high percentage of migrant children had low level of satisfaction with the teacher-student relationship in public schools (Shen, 2006). Third, since Beijing public schools use locally-prepared textbooks rather than national textbooks, migrant children might experience curriculum discontinuity as they transfer from migrant school to public school. Additionally, in the era of New Curriculum Reform, teachers in public schools tend to help students collaboratively construct knowledge, rather than just transmit it to students. Many migrant children lack the necessary high-order thinking skills and language skills, thus getting marginalized from classroom discussions. As has been stated, whether migrant students can benefit academically by studying in Beijing public schools is a legitimate concern.

Research Questions

Since the rural school is the least ideal choice for migrant parents and their children, this study focuses on the academic performance of migrant children studying in either

migrant schools or public schools in Beijing. There are few studies examining whether these new policies expanding equal access to urban public schools are resulting in more equitable achievement for migrant children.

Data for this study were collected by the Panel Study on the Development of Migrant Children (PSDMC) conducted by a research group led by Professor ZHOU Hao at Department of Sociology, Beijing University. This project was intended to examine the effects of family migration on psychological adjustment and academic achievement of migrant children. By making use of this unique longitudinal dataset collected from 19 elementary schools at Beijing, the present study intends to bridge the gaps in previous studies by exploring the following two research questions: (1) what is the current magnitude of achievement gap between urban students and migrant students, and does the achievement gap differ in public schools and migrant schools? and (2) do migrant students benefit academically from attending public schools, and if so, are public schools effectively narrowing the urban-migrant achievement gap? Although public schools and migrant schools have considerable differences in quality of facilities and teachers, both risk and protective factors that influence migrant children's academic achievement coexist in both public schools and migrant schools. Therefore, the answer to the second research question is not self-evident.

CHAPTER Ⅱ

Literature Review and Issues of Research Designs

Much of research on migrant children in previous literature primarily focused on the institutional barriers to equal access to education, document analysis of educational policies and psychological adjustment of migrant children in cites. When parents choose among rural schools, migrant schools and urban public schools, they would presumably want to know what their child's test scores might be in different possible schools. Surprisingly, the disparities in learning experiences and academic achievement for children of migrant workers in different school settings have not received much attention from the scholarly community in China. In this chapter, I review previous empirical research on academic achievement of migrant students in different types of schools. In addition, I present the barriers to identification of school effect on student achievement and discuss how to address these methodological limitations with application of using a statistical approach referred to as Hierarchical Linear Modeling (HLM).

Empirical Research on Academic Achievement

Rural schools: left-behind children vs. rural children

When one or both parents migrated from village into city, some of their children were left behind and attended the rural schools in villages. The concerns about the potential negative effects of parent migration on the academic achievement of these left-behind children were pervasive in the literature and the press (Li, 2004; Tan & Wang,

2004; Wang & Wu, 2003; Zhou & Wu, 2004). However, these studies revealed that the difference in mean achievement scores between left-behind students and other rural students was not statistically significant.

Chen et al. (2009) examined changes in school performance of left-behind children before and after the parent's out-migration. The study sample consisted of 1,649 children and their families, which were randomly drawn from 36 primary schools in 12 townships in Shaanxi province. Student demographics and family information were derived from a survey conducted in 2006. The numerical grades (on a 0-100 scale) were used in this study. Achievement measures were average total scores of reading and math that a student received from the 2001-2002 academic year (the year in which the students were in the first grade) to 2005-2006 academic year (the year students were in the fifth grade). The outcome measure was the change in total scores from grade 1 to grade 5. Both a difference-in-difference approach and a propensity score matching approach were employed. Compared with students from non-migrant households, their results indicated that there was no significant effect of parental migration on the school performance of these left-behind children.

Peng (2009) used class percentile rank as the outcome measure and found that the school performance of left-behind children was not adversely affected by parental migration and that educational attainment of parents was significantly predictive of student achievement. However, it is important to note that percentile ranks are not on an equal-interval scale, but on a cumulative scale. The absolute size of a 10-point difference in percentile rank depends on its location on the scale (for example, moving from the 20th to the 10th percentile represents a larger shift in underlying ability than moving from

the 50th to the 60th percentile). Therefore, using percentile ranks to estimate treatment effect is usually not advisable (May et al., 2009).

In addition, both Chen et al. (2009) and Liu and Ji (2008) found that father's migration was positively associated with children's academic performance. Although the exact mechanism through which parental migration affected student achievement was unknown, a possible explanation was that the benefits associated with parental migration, including rising household incomes, better nutrition, and improved access to educational supplies, could offset the negative effects of reduced parental care (Du et al., 2005).

Migrant children: public school vs. migrant school

With respect to achievement disparities between migrant students studying in different types of schools, researchers have found that migrant students studying in public schools outperformed migrant students studying in migrant schools. Wang (2008) examined achievement scores obtained from a district mid-term reading test at Wuhan city in the fall of 2007 and found distinct patterns for elementary school students and middle school students. Using AONVA, the researcher did not find significant differences at grade 2 (92.1 vs. 89.7) and grade 4 (78.9 vs. 78.5). In contrast, the differences at grade 7 (78.8 vs. 71.4) and grade 8 (87.7 vs. 73.3) were significant. While the author also compared the differences in student demographics, family background and teacher quality between public schools and migrant schools, she did not further investigate the empirical link between these factors and student achievement.

Chen and Feng (2009) explored the determinants of test scores for migrant children of grade 4, based on a survey and researcher-developed assessments conducted in 2008. The study sample included 170 migrant students from a migrant school and 30 migrant

students from a pubic school. They found that migrant children studying in public schools scored significantly higher than migrant students studying in migrant schools on both a reading test (72.5 vs. 50.4) and a math test (64.3 vs. 42.3). The achievement gaps remained significant even after controlling for characteristics of students and their families. Furthermore, the authors suggested that the quality of migrant schools might be related to the poor academic performance of migrant children. However, the preceding claim was ungrounded because of the lack of student prior achievement.

Public school: migrant children vs. urban children

The results from previous research were mixed with regard to achievement differences between urban students and migrant students studying in urban public schools. Much of research has been qualitative. For example, Wu (2003) found that 59 percent of public school teachers and 76 percent of school administrators believed that migrant students did not achieve as highly as their urban peers, even though almost all teachers agreed with the statement that migrant students made great or moderate academic progress upon entering public school.

In contrast, Zeng (2009) used a t-test to compare the z-scores in reading, math, and English of 31 migrant students and 48 urban students in a public middle school at Shanghai. The end-of-year test scores were collected over a four-year period, from grade 6 though grade 9, and no statistical significance was found for any subject in any year. However, it is still worth mentioning that the mean reading achievement of migrant students increased from -0.1 SD at grade 6 to 0.17 SD at grade 9. Z-score is a linear transformation of the numerical scores with a mean of 0 and a standard deviation of 1. The difference computed from z-scores should not be interpreted as learning gains. A

student's positive difference between z-scores of two grades could be interpreted as implying that the average ranking of this student increased more over time than the average ranking of other students in the same school.

Guo (2007) used data that were drawn from the Beijing Migrant Children Compulsory Education Survey conducted in 2005. The study sample consisted of 983 students, which were randomly chosen from grade 4 to grade 6 out of 9 public schools. Fifty-two percent of students were migrant students, and the remaining were Beijing urban students. Guo carried out a hierarchical multiple regression model with dependent variables of reading and math grades, controlling for migrant status (model 1), child characteristics (model 2), family socioeconomic status (model 3), and parental beliefs, child expectation and school fixed effect (model 4 to model 6). For reading grade, model 1 revealed a significant and negative relationship between migrant status and reading achievement. This statistical significance disappeared, however, after controlling for preexisting differences in measured covariates. For math grade, there was no significant difference between migrant students and urban students in both unadjusted and adjusted models. One disadvantage of letter-grade lies in its incapability of distinguishing the relative performance of students and the high and low ends of the same proficiency level. The low precision of letter grade may have led to reduced statistical power to detect treatment effect (May, 2009). Therefore, the failure of detecting significant association between test scores and migrant status might be partially attributable to the usage of four-scale letter grades of reading and math as proxies of student achievement.

A recent survey conducted by researchers from Center for Chinese Agricultural Policy in the fall of 2008 compared the academic achievement of children of migrant

workers in three types of school as well as their rural and urban peers. Seventy rural schools in Shanxi province, 23 migrant schools and 4 urban schools in Beijing were randomly sampled. In theses schools, grade 4 students took a math test. Descriptive results revealed that rural non-migrant children (n=3579), left-behind children studying in rural schools (n=579), migrant children studying in migrant schools (n=931), migrant children studying in urban public schools (n=268), and Beijing urban students (n=159) received a mean score of 64.4, 64.8, 68.6, 80.3, 77.3, respectively (Ke, 2010).

Gaps in Previous Studies

Previous studies found that test scores of children of migrant workers matched perfectly with parental ranking of their preference for different types of schools: migrant students studying in urban public schools performed the highest and the left-behind children studying in rural schools scored the lowest on achievement tests. Some researchers appeared to believe that those studies described causal relationships, that public school attendance caused migrant students to learn more. It also seemed that these empirical results might be used to inform migrant parents about how to wisely choose a school for their child. However, a question that needs to be answered is to what extent the achievement disparities result from by differences in the school effectiveness at improving student learning across different types of schools.

A major challenge in identifying school effects results from the mechanism in which students came to attend particular schools. Social and economic-based selection processes nonrandomly assigned student to particular schools. For example, some migrant parents brought their most intelligent child with them to city if they confronted financial constraints and were not able to afford the living expenses for all their children

(Ke, 2010). On the other hand, poor migrant students were likely to attend inferior migrant schools, and migrant students studying in public schools tended to come from more advantaged migrant families (Chen & Feng, 2009). The unequal distribution of student characteristics made separation of school effects from the characteristics of students who attended different schools difficult (Raudenbush, 2004a; Raudenbush & Willms, 1995; Willms, 1992). As a result, school effects on student achievement can be misestimated, attributed to an incorrect source, or missed entirely (Raudenbush, 2004b).

The best method to draw causal inferences for research is to collect data as part of a randomized controlled trial. Ideally, an experiment in which students are assigned at random to different types of schools would be conducted. With a sufficiently large sample, random assignment can guarantee that the experimental and control groups contain similar mixes of participants—that is, there are no initial differences between students in different conditions. The mean difference between outcomes of experimental and control groups is, in general, an unbiased estimate of school effect. Unfortunately, randomized experiments are extremely rare in educational research due to the overwhelming philosophical, practical, or ethical concerns about the feasibility of random assignment in school settings. It is not possible to conduct an experimental study in which migrant students are randomly assigned to a particular type of school.

No pretest

In observational studies, cross-sectional research designs have been criticized as inadequate for identifying causal effects (Raudenbush, 2001). Although there were considerable differences existing between and within the student population of different types of schools, most previous studies did not include baseline achievement measures.

Therefore, those results can only show the mean difference at some point in time; thus the comparison cannot be used to estimate the net school effects. The level at which students performed at any one point in time was likely to be strongly associated with exogenous factors (Raudenbush & Willms, 1995); therefore, cross-sectional investigation of school effect necessitates inclusion of prior achievement in order to control for the effects of individual characteristics and family background up to that time over which schools have little control.

ANCOVA and gain score approach

Cross-sectional, pretest-posttest designs have been widely used in behavioral research, primarily for the purpose of comparing groups and/or measuring change resulting from treatments (Dimitrov & Rumrill, 2003). None of studies reviewed previously incorporated a pretest measure, with the exception of Chen et al. (2009). However, the availability of baseline data from cross-sectional pretest-posttest design also raises other issues that guide researchers to choose between two primary ways to use pretest scores along with posttest scores to measure students' learning gains in achievement (gain score), or as a covariate to adjust statistically for preexisting differences in a regression framework (ANCOVA). Underlying of theses issues is the further issue of comparability of assessment data across grades and across time (May et al., 2009).

The classical gain score approach measures gains by subtracting each student's pretest score from his or her posttest score. Chen (2009) used gain scores, which were computed on the change from pretest (grade 1 raw score) to post-test (grade 5 raw score), as the outcome to evaluate the effects of parents' migration on students' school

performance. At present, the nationally normed standardized assessments are still not available in China; the achievement tests used by pervious studies were all curriculum-based assessments. Because the achievement tests providing the scores changed each year as student's progressed from one grade to the next, subtraction of these two scores had little or no substantive and valid interpretation.

Moreover, the methodological appropriateness of measuring change based on raw numerical gain scores is questionable because they depend on the level of difficulty of test items. The raw scores do not adequately represent the actual ability that underlies the performance on a (pre- or post-) test, and the relationship between raw scores and ability scores is not linear. As a result, equal (raw) gain scores do not represent equal changes of ability. For example, Fischer (1976) demonstrated that, a low ability person and a high ability person could have made the same change on a particular ability scale (i.e., derived exactly the same benefits from the treatment) but the raw scores might be quite different, a factor that might affect interpretation of academic achievement gain. For subjects with equal actual (true score or ability) change, an easy test (a ceiling effect test) will falsely favor low ability subjects. Conversely, a difficult test (a floor effect test) will falsely favor high ability subjects.

Additionally, a conservative perspective would suggest that gain score is advisable only when the tests from adjacent grades are vertically scaled. In the U.S., some states have explicitly linked the tests for adjacent grades through vertical equating. As a result, test scores across multiple grades can be placed on the same developmental scale. Linking test scores over time creates a multi-wave assessment profile for each student; however, critics of vertical equating argue that any attempt to use test scores from

adjacent grades to measure absolute change is inherently flawed because shifts in the content taught and tested at each grade level make it impossible to equate tests across several grades using a single scale (Martineau, 2006). If the goal is to produce an explicit measure of change in achievement, it is important to consider the similarity in what is being tested at each grade level (Linn, 1993). Without vertical equating and similar content, the gain scores would not reflect differences in students' rates of learning.

An alternative is to compute gain scores from z-scores. Under such a circumstance, the gain score does not reflect learning gains but rather changes in relative performance from one year to the next. For example, a student might move from half standard deviation above the mean to one standard deviation above the mean. Therefore, any significant difference in the magnitude of such relative shifts in test scores can serve as an estimate of the impact of the treatment.

The more prevalent approach to analyzing pretest-posttest data when test content differs across grades involves the use of analysis of covariance (ANCOVA). In addition to a gain score model, Chen et al. (2009) also implemented an unrestricted and adjusted model by including pretest and other student covariates as control variables. Even though the gain score was the outcome variable, their model was expected to yield results similar to those obtained from an analysis of covariance model with the posttest as the dependent variable. Unlike the gain score approach, the pretest in covariance analyses needs not be directly comparable to the posttest from a statistical standpoint, but it is treated as a control variable to be held constant when estimating group differences on the posttest (Wildt & Ahtola, 1978). In other words, the gain score approach inquires whether there is a difference in average change of two populations. In contrast, the analysis of covariance focuses on the posttest differences between the two groups while holding constant any

differences in the pretest. Therefore, the objective of ANCOVA is to control for differences in the pretest; it cannot tell about how the groups changed from pretest to posttest.

A general criticism of the covariance analysis approach is that the pretest regression slope is prone to be underestimated due to unreliability in the pretest scores (Sanders, 2006). In regression and covariance models, parameter estimates for any predictor variable measured with error will be attenuated toward zero by an amount equal to one minus the reliability of that predictor (Neter et al., 1996). Because achievement test scores always have less-than-perfect reliability, the slope estimate for the pretest covariate will be attenuated, resulting in under adjustment of pretest scores.

Multiple waves

Although much of the research on student learning has been based on individual performance on a pretest and a posttest, nevertheless, two time points provide an inadequate basis for studying change (Rogosa et al., 1982). Bryk and Weisberg (1977) pointed out how analyses of pretest–posttest data using gain score and analysis of covariance approach were highly susceptible to bias under most situations. Since then, there is a general agreement among educational researchers that using several time points to model the trajectory of growth is the best way to accurately estimate change (Raudenbush & Bryk, 2002; Rogosa, 1995; Singer & Willett, 2003). Using multi-wave data points in the study of academic growth has important advantages over two-wave data: the assumptions about the nature of growth can be tested (e.g., tests for nonlinearity can be performed) (May & Supovitz, 2006); the precision of the parameter estimates tends to enhance as the number of data points per individual increases (Rogosa et al.

1982); and the hypothesis about the background variables and experimental interventions on individual growth can be systematically tested.

With the advancement of statistical methods, repeated measures ANOVA (Hertzog & Rovine, 1985; McCall & Appelbaum, 1973), Structural Equation Modeling (SEM) (Loehlin, 1998; Maruyama, 1998; Willet & Sayer, 1994), and Hierarchical Linear Modeling (HLM) (Bryk & Raudenbush, 1987, 1992) can effectively handle multi-wave data for the study of student growth. Each of these statistical methods has distinctive technical characteristics related to statistical assumptions, intervals between testing occasions, missing-data handling, characteristics of covariates, and the number of subjects required to get reliable growth estimates. Hierarchical Linear Modeling (HLM) is a regression-based statistical method that deals with multi-level data including repeated measures of student performance (Bryk & Raudenbush, 1992). HLM enables researchers to examine students' academic growth trajectories using more flexible and practically plausible research design than those possible with Repeated Measures ANOVA or SEM. First, both Repeated Measures ANOVA and SEM require that repeated measures of student achievement are collected at the same time with equal time intervals between testing occasions; in contrast, HLM allows student performance data to be collected on different time schedules. Second, HLM can tolerate cases with incomplete achievement data. Each testing occasion for an individual student is treated as a separate case so that only missing data points, not individuals having missing data, are excluded from the analysis. In contrast, both Repeated Measures ANOVA and SEM automatically eliminate cases having incomplete data from analysis, resulting in reduced statistical power to detect the treatment effect and misrepresentative sample (Shin et al., 2004).

Nesting structure

Mach of the data used in studies of school effect consists of students nested within schools they attend and so conform to a hierarchical structure. Conventional single-level, multiple-regression techniques either treat the school as the unit of analysis or treat the student as the unit of analysis. In studies that followed the former case, student-level data were aggregated to the school level. However, the fitted school-level model underestimates the variability associated with students within schools and may misrepresent the relationships among variables at the student level (Aitkin & Longford, 1986; Bryk & Raudenbush, 1992; Burstein, 1980). In the latter case, school-level data were inappropriately repeated at the student level, thus leading to an overestimation of the variability associated with schools. Moreover, students attending the same school share many common, educationally relevant experiences that affect academic performance; therefore, scores on academic measures for students in the same school will not be independent, even after adjusting for student characteristics. Violation of the independence assumption means that, typically, estimates of standard errors of means and regression coefficients related to academic performance will be biased (Braun et al., 2006). In sum, neither approach is optimal for estimating school effects. With HLM, the nested structure is represented explicitly in a multilevel model, with different variances assumed for each level. This addresses the above-mentioned problems with single-level models. Moreover, it is possible to postulate a separate student-level regression for each school. Both student and school characteristics can be included, and standard errors of means and regression coefficients can be estimated without bias (Raudenbush & Bryk, 2002).

For school effect research studying growth of individual student within the organizational context of schools, a three-level HLM model incorporating the nesting of observations within students and the nesting of students within schools is well suited for carrying out an investigation that estimates growth trajectories for students and schools: individual growth trajectories comprise the level-1 model; the variation in growth parameters among children within a school is captured in the level-2 model; and the variation among schools is represented in the level-3 model (Boyle & Willms, 2001; Bryk & Raudenbush, 1988; Raudenbush & Bryk, 2002; Willms, 1992).

CHAPTER Ⅲ

Method

Procedure and Participants

The sample used in this study was drawn using a two-stage clustering design with random sampling procedures employed at each stage. For public schools, 12 schools were randomly chosen from a list of all elementary schools in a southwestern school district of Beijing. For migrant schools, because only a small fraction had been granted license to operate, there were only 10 licensed migrant schools in that district. Therefore, all licensed migrant schools were contacted, but three schools declined to participate. Eventually, 7 migrant schools were included. The students were selected at the second stage of sampling. Within each school, one grade 3 class and one grade 5 class were randomly chosen.

There were three waves of data collection. Achievement test, parent survey, and student survey were administered during each wave of data collection. Specifically, the baseline data were collected in November, 2006. Meanwhile, family address and parent contacting information were also collected in order to follow the students in the sample. The second wave of data collection occurred in May, 2007. The third wave of data collection took pace in November, 2007. Family information was collected by a series of parent surveys, including family SES, the highest educational attainment of parents, educational expectation of parents, years of living in Beijing et al. Student characteristics

and school leaning experiences were collected by student surveys, including gender, age, number of siblings, hours spent on homework, distance to school, and social interactions in school (among other variables).

Table 3.1: The Number of Migrant Students in Grade 3 Cohort by Missing Data Pattern

Observations	*wave 1*	*wave 2*	*wave 3*
All three waves	311	311	311
Wave 1 & 2	109	109	
Wave 2 & 3		40	40
Wave 1 only	106		
Wave 2 only		39	
Wave 3 only			144
Total	526	499	495

Table 3.2: The Number of Migrant Students in Grade 5 Cohort by Missing Data Pattern

Observations	*wave 1*	*wave 2*	*wave 3*
All three waves	328	328	328
Wave 1 & 2	83	83	
Wave 2 & 3		63	63
Wave 1 only	102		
Wave 2 only		22	
Wave 3 only			87
Total	513	496	478

The sample used in the present study consisted of 1785 students. According to the students records, 51.1 percent of the students were in the grade 3 cohort (n=912), and 48.9 percent were in the grade 5 cohort (n=873); 19.7 percent were urban students (n=351), 28.2 percent were migrant students studying in public schools (n=504), and 50.4 percent were migrant students studying in migrant schools (n=930). Because of school mobility rate of migrant students was relatively high, missing data were inevitable in this kind of longitudinal data. Among the 1434 migrant students in the current sample, only 639 of them had complete observations in all the three waves of study; 295 students had

two complete observations; and 500 students had only one complete observation. Table 3.1 and Table 3.2 display the missing data patterns for grade 3 and grade 5, respectively.

Assessment Instruments

In 2001, China launched the New Curriculum Reform, aiming to achieve a fundamental and systematic change in traditional curriculum and instructional paradigms (Zhong, 2006). The transformation from scientific discipline-centered curriculum to society construction-centered curriculum required that the contents of curriculum reflected students' daily life. Moreover, classroom instruction was supposed to connect with students' life experiences and preexisting knowledge. The curriculum management system was reformed accordingly. With the cessation of a centralized curriculum management system, a three-level paralleling curriculum system has been established nationwide: central government promulgated the National Curriculum Standards for each subjects; local governments were able to develop a series of alternative textbooks with endorsement from Ministry of Education; and schools also built their own school-based supplementary curriculum along with the local curriculum (Guan & Meng, 2007).

China's decentralized curriculum system creates a problem of discrepancy in curriculum across schools. Beijing public schools use locally-developed Beijing curriculum; on the other hand, individual migrant schools can choose among different systems: the national curriculum, Beijing curriculum, or various other curricula used in migrants' province of origin (REAP, 2009). Therefore, any existing achievement tests designed to align with Beijing curriculum might lead to serious test bias toward migrant children using different curriculum. A test may be considered biased if it leads to provable and systematic differences in the results of people based on group membership.

In the U.S., researchers have demonstrated that some tests are culturally biased in favor of middle-class white culture and against Africa-American or Hispanic cultures (Hood, 1998; Parker, 2000). Therefore, the reasons for the low achievement of minority students can be partially attributable to the fact that schools often inadvertently test students on their knowledge and familiarity with white, middle-class culture instead of how well students have learned the subject matter (Hallinan, 1994).

In order to minimize the test bias resulting from migrant children's unfamiliarity with urban lives, the academic tests used in this study were designed by a team of educators to align with national curriculum performance standard for reading and mathematics at each grade level, rather than respective curriculum adopted by migrant schools and public schools. A sample of content of the reading tests included vocabulary, sentence structure, numbering the sentences to make a conversation, and a passage followed by a series of comprehension questions. The reading tests were made up of a total of 15-20 items. Both a sufficient range of item difficulty and a reasonable number of items enabled the tests to assess the reading levels of students and to be completed in a time limit of 40 minutes. The test was administered by classroom teachers in collaboration with a research assistant of PSDMC project.

Measures

Achievement Measures: Reading

During this study, grade 3 cohort students progressed to grade 4, and grade 5 cohort students progressed to grade 6. I used rescaled reading scores instead of raw scores in order to place the test scores on a common metric and ensure that the interpretation of treatment estimates was comparable across grades and across cohorts (May et al., 2009).

The simplest method for placing test scores of multiple waves on a common scale is to convert them to z-scores. Moreover, effective rescaling is needed to enable treatment estimates to reflect the differences between experimental and control groups, not only in a common scale but also for a common reference population (Dong et al., 2008; Hedges & Olkin, 1985; Lipsey & Wilson, 2001). In this study, my interest is the difference in reading achievement between migrant students in two types of schools—urban public schools and migrant schools. Public school is viewed as a treatment variable; therefore, migrant students studying in migrant schools serve as the control group. However, migrant schools involved in the current study have a high mobility rate. Frequent school changes cause educational disruption, which is likely to adversely affect student achievement. As a result, the differences in reading achievement between public schools and migrant schools might be overestimated. Further, to compute the treatment effect size, a Cohen's d effect size which is defined as the difference between two means divided by a standard deviation of reference group, is commonly used by researchers; however, this measure of effect size is highly sensitive to the reference population whose standard deviation provides the scale for this statistic (Cohen 1988; Cooper 1998). Without effective rescaling of the individual test scores or calculation of comparable standardized effect estimates separately for each wave, combining results across waves might produce misleading results.

To rescale scores from distinct assessments and make them directly comparable, I used the mean and standard deviation of neither the sample (all three group students) nor migrant-migrant students, but rather of urban students. I rescaled migrant students' scores by substracting the urban students mean and dividing by the urban students' standard

deviation for each wave. The reasons for this rescaling approach are twofold: first, the urban students are a stable population, and second, the research question of this study is the school effect on change in achievement gap between urban and migrant students. Therefore, the rescaled score of each migrant student represents his or her performance relative to urban students. For example, a migrant student with a z-score of -0.5 means that his or her score is half standard deviation lower than average achievement of urban students. The difference in reading achievement between two migrant students can also be computed from their rescaled scores.

Student Level Measures

Student demographics

The student-level variables used in the analyses were selected from information collected from student and parent questionnaires. I used two demographic characteristics of the students: age (measured in years) and gender (male=1, female=0).

Financial capital and human capital

The lack of a comprehensive conceptual framework has inhibited a systematic examination of various factors that influence children's academic achievement among previous studies. When examining the influence of family resources on child's education outcomes, Coleman (1988, 1990) categorized family capitals as three dimensions: human capital, financial capital and social capital. According to Coleman (1990), human capital encompasses the acquired knowledge, intelligence, personal abilities and talents housed within a particular person, usually measured as parents' educational attainment. The notion of financial capital refers to the physical and material resources available to the family, typically measured as the family's total household income (Coleman, 1988).

Socioeconomic Status (SES). In the child development literature, previous research has consistently indicated the great impact of family human capital and financial capital on child's academic outcomes (e.g. Eamon, 2002; Smith et al., 1997). In examining the impact of different capitals in the home, researchers often combine financial capital and human capital into an index of family Socioeconomic Status (SES). Families with high socioeconomic status often have more success in preparing their young children for school because they typically have access to a wide range of resources to promote and support young children's development. In this study, socioeconomic status is a composite measure of family's economic and social position relative to others, based on family income, parental education level, and parental occupation. Family income was measured by average gross monthly household income; parental education level was measured by the highest year of education attained by either father or mother; parental occupation was ranked by China Occupational Prestige Index (Li, 2005). These three measures were all parent self-reported. SES then was extracted through principal components analysis.

Fluency in spoken Mandarin Chinese. Language is a highly important component of human capital as well as a dimension of self-identity. China is characterized by linguistic diversity, and Putonghua (common language) or Mandarin is the government-mandated language in schools. Therefore, regional dialects used by migrant children might inhibit effective communication among classmates and teachers, which in turn leads to difficulties in student learning and social integration (Han, 2004; Li, 2004). In the U.S., the persistent achievement gaps between English language learners and native English speakers are well-documented (Bianchi & Israel, 2006; Grigg, et al., 2003; Kindler, 2002). Several studies also provided evidence of a positive relation between English

language proficiency of English language learners and their reading achievement (Garcia, Vázquez, Lopez, & Ward, 1997; Royer & Carlo, 1991; Saville, 1984; Snow, Cancino, Gonzalez, & Shriberg 1987; Ulibarri, Spencer, & Rivas, 1981).

In the student survey, fluency in spoken Mandarin Chinese was self-reported. It was observed on a scale from 1 to 5 (1=very poor, 2=poor, 3=fair, 4=well, 5=very well). For the simplicity of empirical analysis, the language fluency was condensed into a binary variable, being equal to 1 if student reported speaking Mandarin well or very well, and 0 otherwise. The problems of using self-reported language skills have been emphasized repeatedly in the literature. However, other alternatives are rare because test-based measures of language abilities are less available in China.

Frequency of buying books. The home environment of poor families tends to be less cognitively stimulating than is the case for more advantaged families (Eamon, 2002). Poverty decreases the likelihood that children are exposed to developmental materials and experiences (e.g., the number of books at home and frequency of family reading), which might negatively influence children's academic outcome (Bradley et al., 2001). In multivariate analyses exploring ethnic disparities in test score performance during the first two years of school, Fryer and Levitt (2004) found that the inclusion of a composite measure of socioeconomic status and the number of books in children's homes accounted for the entire gap in reading scores between Black students and White students and most of the gap between Hispanic students and White students. Based on these results, Fryer and Levitt argued that the number of books in a child's home was a "useful proxy for capturing the conduciveness of the home environment to academic success" (p. 452). In this study, because students were not asked to report the number of books available at

their home, educational quality of the home environment was assessed by an ordinal variable describing whether children bought books of their interest. Four-point rating was utilized (4=often, 3=occasionally, 2=seldom, 1=never). Frequency of buying book was treated as a dummy variable which was coded as 1 if student could often or occasionally buy books and 0 otherwise.

Social capital: family structure

According to Coleman (1990), social capital refers to resources inherent in social relationships that facilitate a social outcome. The operationalization of social capital in the home includes the relationship between parents and children, the presence of parents, the time parents spend with children and their interactions. The social capital in the family is important for the cognitive or social development of a child (Coleman, 1988). There is a large body of literature highlighting the relationship between children's schooling and family structure, for example, the number and presence of parents in the family (Milne, Myers, Rosenthal, & Ginsburg, 1986), and the number and gender configuration of siblings (Downey, Powell, Steelman, & Pribesh, 1999).

Student living in a two-parent family. Cumulative evidence suggests that children who live in a two-parent family tend to perform higher on standardized tests than children living in a single-parent family (Entwisle & Alexander, 1995; Lee, 1993; McLanahan & Sandefur, 1994). In this study, two-parent family was coded 1 if students lived with two parents and 0 otherwise.

Sibling structure. Generally, previous research found that the number of children in a family had small but significant inverse associations with academic outcomes, especially verbal measures of achievement (e.g., Polit & Falbo, 1988). The resource

dilution hypothesis has been proposed to explain the advantage of the child with few siblings on test scores. According to this hypothesis, parental resources are important but finite; children with many siblings receive fewer resources, thus leading to lower scores on academic outcomes (Downey, 2001). In China, family planning policy limiting one child per couple was instituted in 1970s. However, this policy is not implemented fully in rural areas; many migrant parents have more than one child. If the number of children in a migrant family is one, migrant parents can concentrate the limited financial or social resources to the education of their only child. For the present study, only-child is coded 1 if a child has no siblings, either biological or adopted, and 0 otherwise.

Social capital: parent-child relations

Family social capital plays an intermediate role in transmitting parental resources or family norms to children through interaction. Previous research has demonstrated that social capital within the family, reflected by the bonds between parents and children, is associated with increased educational aspiration (McNeal, 1999) and higher academic performance (Coleman & Hoffer, 1987; White & Glick, 2000; Zhou & Bankston, 1994). However, children in migrant families often have limited parental support, a factor that is exacerbated when their parents are in dirty, dangerous and demanding professions and feel excluded by the society. As a result, children are likely to be poorly motivated to try their best at school because they do not perceive the benefits of education (Raffo et al., 2007). Regardless of possible scarcity, social capital in the families is fundamental to the educational success of migrant children. High levels of parental involvement and family values that stress education as a means to breaking the cycle of poverty may play an important role in mitigating the negative effects of social and cultural marginalization on

school learning of migrant children. In addition, social capital does not necessarily require extra expenditures of monetary or material resources in its creation. Coleman (1988) highlighted two indicators of social capital within the family, parental involvement in children's schooling and parental educational expectation.

Parental involvement. Parent involvement has consistently shown significant impact on children's attitudes towards schooling and academic achievement in research literature (Cao et al., 2007; Fan & Chen, 2001; Lareau, 1987). With regard to which aspects of parental involvement were most important, Jeynes (2005) found that the facets of parental involvement that required a large investment of time, such as reading and communicating with one's child, had a greater impact on student educational outcomes than some other aspects of parental involvement, such as having household rules. In China, the effects of parental involvement in schooling were documented in a number of studies (Li et al., 2005; Xu, 2009). Promoting parental involvement has been proposed as an effective approach for enhancing all-around development of children of migrant workers (Du, 2008).

The measure of parental involvement was created from 4 items to which parents responded on a 3-point likert-type scale (3= Usually, 2=Occasionally, 1= Seldom) regarding homework supervision, communication about school, school dropping off and picking up children and playing with children.

Parental educational expectation. Asian parents hold a traditional culture belief in the importance of education and generally have higher educational expectations (Goyette & Xie, 1999; Stevenson et al., 1990). Research has shown that parental expectations outweigh some measures of parental involvement, such as attending school events, in

their association with educational outcomes (Fan, 2001; Jeynes, 2005, 2007; Redd et al., 2004). The measure of parental expectation of their child's educational attainment was an ordinal variable (6=graduate school or more; 5=college & university; 4=high school; 3=middle school; 2=elementary school; 1= no school). It was recoded as a dummy variable, which was coded as 1 if parents expected their children to attend college or beyond and 0 otherwise.

Parental satisfaction with achievement. Jacob and Lefgren (2007) found that parents in high-poverty schools strongly valued student achievement as well as a teacher's ability to raise student achievement. Therefore, parental satisfaction with their child's achievement might function as an important indicator in judging how well their child's school was doing in educating their own child. The parental satisfaction factor utilized 5-point ratings ranging from 1 (strongly disagree) to 5 (strongly agree). Items included: "I am satisfied with my child's academic achievement", "I am satisfied with my child's progress made in study", and "I am satisfied with my child's learning perseverance".

Social capital: school

From the ecological perspective, social capital can occur at any level of social aggregation (Parcel & Menaghan, 1993). Along with family, peer groups, school and community are also key social contexts in which social resources reside for children.

School is a key institutional factor for children's academic performance. When students have good relations with teachers and with other students, they are more likely to have a higher sense of belonging at school, and this attitude can be reflected in their participation in academic pursuits (Finn, 1989). Social capital embedded in the school, usually manifested as student-teacher relationship and peer relationship, has been found

to have a significant impact on children's psychological adjustment and school performance (Croninger & Lee, 2001; Parcel & Dufur, 2001; Ream, 2003).

Two school factors were considered as possible sources of social capital. School connectedness refers to students' school experiences and their perceptions and feelings about school. It was assessed by an ordinal variable describing whether students liked their current school. Five-point rating was utilized (5=strongly like, 4=moderately like, 3=neutral, 2=moderately dislike, 1=strongly dislike). Due to the highly skewed distribution, this variable was recoded as 1 if students strongly liked their school and 0 otherwise. On the other hand, the factor of relation with teachers and peers was extracted from 2 items to which students responded on a 5-point likert-type scale (5=very good, 4=good, 3=fair, 2=poor, 1=very poor) regarding their perception of their relation with their teachers and classmates.

Social capital: community

The aggregate of individuals and families, within a neighborhood setting creates a context that influences child development (Brooks-Gunn et al., 1997; Coleman, 1987; Wilson, 1987). The resources available for children growing up in neighborhoods are indicated by the collective incomes and family compositions within the area: higher proportions of poverty families translate to less human capital available to promote development for children. Moreover, adults within a neighborhood serve as role models and their educational attainment represents what a child can expect to attain in school (Wilson, 1987). The positive associations between neighborhood socioeconomic context and academic performance typically have been identified (Dornbusch et al., 1991; Shumow, Vandell, & Posner, 1999).

At Beijing, many migrant families are isolated on the outskirt areas of cities and live in impoverished neighborhoods. A survey by the China Youth Research Center (2006) revealed that 69 percent of migrant children lived in migrant enclaves, in which the ratio of migrants to local residents could be as high as twenty to one; 41 percent of migrant children reported that they disliked the community they lived (Huang et al., 2008). Living in migrant enclaves far from the centre of the city made social integration difficult, and limited the chances for children of different backgrounds to meet. In this study, living in an urban community was coded 1 and 0 if child resided in a migrant community.

Children as independent agents

It is possible to extend previous research by taking into account the fact that children, as independent agents, may actively generate, drawn on, or negotiate their own social capital, thus influencing the way social capital works (Morrow, 1996, 1999). The effects of social capital on school adjustment and academic performance might be maximized through individual initiative and efforts. Such initiative and efforts are crucial for migrant children with limited access to resources and supports in their various social contexts (Wu, 2009).

Two measures were included: First, children's educational expectation was coded as 1 if they expected to attain a bachelor's degree or higher and 0 otherwise. Second, finishing homework was coded as 1 if students could always finish homework on time and 0 otherwise.

School Level Measures

School-level variables included an indicator of school type as well as aggregated information about students in the school. School type was the treatment variable (Z) of

this study, with Z=1 indicating a public school and Z=0 indicating a migrant school. Other continuous variables were created from aggregating information of student-level within each school. The resulting variables were as follows: the percentage of migrant students, the percentage of male students, the percentage of mobile students who moved to current school during the duration of the study, the mean SES and the mean reading achievement.

Analytical Models

To answer my research questions, multilevel modeling techniques were used to overcome some of the methodological limitations that hindered previous investigations of school effect. A HLM growth curve model with test scores nested within students and students nested within school was used to model student and school growth trajectories, while adjusting for differences in student and school characteristics. The application of a three-level model to repeated student achievement data not only enabled variance at the individual student level to be separated from school-level variance, but also permitted simultaneous examination of school effect on student baseline achievement as well as longitudinal study of achievement growth over multiple time points.

Within-individual model

The first level was composed of a longitudinal growth model that fitted a linear or quadratic regression function to repeated reading achievement scores of migrant students (Bryk & Raudenbush, 1987). In this study, three observations were carried out from 2006 fall to 2007 fall. When the number of observations per individual is few and the time period is relatively short, a linear individual growth model can provide a good approximation for more complex processes (Raudenbush & Bryk, 2002).

Visual inspection provides another basis for determining an appropriate growth model. Individual students' growth curves displayed in Figure 3.1 for grade 3 and Figure 3.2 for grade 5 did not suggest that student achievement scores increased or decreased at an accelerating rate over time. Moreover, a deviance test that compared the deviance statistic from a quadratic growth curves model to a simpler linear growth model did not show a significant difference in the goodness-of-fit to existing data. Based on these results, a linear growth model was adopted for further analysis.

Figure 3.1: Observed Growth Curves for Randomly Selected Grade 3 Students (p=0.25)

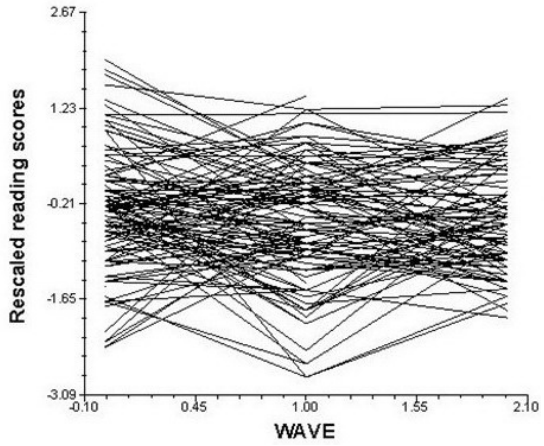
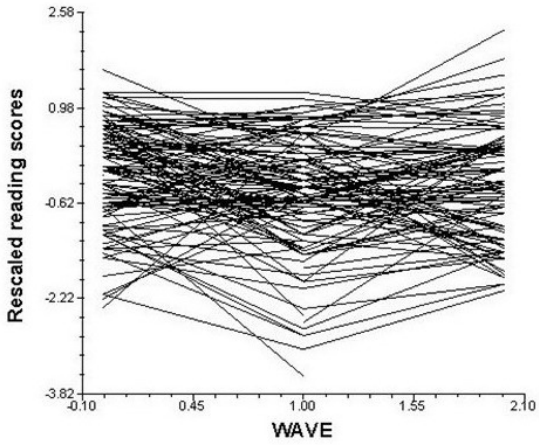


Figure 3.2: Observed Growth Curves for Randomly Selected Grade 5 Students (p=0.25)



In level 1 model I assumed that the reading achievement at time *t* for child *i* in school *j*, was a function of a growth curve plus random error.

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}*(\text{wave})_{tij} + \boldsymbol{e}_{tij}$$

where

π_{0ij} is the initial status of child *ij*, that is the expected outcome for that child in the fall of 2006;

wave_{tij} is 0 at fall of 2006, 1 at spring of 2007, and 2 at fall of 2007;

π_{1ij} is the growth rate for child *ij* during each wave;

$\boldsymbol{e}_{tij}$ is the random error in the level 1 equation, assume to be independently and normally distributed with a mean of 0 and constant variance σ^2.

Within-school model

School means adjusted for student characteristics were estimated through the level 2 model. When control variables were introduced at the student level, they were centered

on the grand mean—that is, at the overall mean for migrant students in the sample. It can be seen from two equations listed below that level 1 parameters were modeled as a function of the status (β_{00j}) or growth (β_{10j}) of school j, the student characteristics that were hypothesized to account for observed variation in the parameters of the student growth model and respective student-level residual terms, r_{0ij} or r_{1ij}.

$$\pi_{0ij} = \beta_{00j} + \beta_{01j}*(age)_{ij} + \beta_{02j}*(male)_{ij} + \beta_{03j}*(SES)_{ij} + \beta_{04j}*(buybook)_{ij} + \ldots\ldots + \beta_{015j}*(finsh\_hw) + r_{0ij}$$

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}*(age)_{ij} + \beta_{12j}*(male)_{ij} + \beta_{13j}*(SES)_{ij} + \beta_{14j}*(buybook)_{ij} + \ldots\ldots + \beta_{115j}*(finsh\_hw) + r_{1ij}$$

where

β_{00j} is the mean initial status for students within school *j*;

$\beta_{01j\ldots,}$ β_{015j} are the regression coefficients for initial status in school *j*, associated with student covariates.

β_{10j} is the mean growth rate for students within school *j*;

$\beta_{11j\ldots,}$ β_{115j} are the regression coefficients for growth rate in school *j*, associated with student covariates.

r_{0ij} and r_{1ij} are level-2 random effects. Taken as a vector, the r 's are assumed to have a multivariate normal distribution with a mean vector of 0 and a covariance matrix $T\pi$, with maximumdimension (P + 1) _ (P + 1).

Between-school model

The previous conditional between-students model was extended by incorporating school characteristics in level 3 of the model. The adjusted school means were then regressed on an indicator of school type (public vs. migrant) and several other school covariates. At level 3, all covariates were grand-mean centered except school type indicator. The fitted coefficients of the school-type indicator are of primary interest of this study. They indicated how much of the variation in adjusted school means could be associated with the school-type distinction, after taking into account differences in school characteristics.

It can be seen from the two equations listed below that the initial status and growth of schools were modeled as a function of grand-mean achievement (γ_{000}) and grand mean growth (γ_{100}), school characteristics, and respective school-level residual terms, u_{00j} or u_{10j}.

$\beta_{00j} = \gamma_{000} + \gamma_{001}\,(\text{Public})_j + \gamma_{002}\,(\%\ \text{migrant})_j + \gamma_{003}\,(\%\ \text{male})_j + \gamma_{004}\,(\%\ \text{mobile})_j + \gamma_{005}\,(\text{mean SES})_j + \gamma_{006}\,(\text{mean achievement})_j + u_{00j}$

$\beta_{01j} = \gamma_{010}$

$\beta_{02j} = \gamma_{020}$

$\beta_{03j} = \gamma_{030}$

$\beta_{04j} = \gamma_{040}$

$\beta_{05j} = \gamma_{050}$

$\beta_{06j} = \gamma_{060}$

$\beta_{10j} = \gamma_{100} + \gamma_{101}\,(\text{Public})_j + \gamma_{102}\,(\%\ \text{migrant})_j + \gamma_{103}\,(\%\ \text{male})_j + \gamma_{104}\,(\%\ \text{mobile})_j + \gamma_{105}\,(\text{mean SES})_j + \gamma_{106}\,(\text{mean achievement})_j + u_{10j}$

$\beta_{11\,j} = \gamma_{110}$

$\beta_{12j} = \gamma_{120}$

$\beta_{13j} = \gamma_{130}$

$\beta_{14j} = \gamma_{140}$

$\beta_{15j} = \gamma_{150}$

$\beta_{16j} = \gamma_{160}$

where

γ_{000} is the overall mean initial status across migrant schools;

γ_{001} is the estimated difference in mean initial status between migrant schools and public schools;

$\gamma_{002\ldots,}\ \gamma_{006}$ are the regression coefficients for overall mean initial status, associated with other school covariates.

γ_{100} is the overall mean growth rate across migrant schools;

γ_{101} is the estimated difference in mean growth rate between migrant schools and public schools;

$\gamma_{102\ldots,}\ \gamma_{106}$ are the regression coefficients for overall mean growth rate, associated with other school covariates.

u_{00j} and u_{10j} are the level-3 random effects. Taken as a vector, the u's are assumed to have a multivariate normal distribution with a mean vector of 0 and a covariance matrix T, with maximum dimension $\sum_{p=0}^{P}(Q_p+1)\times\sum_{p=0}^{P}(Q_p+1)$.

Pooled or separate model

For studies involving multiple grades, researchers may consider whether to combine results across grades to obtain an overall estimate of school effect. It is important to note

that combining results across different grades means that the study is conducted under certain assumptions. First, the means and variances of student performance should be consistent across grades. This can be easily done by converting test scores in each grade to z-scores, thus placing scores to a common metric. Second, the shapes of the distribution of achievement scores should be similar across grades. To examine the plausibility of the second assumption, I compared the shapes of the distribution of baseline scores for each grade through graphical displays. Figure 3.3 revealed a nearly normal distribution for grade 3 and a left-skewed distribution for grade 5. Furthermore, Figure 3.4 and Figure 3.5 indicated that the distributions of baseline scores of urban students, migrant students studying in public schools and migrant students studying in migrant schools looked distinct across grades, too (see Appendix A).

In addition to psychometric considerations, the tests used for two grades may differ substantially in terms of the knowledge and skills assessed or difficulty levels of test items. Therefore, estimated public school impact for one grade might be systematically different from estimates for another grade. Further argument for separate analysis at the two grade levels was based on a policy consideration. The Notice of the State Council on Further Strengthening Rural Education which abolished extra school fees for migrant schools in order to study in urban schools was enacted in 2003. Grade 3 cohort migrant students, who entered elementary schools at the same year, perhaps had larger chance to study in urban public schools. In other words, the 2003 Notice might exert varying influences on the school assignment mechanism for grade 3 and grade 5 migrant students. In sum, aggregating to produce an overall school effect might mask important variation across grades; therefore, separate models were estimated for each grade.

Structure of fitted models

When researchers discuss school effect, they might be referring to different constructs. Raudenbush and Willms (1995) distinguished two ways of measuring school effect. At first, they categorized the factors associated with school performance into school context and school practice. Factors falling into the school context category include demographic composition of the student body as well as social and economic characteristics of the community in which the school is located. School practice consists of administrative leadership, utilization of resources, and classroom instruction, et al. School personnel can steer school practice, but have little or no control over school context. Raudenbush and Willms (1995) clarified the difference between two types of school effect. The first effect, or what Raudenbush and Willms labels as a "Type A" effect, is of interest to parents selecting schools for their children. It is defined as the difference between a child's actual performance and the potential outcome that would have been expected if that child had attended another school. A child might achieve higher in school 1 than school 2 for a variety of reasons. School 1 might enjoy more effective school leadership, sounder organization, better professional development, and more competent classroom instruction than does school 2, or school 1 might enjoy a more favorable student composition than school 2 even though the quality of leadership and instructional skill in the two schools are equivalent. However, parents would send their child to a school producing the largest Type A effect, regardless of whether that school's effectiveness derives from the effective practice of its qualified staff, or from its favorable student composition.

The second effect, or what Raudenbush and Willms labels as a "Type B" effect, is of interest to district or state administrators who wish to hold school personnel accountable for their contributions to student outcomes. This effect is designed to isolate the impact of a school's practice, which is the difference between a child's performance in a particular school and the performance that would have been expected if that child had attended a school with identical context but with varied practice. A school with an unfavorable context can still produce a large Type B effect through the effort and talent of its staff.

In order to examine different types of school effect, a sequence of growth curve models are conducted for grade 3 and grade 5. The sequence of analyses is summarized in Table 3.3. First, a growth curve model with no predictors on individual and school level is specified. This model yields an overall growth trajectory averaged across all migrant children, as well as a decomposition of the total variance in initial status and growth rate into within- and between-school components.

Model 2 includes school type on level 3. The school-type contrast estimates the average difference in unadjusted school mean initial status and mean growth rate between public and migrant schools.

Model 3 adds student covariates. The school-type contrast estimates what the average difference in school means of initial status and growth rate between public and migrant schools would be, if adjusting any differences in student characteristics. The estimated school effect is Type A effect—that is, whether school mean differences stem from school's favorable student composition or effective practice is not of interest in this model.

Model 4 builds on model 3 by including socio-demographic characteristics of school

on level 3 in addition to the school-type contrast, which now estimates what the average difference in school means between public and migrant schools would be, if holding constant any differences in student characteristics and school context. Because school practice is not defined and observed for most school effect studies, the inclusion of school contextual factors at level 3 can not only determine whether and to what extent student achievement is accounted for by school context, but also obtain a crude estimate of Type B effect.

Table 3.3: Structure of Fitted Three-level Models

Models	Covariates included in level 2	Covariates included in level 3
1	None	None
2	None	School type
3	Students covariates	School type
4	Students covariates	School type + school context

Propensity Score Matching (PSM)

Even if a three-level growth curve model analysis is conducted in this study, without random assignment, an estimate of school effect calculated by the difference between the mean trajectory of migrant students studying in public schools and the mean trajectory of migrant students studying in migrant schools, in general, is subject to bias (Raudenbush, 2001). The problem is that such an estimate assumes that the two groups would have experienced identical growth rates in the absence of the treatment. Given nonrandom school assignment, this seems improbable. Those students selected into the public schools may be more advantaged than those selected into the migrant schools. If so, the potential outcomes of those assigned to the public would be higher (or lower), on average, than of those assigned to the migrant schools in the absence of a school effect.

Statisticians have reached a near consensus that causal inferences are comparisons between the outcomes a unit would experience under alternative possible treatments (Holland, 1986; Rosenbaum & Rubin, 1983; Rubin, 1978). In this study, to estimate the effect of being in public school versus migrant school for a particular migrant student, say Q. Q's growth rate if Q had been in public school, $Y_Q(P)$, is compared with Q's growth rate if Q had been in migrant school, $Y_Q(M)$. The causal effect of the public school could simply be calculated the difference between $Y_Q(P)$ and $Y_Q(M)$. The "fundamental problem of causal inference" (Holland 1986) is that one of potential outcomes (the counterfactual) is always missing because student Q is in either public school or migrant school. Thus, the problem of causal inference is a problem of missing data.

Randomized studies ensure that the missing counterfactual is missing completely at random. In other words, the decision about which outcome is observed, $Y_Q(P)$ or $Y_Q(M)$, is decided by chance alone. While it is not possible to estimate the causal effect for each migrant student, a randomized experiment enables unbiased estimation of the average causal school effect—that is, the difference in growth rates between means of migrant students studying in different types of schools.

Although randomized control trial ensures the equivalence of treatment and control group, unfortunately, educational researchers are often prevented from incorporating randomization in their designs due to a variety of practical, ethical and political constrains. Researchers often attempt to control for confounding variables—preexisting variables that predict treatment group membership and are related to the potential outcomes—by means of matching (Cook & Campbell, 1979). The propensity score was

introduced by Rosenbaum and Rubin (1983) to provide an alternative method for balancing treatment and control groups and estimating treatment effects when treatment assignment was not random. The propensity score is defined as the conditional probability of assignment to a treatment group, given a set of observed covariates. In a typical application of this approach, each observation is associated with a propensity to be assigned to the treatment group. The use of propensity scores in observational data can identify groups of participants who are comparable on measured pretreatment covariates; therefore, the outcome differences are attributable to the treatment effect.

In this study, in addition to modeling the school effect with the entire set of migrant students by classic covariates adjustment, I conduct propensity score matching at the student level to create a matched comparison group for overcoming or reducing bias when it is impossible to randomly assign students to public schools or migrant schools. In the present case, a propensity score is simply the probability that migrant students attend public school. School effect is estimated by finding two subsets of migrant students, some attending public schools and some migrant schools, who are similar in these characteristics associated with the potential outcomes and also with assignment to different types of schools. The difference in mean outcomes between those two groups of children may be viewed as an unbiased estimate of the effect of public school for migrant children under the strong ignorability assumption that, after taking into account all these measured characteristics of children, there are no unmeasured characteristics that are related both to their potential outcomes and to which school they would attend (Rosenbaum & Rubin, 1983; Rubin, 1978).

Propensity score approach is also superior to linear regression model in two other respects. First, a traditional linear regression model makes use of the full sample. If the treated and control groups have very different distributions of background covariates, this will lead to extreme extrapolation in models relating outcome variable to covariates, thus making any estimates highly sensitive to untestable modeling assumptions (Rubin et al., 2004). In contrast, propensity score approach compares groups that are similar with respect to the measured covariates. Second, propensity score approach avoids any specification of regression models for the relationship between the outcome and the covariates, although propensity score models must be fit to estimate the probability of receiving treatment. The estimates of treatment effects are generally less sensitive to misspecification of the propensity score model than to misspecification of the regression model (Drake 1993; Rubin 1997).

Missing Data

Missing data occur in many observational studies, especially when data are collected by surveys (Kline, 1998). Although HLM can deal with migrant students with incomplete achievement data at level 1, students with incomplete level-2 covariates are eliminated from analysis. This listwise deletion will result in a substantial decrease in the sample size, and analysis of this sort could potentially lead to erroneous inferences when the discarded cases differ systematically from the rest. Furthermore, even when the data are missing completely at random (MCAR) (Rubin, 1976), there is a loss in statistical power using this approach.

Traditional methods to replace missing data with imputed values are problematic (Graham et al., 2003). The method of mean substitution replaces missing data with the

average of valid data for the variable in question. Because the same value is being substituted for each missing case, this method distorts the covariance structure, biasing estimated variance and covariance toward zero (Darmawan, 2002). Another approach is regression substitution. A regression model is fitted for each variable with missing values, with other variables as predictors. Nevertheless, regression substitution tends to overestimate confidence in the parameter estimates, thus inflating observed correlations (Schafer, 1997).

A limitation of single imputation is that it treats imputed values as though they were observed which is not true. Multiple imputation addresses this problem by introducing an additional form of error based on variation in the parameter estimates across the imputations. Uncertainty is accounted for by creating different versions of the missing data and observing the variability between imputed datasets. The missing values are replaced by m >1 (usually m=5) plausible values drawn from their predictive distribution. Standard statistical analysis is carried out on each imputed data set, and multiple analysis results are produced. Finally, the estimates from the imputed datasets are combined to generate a single set of estimates (Wayman, 2003).

The performance of multiple imputations in a variety of missing data situations has been well-studied and it has been shown to perform favorably (Graham & Schafer, 1999; Raghunathan et al., 2001; Schafer & Graham, 2002). In this study, I employed multiple imputation, which was achieved by using the STATA command ICE (imputation by chained equations) (Patrick, 2004) to impute missing values under the assumption that data are missing at random (MAR).

CHAPTER Ⅳ

Results

Descriptive Statistics

Descriptive statistics on student-level measures are presented in Table 4.1 for grade 3 students and Table 4.2 for grade 5 students. One-way ANOVA was performed to determine whether there were significant differences between the means of the three groups (urban students, migrant-public students and migrant-migrant students). In addition, t-test was used to determine whether there were significant differences between migrant students studying in different types of schools. ANOVA results revealed that the differences in most student measures were statistically significant, and Beijing urban students were the most advantaged group. For the migrant students, the t-test results revealed that migrant students studying in migrant schools were significantly disadvantaged than their migrant counterparts in public schools. Table 4.3 and Table 4.4 present the descriptive statistics on school measures by school type for grade 3 and grade 5, respectively (see Appendix B).

Table 4.5 displays the mean reading achievement of the three groups at grade 3. ANOVA results revealed significant differences between average scores of the three groups, urban students consistently scored higher than migrant students. T-test results indicated that there were significant differences between test scores of migrant-public students and migrant-migrant students. For example, in the fall of 2006, urban students

scored 0.18 standard deviation (SD) higher than migrant-public students, and 0.45 SD higher than migrant-migrant students; meanwhile, the difference between migrant students in different types of schools was significant at 0.05 level, too. Table 4.6 shows that the results followed a similar pattern for grade 5 students, with the exception that there was no significant difference in the baseline scores. To aid in interpretation of these results, Figure 4.1 and Figure 4.2 graphically illustrate the observed mean growth curves of three groups for both grades (see Appendix C).

Table 4.5: Mean Standardized Scores of Reading Achievement for Grade 3

Grade 3	*wave 1*	*wave 2*	*wave 3*
Urban students	0.00(1.00)	0.00(1.00)	0.00(1.00)
Migrant-public students	-0.18(1.01)	-0.26(0.89)	-0.14(0.94)
Migrant-migrant students	-0.45(0.80)	-0.71(0.86)	-0.68(0.82)
p-value[a]	.000	.000	.000
p-value[b]	.001	.000	.000

Table 4.6: Mean Standardized Scores of Reading Achievement for Grade 5

Grade 5	*wave 1*	*wave 2*	*wave 3*
Urban students	0.00(1.00)	0.00(1.00)	0.00(1.00)
Migrant-public students	-0.09(0.94)	-0.26(0.96)	-0.08(0.95)
Migrant-migrant students	-0.07(0.87)	-0.87(1.01)	-0.55(0.81)
p-value[a]	.616	.000	.000
p-value[b]	.847	.000	.000

Note: 1. Standard deviations are presented in parentheses.
2. p-value[a] is calculated from one-way ANOVA for testing whether there are significant difference among urban students, migrant-public students and migrant-migrant students.
3. p-value[b] is calculated from t-test for testing whether there are significant difference between migrant-public students and migrant-migrant students.

The initial comparability between groups in terms of their baseline achievement levels was also examined. Figure 4.3 and Figure 4.4 show box plots of the rescaled reading achievement scores by grade. Visual inspection of the distribution of scores on the baseline tests for each grade revealed that each group distribution overlapped the others. In Figure 4.4, for example, although the variability in reading scores of migrant-migrant students was slightly smaller, the shapes of the distribution of baseline scores for

grade 5 migrant students studying in different types of schools were similar and approximately normal. Thus, it may be concluded that the initial ability levels of two migrant student groups were comparable. Subsequent differences in reading achievement might then be attributed to the school effect.

Figure 4.3: Box Plots of Rescaled Reading Achievement Scores for Grade 3 Students

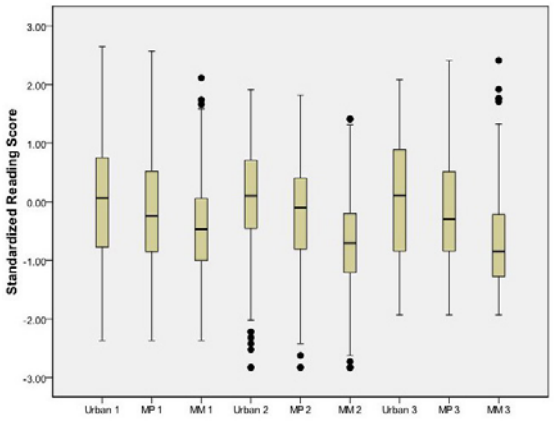


Figure 4.4: Box Plots of Rescaled Reading Achievement Scores for Grade 5 Students

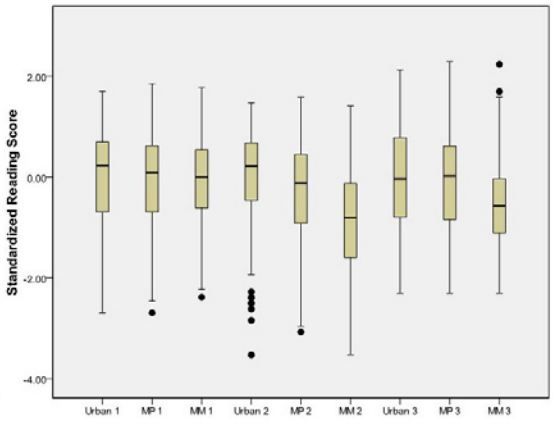


Table 4.7 and Table 4.8 show mean reading achievement for migrant students by missing data pattern (see Appendix D). The missing data problem for many of these students is likely to stem from their relatively high mobility. As such students change schools, they may suffer from discontinuity in curriculum and in learning to read. It is also likely that the student mobility rates are different in migrant schools and public schools. Take grade 5 for example, for those students without baseline data, their mean reading score at wave 2 was 0.88 SD lower than urban students, and 89 percent of them attended migrant schools. This result suggests that data might not be missing completely at random. Thus, analysis with a reduced sample excluding students without three full observations will be seriously biased (Little & Rubin, 1987; Raudenbush, Hong, & Rowan, 2002). For this reason, I included all the students in my analysis regardless of their missing data pattern. Moreover, one advantage to HLM growth curve model is the

number of repeated measures of achievement available for each student may vary; thus missing values at level 1 do not pose a serious problem.

There are no government regulations on education of migrant children and operation of migrant schools at the present time; therefore, migrant schools might constitute a heterogeneous category and could differ from one another as much as they differ from public schools. Table 4.9 and Table 4.10 present the school-by-school results on percentage of migrant students, class mean SES, and class mean baseline achievement for all students and migrant students for grade 3 and grade 5, respectively. In Table 4.9, for example, the percentage of migrant students ranges from 8 percent to 100 percent in public schools, and is 100 percent for all migrant schools. The mean achievement on baseline test for all students ranges from -0.89 SD to 0.1 SD in migrant schools, and from -0.81 SD to 0.60 SD in public schools. The large variability among schools has an important implication for the statistical power to detect the school effect.

Propensity Score Models

In this study, I conducted propensity score matching at the student level to create a matched comparison group for migrant students studying in different types of schools**.** The propensity score analysis consisted of three main steps. First, I estimated the propensity, or probability, that a migrant student would enroll in public school using logistic regression model, with studying at public school as the outcome measure and possible confounders as the independent variables. The predictors entered into the regression were all of the student-level covariates and baseline achievement score as well as other variables obtained from both student and parent questionnaires that were deemed to be potentially relevant to school membership and reading development. Table 4.11

lists descriptions and descriptive statistics for each predictor that is only included in propensity score models (see Appendix F).

Table 4.12 presents the results of logistic regression models for each grade (see Appendix G). If adopting a nominal significance level of $\alpha = .05$, there are only a few variables that show significant association with public school attendance at grade 3. For example, migrant students whose parents had higher level of parental involvement and satisfaction with school were more likely to attend public school. More predictors in grade 5 model displayed significantly positive relations with treatment assignment. For example, students who loved Beijing, had studying room, spoke Mandarin well, lived in a urban community or had close child-parent relationship were more likely to go to public school. It is interesting to note that students with a high level of satisfaction with their achievement are more likely to studying in migrant schools. ANOVA results reported by others (Chen & Feng, 2009; Ke, 2010; Wang, 2008) have consistently shown that migrant-migrant students had the poorest academic performance among three groups. In spite of significant achievement disparities, there was no significant difference in satisfaction with achievement between migrant students in different types of schools (migrant school= -.0834, public school= -.0150, p=.155). One possible explanation is students might judge their academic achievement relative to that of their classmates. Thus, the overall low performance of migrant schools might inflate their students' level of satisfaction with achievement.

To implement PSM successfully, however, the nature of the samples of migrant-migrant students and migrant-public students must meet certain criteria and several other choices must be made. Importantly, there should be a sizeable overlap of common

support across treatment groups. Intuitively, wide common support means that there must be a fairly large overlap in the propensity scores between the treated and control groups. The distributions of the propensity scores for the two student groups are presented in Figure 4.5 and Figure 4.6 (see Appendix H). As would be expected, students who enrolled in public school had higher propensity scores compared to their counterparts in migrant schools. Notice, however, that there is considerable overlap in the distributions. Some students should have very little chance of attending public school according to their pretreatment variables, but attended a public school. Conversely, there were migrant students with high similarity to other migrant students studying in public schools who actually studied in a migrant school.

Second, once I determined that PSM was feasible, the next step was to choose the method of matching. One option for investigating school effect using propensity scores is to calculate the average difference between two matched students who have the same (or similar) propensity scores (e.g., nearest neighbor matching). I chose not to use this method because it would lead to a substantially smaller sample, and it was difficult to use matched comparisons with a hierarchical model (Katz et al., 2008). Instead, I created matched groups called strata. The distribution of propensity scores was then divided into strata and analyses of treatment group differences were conducted within strata. Comparisons of treatment group differences within and across strata provide evidence for whether or not the bias due to non-random selection into treatment groups has been accounted for by the propensity score adjustment. I used the propensity scores to group similar students into five strata that were balanced on propensity score and, therefore, on possible confounders. Table 4.13 and Table 4.14 display the range of propensity scores

and the number of migrant-migrant students and migrant-public students in each stratum by grade.

Table 4.13: Range of Propensity Scores and Number of Students in Each Stratum for Grade 3

	Propensity Score		*Number of Students*		
Strata	*Minimum*	*Maximum*	*migrant school*	*public school*	*Total*
Stratum 1	0.043	0.2	92	15	107
Stratum 2	0.2	0.4	98	37	135
Stratum 3	0.4	0.6	55	53	108
Stratum 4	0.6	0.8	25	68	93
Stratum 5	0.8	0.963	8	62	70
Total			278	235	513

Table 4.14: Range of Propensity Scores and Number of Students in Each Stratum for Grade 5

	Propensity Score		*Number of Students*		
Strata	*Minimum*	*Maximum*	*migrant school*	*public school*	*Total*
Stratum 1	0.037	0.2	113	15	128
Stratum 2	0.2	0.4	81	34	115
Stratum 3	0.4	0.6	39	31	70
Stratum 4	0.6	0.8	22	54	76
Stratum 5	0.8	0.975	6	88	94
Total			261	222	483

Third, in conducting a propensity score analysis, it is important to ensure that the target groups within each stratum are comparable. I then tested the comparability of the migrant-migrant students and migrant-public students within each stratum, using t-tests on propensity scores and pretest covariates. The results indicated that stratification maintained balance on propensity scores in all strata and balance on pretreatment covariates in all strata.

Results of HLM Models with Covariate Adjustment for Grade 3

Results of the three-level covariate-adjusted model for reading achievement of grade 3 migrant students are presented in Table 4.15. In HLM, group-mean estimates of growth parameters are referred to as fixed effects, whereas variance estimates (i.e., within and between school variation) are referred to as random effects. The table is divided into two sections. The top section notes the fixed effects and the bottom section notes the random effects.

Unconditional Model

An unconditional three-level model was first used to (a) estimate a growth trajectory for each migrant student, (b) estimate mean initial status and mean growth rate, and (c) partition the observed parameter variance into within- and between-school components.

Estimates associated with the unconditional model are presented in model 1. The predicted mean initial status for all migrant students was 0.32 standard deviation lower than urban students. The predicted mean growth rate for migrant students was -0.023, showing that the overall urban-migrant achievement gap increased at a rate of 0.023 SD per term. The initial achievement gap was statistically significant; however, the linear growth rate estimated was not statistically different from zero.

Variability

The second panel demonstrates the decomposition of the variance in initial status and growth rate into their within- and between-schools components. The chi-square statistics for these variance components indicated significant variation among children within schools for initial status, but not for individual growth rates. Significant variation between schools for mean initial status and mean growth rates were found at school level.

Table 4.15: Three-Level Covariate-Adjusted Models for Migrant Students' Reading Achievement Over Time at Grade 3 (n=749)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Model for initial status				
Intercept for migrant schools, γ_{000}	-0.322***	-0.502***	-0.469***	-0.554***
Intercept for public schls, γ_{000}+ γ_{001}		-0.208~	-0.301***	-0.25**
School type (public schl=1), γ_{001}		0.294~	0.168	0.304~
% migrant students, γ_{002}				0.212
% male students, γ_{003}				-0.589
% mobile students, γ_{004}				0.679
Mean SES, γ_{005}				-0.156
Mean prior reading, γ_{006}				0.083***
Male, β_{01j}			-0.241***	-0.239***
Age, β_{02j}			0.052	0.072~
SES, β_{03j}			0.093*	0.082~
Buy books, β_{04j}			0.009	-0.004
Speaking Mandarin, β_{05j}			0.06	0.045
Only-child, β_{06j}			0.142~	0.134~
Live with parents, β_{07j}			0.151	0.149
Parental expectation, β_{08j}			0.146	0.164
Parental involvement, β_{09j}			-0.009	-0.017
Parental satisfaction, β_{010j}			0.169***	0.165***
Teacher& peer relationship, β_{011j}			0.014	0.012
School connectedness, β_{012j}			-0.052	-0.031
Local community, β_{013j}			0.004	0.005
Student expectation, β_{014j}			0.265*	0.258*
Student finish homework, β_{015j}			0.197*	0.188*
Model for growth rate				
Intercept for migrant schools, γ_{100}	-0.023	-0.106	-0.108	0.129
Intercept for public schls, γ_{100}+ γ_{101}		0.029	0.037	-0.06
School type (public schl=1), γ_{101}		0.135	0.145	-0.189
% migrant students, γ_{102}				0.316
% male students, γ_{003}				-0.034
% mobile students, γ_{104}				-1.445*
Mean SES, γ_{105}				0.432**
Mean prior reading, γ_{106}				-0.073***
Male, β_{11j}			0.139*	0.145**
Age, β_{12j}			-0.028	-0.038
SES, β_{13j}			0.029	0.028
Buy books, β_{14j}			0.053	0.061

Speaking Mandarin, β_{15j}	-0.029	-0.019
Only-child, β_{16j}	-0.098	-0.1~
Live with parents, β_{17j}	0.031	0.019
Parental expectation, β_{18j}	0.025	0.026
Parental involvement, β_{19j}	-0.033	-0.033
Parental satisfaction, β_{110j}	0.026	0.028
Teacher& peer relationship, β_{111j}	0.026	0.027
School connectedness, β_{112j}	0.102~	0.084
Local community, β_{113j}	-0.091~	-0.096~
Student expectation, β_{114j}	-0.082	-0.077
Student finish homework, β_{115j}	-0.163**	-0.161**

Random effect	*variance component*			
Level-1 variance				
Temporal variation, e_{tij}	0.52634	0.52624	0.51525	0.51223
Level-2 (students within school)				
Individual initial status, r_{0ij}	0.19108***	0.19220***	0.1281***	0.12879*
Individual growth rate, r_{1ij}	0.00047	0.00047	0.00045	0.00048
Level-3 (between school)				
School mean initial status, u_{00j}	0.12814***	0.09932***	0.07023***	0.00105
School mean growth rate, u_{10j}	0.04491***	0.04108***	0.04065***	0.00307*
Model Deviance	3780.5	3766.2	3628.1	3588.4
Parameters estimated	9	11	41	51

Note: ~ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Variance

In the next step, I considered how variation in student initial status was partitioned within and between schools, how variation in rates of growth was partitioned. Based on these variance component estimates, I computed the percentage of variation that lay between schools for both initial status and growth rate by $u_{00j}/(r_{0ij}+u_{00j})$ and $u_{10j}/(r_{1ij}+u_{10j})$, respectively.

I found that more of the variation in individual initial status lay between students within schools, r_{0ij} =0.191, than between schools, u_{00j} =0.128. I concluded that about 40.1

percent of the variance in initial status lay between schools. The school share of variance was larger, however, when I considered variation in growth rates. The result for growth rates was startling: variation within schools was estimated to be $r_{1ij} = 0.00047$ versus variation between schools $u_{10j} = 0.04491$, so that the between-school share was about 98.9 percent. This result was much higher than typically encountered in cross-sectional studies of school effects. Investigators who have used three-level longitudinal growth models to study school effects found evidence of large school impact on student achievement when rates of student growth were examined (Bryk & Raudenbush, 1988; Stevens, 2005; Zvoch & Stevens, 2003). Estimates of the proportion of variance in student growth rates attributable to schools have only ranged as high as 80 percent (Zvoch & Stevens, 2003).

Reliability

Before a conditional model was run to investigate relations between growth parameters and characteristics of student and school, it was important to examine whether growth parameters were estimated reliably (Willet, 1989). The reliability of estimated growth parameters in HLM is the ratio of the true parameter variance to the observed variance that consists of the true and error variances (Bryk & Raudenbush, 1987). The reliability estimates of the school-level initial status and growth rates were 0.78 and 0.75, respectively, suggesting that most of the observed variability was true parameter variance. The student-level reliability for initial status was 0.274; however, the reliability of individual growth rate was less than 0.10.

Three factors are known to influence the reliability of growth parameters (Willet, 1989): (a) number of data points, (b) heterogeneity of true growth parameters of

individual students, and (c) measurement error. Therefore, the low reliability for growth rates at student level can be partially attributable to the lack of significant variation among students for growth rates, which might be the result of the rescaling approach used in this study. Students' reading scores were converted to z-scores by substracting the urban students' mean and dividing by the urban students' standard deviation for distinct assessments. It is possible to conduct longitudinal analyses using standardized scores, but the resultant effects are expressed relative to the overall variance in student achievement at a single point in time. However, some researchers argued against standardizing the test scores to a common mean and variance over time because such statistical procedures effectively eliminated the essence of individual growth (Rogosa et al., 1982; Thorndike, 1966). For example, a student who learns at an average rate will have the same score from one year to the next, and subtracting the two scores produces a gain of zero. Moreover, whenever a variable is standardized to have equal variance over time, the correlation between change and initial status must be less than or equal to zero. Therefore, psychometric procedures are needed to ensure the adequacy of assessment instruments for measuring both initial status and growth rate.

However, low reliability does not invalidate the HLM analysis. It often indicates that a random coefficient might be considered fixed in subsequent analyses (Raudenbush et al., 2004). Because of the lack of vertically-scaled test scores, I also adopted an alternative rescaling approach to check the robustness of my results. Individual-level scores were converted to grade-equivalent scores. For example, the group means of grade 3 urban students were designated as 35, 40 and 45 for three waves, allowing both means and standard deviations to grow over time. The results from the unconditional model

indicated that the reliability of growth rate at student level increased to 0.209, and 60 percent of the variance in growth rates lay between students. However, for the current study, the major research interest was to investigate whether migrant students attending public school showed growth trajectories in reading achievement comparable to those of migrant students studying in migrant schools. The same pattern of school effects held for models with standardized scores as reading outcomes and models with grade-equivalent scores as reading outcomes. Therefore, the rescaling approach used in this study did not bias the estimate of school type contrast, which was fit at level 3.

Conditional Models

Model 2 to model 4 display the results of three conditional models. Fitting different models shows how the inclusion of different combinations of covariates changes the estimate of school effects. Thus, in reporting the results of a sequence of analyses, there is an interest not only in the estimate for a specific model but also in the pattern of estimates through the sequence.

As mentioned previously, the school type variable was uncentered, and all other level 2 and level 3 control variables were centered around the grand mean. Therefore, the estimated mean initial status for migrant-migrant students is γ_{000}, $_{(}\gamma_{000} + (0)_{*}\ \gamma_{001)}$, and the estimated mean initial status for migrant-public students is $\gamma_{000+}\ \gamma_{001,}\ _{(}\gamma_{000} + (1)_{*}\ \gamma_{001)}$. The difference in mean initial status between public schools and migrant schools is γ_{001}. Similarly, γ_{100} coefficient represents the expected mean growth rate for migrant-migrant students, $\gamma_{100+}\gamma_{101}$ represents the expected mean growth rate for migrant-public students, and γ_{100} represents the difference between them. Because the corresponding standard errors and p values for the mean initial status ($\gamma_{000+}\ \gamma_{001}$) and mean growth rate ($\gamma_{100+}\gamma_{101}$)

of migrant-public students were unknown in these models, I obtained the results of the significance test by reverse coding the school type (migrant school=1, public school=0).

Model 2 showed that the mean initial status for migrant students studying in migrant schools was 0.502 SD (-0.502+(0)*0.294) lower than the average of urban students, the mean initial status for migrant students studying in public school was 0.294 SD higher than that for migrant students studying in migrant schools; therefore, the mean initial status for migrant students studying in public schools was 0.208 SD (-0.502+(1)*0.294, $p<0.1$) lower than the average of urban students.

Similarly, the estimated mean growth rate was -0.106 SD for migrant students studying in migrant schools and 0.029 SD for migrant students studying in public schools. In other words, the initial urban-migrant achievement gap decreased at a rate of 0.029 SD per term for migrant-public students, and increased at a rate of 0.106 SD per term for migrant-migrant students. For migrant students studying in migrant schools, their mean growth rate was 0.135 SD lower that for migrant-public students. However, the estimated growth rates and school effect were not statistically significant. In summary, the results of the HLM analyses indicated that migrant students studying in public schools had lower initial levels of reading achievement in the fall of 2006, but they appeared to show similar growth rates as those of their urban peers. In contrast, the migrant students studying in migrant schools started with much lower status, and they were left further behind by both urban students and migrant-public students.

In Model 3, 15 student covariates were added to test significant effects on the initial status and the growth rate. With adjustment for differences among students, Model 3 indicated that both migrant-migrant students (-0.469^{***}) and migrant-public students (-

0.301***) had significant lower initial levels of reading scores than urban students. The difference in initial status between migrant students studying in public schools and migrant schools (0.168) was not statistically significant. In contrast, the estimated mean growth rate just changed slightly compared to the results from Model 2. The achievement gap approximately (a) enlarged at a rate of 0.108 SD per term between urban and migrant-migrant students, (b) enlarged at a rate of 0.145 SD per term between migrant-migrant students and migrant public students, and (c) decreased at a rate of 0.037 SD per term between migrant-public students and urban students. Again, the estimated growth rates and school effect were not statistically significant.

Model 4 tested the importance of school context variables. Researchers found that measures of school context were likely to be strong predictors of average levels of achievement (e.g., Hauser et al., 1976; Raudenbush, 2004; Stone & Lane, 2003; Willms, 1986), but had little association with student growth rates (Stevens et al., 2000; Zvoch & Stevens, 2006). However, in this study, those context effects were minor for the prediction of achievement level in the fall of 2006, with only one significant positive effect for schools with relatively high mean prior achievement. More pronounced context effects emerged for the change in achievement gap in reading. Students in schools with high percentage of mobile students, and high concentration of economic disadvantaged students showed a slower growth rate than that found in schools with low school mobility rate and with a relatively low percentage of students with economic disadvantage. After adjusting for differences among schools, the school type was statistically associated with school mean achievement at the 0.1 level, but did not share a statistical relationship with school mean growth. The estimated mean growth rate was 0.129 SD for migrant-migrant

students and -0.060 SD for migrant-public students. This result suggested that the higher growth rate of migrant students studying in public schools was mainly due to the fact that public schools had a more favorable student composition than migrant schools.

Variance explained

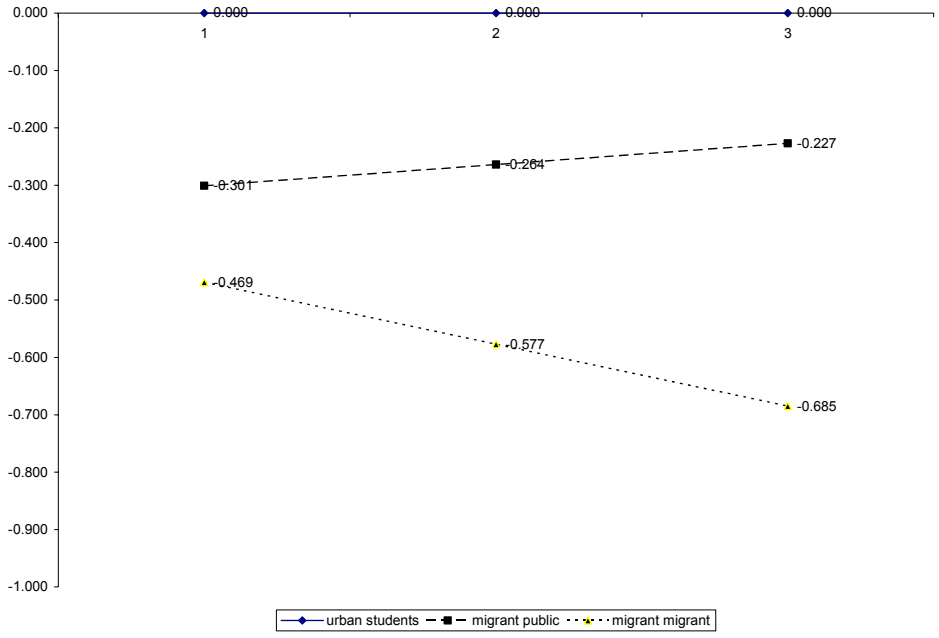
An analysis of unconditional model yields a decomposition of the total variance into within-school and between-school components. Table 4.15 also presents the percentage reduction in the variances achieved by each conditional model, treating the variances in unconditional as the baseline. I followed the suggestion of Raudenbush and Bryk (2002) by calculating the variance explained only at the level of the researcher's interest—that is, the school level in this study. This was calculated by dividing the difference of the variance estimates in the conditional and unconditional models by the variance in the fully unconditional model. I found that about 22.5% of the variance in mean initial status between schools was explained, and 8.5% of the between-school variance in growth rate was explained in model 2. After student covariates were included in model 3, I found that 45.2% of the between-school variance in mean initial status and 9.5% of the between-school variance in mean growth rate was explained. After school covariates were included in model 4, 99.1% of the between-school variance in mean initial status and 93.2% of the between-school variance in mean growth rate was explained.

Visual projections of growth trajectories

The school effect of interest in this study is Type A effect, that is whether public schools or migrant schools are more effective at narrowing achievement gap, regardless of whether that school's effectiveness derives from the effective practice of its qualified staff, or from its favorable student composition. In this section I introduce visual plots of

estimated growth curves of reading achievement using results in Model 3. It can be seen in Figure 4.7 that the dot line depicts the mean growth trajectory of migrant students studying in migrant schools, and the dash line depicts that of migrant students studying in public schools. The migrant students studying in public schools experienced a slightly positive rate of growth, while migrant students studying in migrant schools had a declining trajectory relative to both urban students and migrant students studying in public schools.

Figure 4.7: Reading Achievement at Three Time Points for Grade 3 Students in Public Schools and Migrant Schools (covariate-adjusted model)



Results of HLM Models with Propensity Score Matching for Grade 3

The same sequence of growth curve models combined with propensity score matching was conducted. I included the strata membership in the level 2 model to estimate the effect of public school attendance on change in achievement gap. I used the highest propensity score level, stratum 5, as the reference group; this group represented students with greatest likelihood to enroll in public school. The estimated coefficients for

Table 4.16: Three-Level Models Combined with Propensity Score Matching for Migrant Students' Reading Achievement Over Time at Grade 3 (n=513)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Model for initial status				
Intercept for migrant schools, γ_{000}	-0.327***	-0.485***	-0.398**	-0.481***
Intercept for public schls, γ_{000}+ γ_{001}		-0.216~	-0.329**	-0.286**
School type (public schl=1), γ_{001}		0.269	0.069	0.195
% migrant students, γ_{002}				0.117
% male students, γ_{003}				-0.807
% mobile students, γ_{004}				0.709
Mean SES, γ_{005}				-0.212
Mean prior reading, γ_{006}				0.091***
Stratum 1, β_{01j}			-0.583**	-0.526***
Stratum 2, β_{02j}			-0.453***	-0.397***
Stratum 3, β_{03j}			-0.495**	-0.465**
Stratum 4, β_{04j}			-0.255*	-0.236
Model for growth rate				
Intercept for migrant schools, γ_{100}	-0.018	-0.081	-0.108	0.045
Intercept for public schls, γ_{100}+ γ_{101}		0.015	0.056	0.012
School type (public schl=1), γ_{101}		0.096	0.164	-0.033
% migrant students, γ_{102}				0.355
% male students, γ_{003}				0.426
% mobile students, γ_{104}				-0.901
Mean SES, γ_{105}				0.496*
Mean prior reading, γ_{106}				-0.076**
Stratum 1, β_{11j}			0.231*	0.218*
Stratum 2, β_{12j}			0.165	0.154
Stratum 3, β_{13j}			0.134	0.135
Stratum 4, β_{14j}			0.151	0.141

Random effect	*variance component*			
Level-1 variance				
Temporal variation, e_{tij}	0.53936	0.5396	0.53618	0.53421
Level-2 (students within school)				
Individual initial status, r_{0ij}	0.18816***	0.18944***	0.17688***	0.16958***
Individual growth rate, r_{1ij}	0.00073	0.00067	0.00087	0.0012
Level-3 (between school)				
School mean initial status, u_{00j}	0.12480***	0.10010***	0.07199***	0.00082

School mean growth rate, u_{10j}	0.05189***	0.04930***	0.04660***	0.00634
Model Deviance	3077.8	3068.8	3046.4	3009.1
Parameters estimated	9	11	19	29

Note: ~ p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

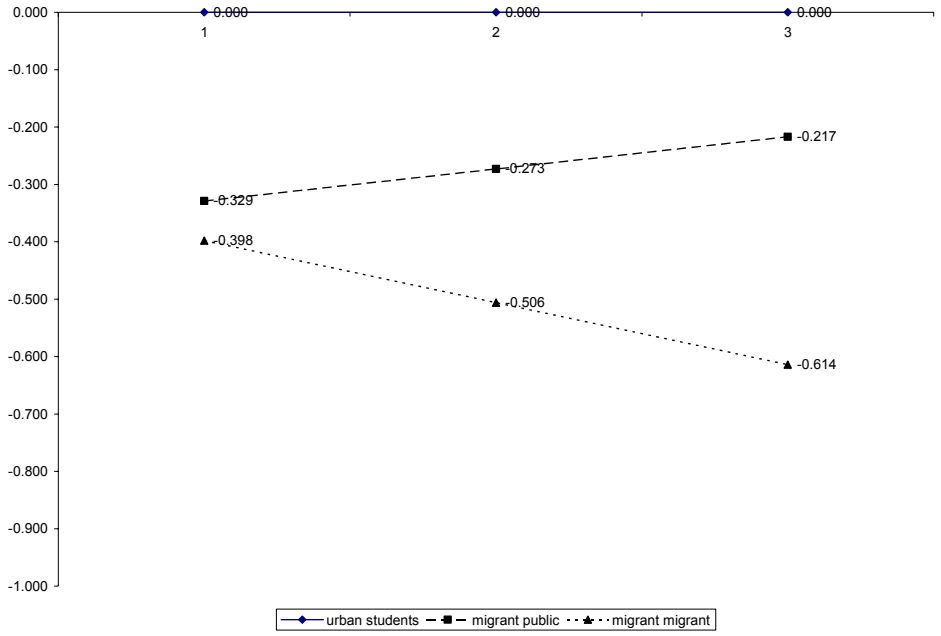
other strata will show whether the more disadvantaged migrant students gain the most with access to high-quality public school. The HLM models combined with propensity score models yielded results generally similar to those obtained for the covariate-adjusted HLM models (see Table 4.16).

According to the chi-square tests, there was significant variation among children within schools for initial status, but not for growth rate. Examination of random effects also suggested considerable random variation in both mean initial status and mean growth rate lay at school level. Based on these variance components, I found that 39.8% of variance in initial status and 98.6% of the variance in growth rate existed between schools.

From Model 3, it can be seen that students with a lower propensity for attending public school tend to demonstrate lower initial status but higher growth rate. For example, on average, students in stratum 1 scored 0.583 SD lower than stratum 5 students in the fall of 2006. However, they exhibited the largest gains from public school attendance, their growth curve was much steeper (β_{11j}=0.231*) relative to stratum 5 students. For the school effect, the initial difference between migrant students studying in migrant schools and urban students (γ_{000}=-0.398***) was significant, and widened at a rate of 0.108 SD per term. The initial difference between migrant-public students and urban students ($\gamma_{000}+\gamma_{001}$=-0.329***) was significant and narrowed at a rate of 0.056 SD per term. The initial difference between migrant-public students and migrant-migrant students (γ_{001}=0.069) was not significant and increased at a rate of 0.164 SD per term. In other

words, despite demonstrating comparable initial status, migrant students studying in migrant schools did not demonstrate growth trajectory comparable to their migrant peers studying in public schools. Figure 4.8 presents a visual depiction of growth curves for three groups students based on the results from Model 3.

Figure 4.8: Reading Achievement at Three Time Points for Grade 3 Students in Public Schools and Migrant Schools (PSM Model)



Results of HLM Models with Covariate Adjustment for Grade 5

Table 4.17 shows the results of the three-level covariate-adjusted models for grade 5 migrant students. In fully unconditional model, I found that migrant students demonstrated a slightly lower mean initial status (-0.113), but a significantly negative growth rate (-0.128***) than urban students. Proceeding to the bottom section of the table, it may be seen that there was significant variability among students in terms of their levels of achievement, but not their growth rates. Schools differed significantly in mean initial achievement level and in mean growth rate. Calculation of the percentage of variation attributable to schools indicated that 29.1% of the variability in initial reading

Table 4.17: Three-Level Covariate-Adjusted Models for Migrant Students' Reading Achievement Over Time at Grade 5 (n=685)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Model for initial status				
Intercept for migrant schools, γ_{000}	-0.113	-0.272**	-0.272**	-0.009
Intercept for public schls, γ_{000}+ γ_{001}		-0.011	-0.16	-0.24*
School type (public schl=1), γ_{001}		0.261	0.112	-0.231
% migrant students, γ_{002}				-0.835~
% male students, γ_{003}				0.965
% mobile students, γ_{004}				-0.643
Mean SES, γ_{005}				-0.174
Mean prior reading, γ_{006}				0.073***
Male, β_{01j}			-0.176*	-0.187**
Age, β_{02j}			-0.197***	-0.177***
SES, β_{03j}			0.083*	0.075
Buy books, β_{04j}			0.151*	0.152*
Speaking Mandarin, β_{05j}			0.037	0.027
Only-child, β_{06j}			-0.044	-0.075
Live with parents, β_{07j}			0.125	0.087
Parental expectation, β_{08j}			0.168	0.135
Parental involvement, β_{09j}			-0.074	-0.068
Parental satisfaction, β_{010j}			0.253***	0.244***
Teacher& peer relationship, β_{011j}			0.023	0.024
School connectedness, β_{012j}			0.018	0.049
Local community, β_{013j}			-0.166*	-0.176*
Student expectation, β_{014j}			0.265*	0.264*
Student finish homework, β_{015j}			0.209*	0.225*
Model for growth rate				
Intercept for migrant schools, γ_{100}	-0.128**	-0.247**	-0.24***	-0.402**
Intercept for public schls, γ_{100}+ γ_{101}		-0.046	0.002	0.073
School type (public schl=1), γ_{101}		0.201**	0.242**	0.475*
% migrant students, γ_{102}				0.396
% male students, γ_{003}				0.194
% mobile students, γ_{104}				0.964
Mean SES, γ_{105}				0.186
Mean prior reading, γ_{106}				-0.016
Male, β_{11j}			-0.150**	-0.146**
Age, β_{12j}			0.041	0.031
SES, β_{13j}			0.021	0.016
Buy books, β_{14j}			-0.015	-0.021

Speaking Mandarin, β_{15j}	-0.092	-0.083
Only-child, β_{16j}	0.027	0.038
Live with parents, β_{17j}	-0.061	-0.027
Parental expectation, β_{18j}	-0.069	-0.051
Parental involvement, β_{19j}	0.007	0.005
Parental satisfaction, β_{110j}	-0.088*	-0.081*
Teacher& peer relationship, β_{111j}	0.063~	0.063*
School connectedness, β_{112j}	0.029	0.012
Local community, β_{113j}	-0.035	-0.035
Student expectation, β_{114j}	-0.156	-0.156
Student finish homework, β_{115j}	-0.112	-0.11

Random effect	*variance component*			
Level-1 variance				
Temporal variation, e_{tij}	0.56499	0.56559	0.55157	0.55166
Level-2 (students within school)				
Individual initial status, r_{0ij}	0.26679***	0.26394***	0.12782***	0.11775**
Individual growth rate, r_{1ij}	0.00082	0.00075	0.00048	0.00041
Level-3 (between school)				
School mean initial status, u_{00j}	0.10927***	0.09425***	0.06350***	0.00013
School mean growth rate, u_{10j}	0.03058***	0.01879***	0.01456***	0.00518*
Model Deviance	3775.1	3761.1	3547	3506
Parameters estimated	9	11	41	51

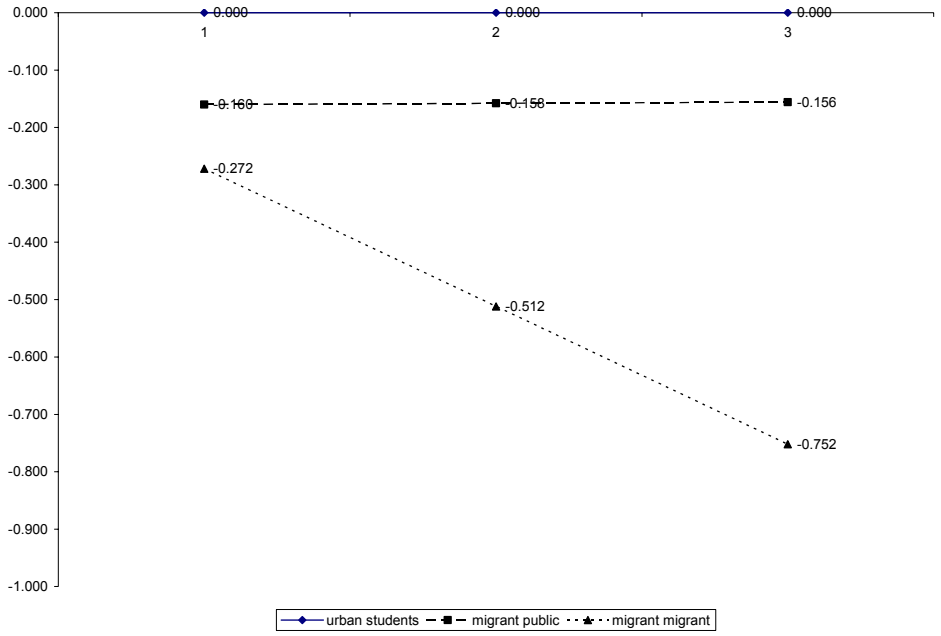
Note: ~ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

achievement and 97.3% of the variability in growth rate was due to school-to-school differences.

The adjusted results in model 3 were very similar to the unadjusted results in model 2. With adjustment for differences among students, the initial differences showing a lower mean for migrant students studying in migrant school than for urban students was significantly different from zero (-0.272***). Migrant students studying in public schools had lower mean initial status than urban students (-0.16) and a higher mean initial status than migrant students studying in migrant schools (0.112); these differences were not

significant. On the other hand, the migrant-migrant students demonstrated significantly slower growth rates than the migrant-public students (-0.242**) and urban students (-0.24***). In addition, migrant students studying in public schools experienced almost the same rates of growth as their urban peers (0.002). This result may also be interpreted as indicating that the initial achievement gap between migrant students studying in public schools and urban students remained persistent as they progressed to grade 6. Figure 4.9 presents an illustration of estimated growth trajectories for migrant students at grade 5 in different types of schools from model 3 of HLM covariates-adjusted models.

Figure 4.9: Reading Achievement at Three Time Points for Grade 5 Students in Public Schools and Migrant Schools (covariate-adjusted model)



Results of HLM Models with Propensity Score Matching for Grade 5

HLM models combined with propensity score matching yielded results generally similar to the preceding covariate-adjusted model (see Table 4.18). The unconditional model (Model 1) revealed that the mean of initial status in the fall of 2006 for all migrant students was 0.066 SD lower than that of urban students, and the difference was not

Table 4.18: Three-Level Models Combined with Propensity Score Matching for Migrant Student's Reading Achievement Over Time at Grade 5 (n=483)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Model for initial status				
Intercept for migrant schools, γ_{000}	-0.066	-0.155	-0.194	0.004
Intercept for public schls, $\gamma_{000}+\gamma_{001}$		-0.016	-0.060	-0.014
School type (public schl=1), γ_{001}		0.139	0.134	-0.018
% migrant students, γ_{002}				-0.543
% male students, γ_{003}				0.515
% mobile students, γ_{004}				-0.192
Mean SES, γ_{005}				-0.019
Mean prior reading, γ_{006}				0.092***
Stratum 1, β_{01j}			0.248~	0.274*
Stratum 2, β_{02j}			0.032	0.076
Stratum 3, β_{03j}			0.238	0.265*
Stratum 4, β_{04j}			0.103	0.121
Model for growth rate				
Intercept for migrant schools, γ_{100}	-0.161**	-0.322***	-0.354***	-0.451**
Intercept for public schls, $\gamma_{100}+\gamma_{101}$		-0.058	-0.013	0.034
School type (public schl=1), γ_{101}		0.264**	0.341**	0.485*
% migrant students, γ_{102}				0.343
% male students, γ_{003}				-0.071
% mobile students, γ_{104}				0.622
Mean SES, γ_{105}				0.164
Mean prior reading, γ_{106}				-0.023
Stratum 1, β_{11j}			0.113	0.114
Stratum 2, β_{12j}			0.151	0.145
Stratum 3, β_{13j}			0.103	0.098
Stratum 4, β_{14j}			0.031	0.042

Random effect	*variance component*			
Level-1 variance				
Temporal variation, e_{tij}	0.52885	0.52905	0.52769	0.52323
Level-2 (students within school)				
Individual initial status, r_{0ij}	0.24007***	0.24334***	0.23341***	0.21786***
Individual growth rate, r_{1ij}	0.00043	0.00053	0.00046	0.00065
Level-3 (between school)				
School mean initial status, u_{00j}	0.08603***	0.08106***	0.08656***	0.00061

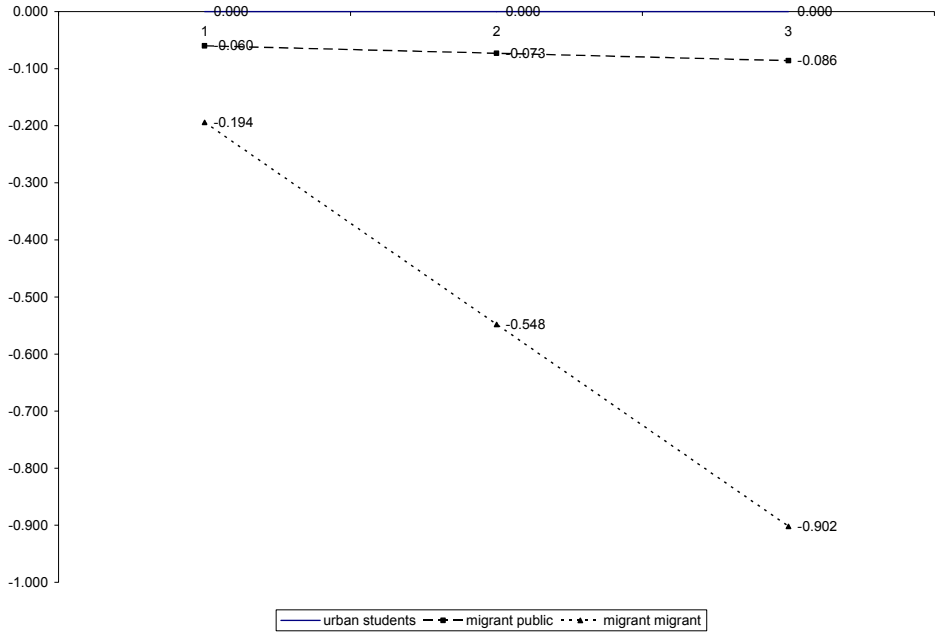
School mean growth rate, u_{10j}	0.02951***	0.00974*	0.00811*	0.00463
Model Deviance	2917.5	2903.2	2888.9	2847.6
Parameters estimated	9	11	19	29

Note: ~ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

statistically significant. In addition, the overall urban-migrant achievement gap increased at a rate of 0.161SD per term. The linear growth rate estimated was statistically different from the growth rate of zero. Examination of random effects showed while student achievement levels varied significantly within schools, their rates of growth did not. Estimated both mean initial status and mean growth rate varied significantly across schools. Thus, approximately 26.4% of the variance in initial status and 98.5% of the variance in growth rate occurred between schools.

Model 3 indicated that after adjustment for strata membership, there was no significant difference in mean initial status of three group students. However, the initial achievement gap increased at a rate of 0.354 SD per term between urban students and migrant-migrant students; the gap widened at a rate of 0.341 SD per term between migrant-migrant students and migrant-public students. Moreover, these differences in mean growth rate were statistically significant. The growth rate difference between migrant students and urban students in public schools was quite small (-0.013) and not significant. Figure 4.10 presents an illustration of estimated growth trajectories for migrant students at grade 5 in different types of schools from Model 3 of HLM models combined with propensity score matching.

Figure 4.10: Reading Achievement at Three Time Points for Grade 3 Students in Public Schools and Migrant Schools (PSM Model)



CHAPTER Ⅴ

Discussion

In the present study, the application of a three-level HLM model allowed me to examine the extent to which the initial urban-migrant achievement gap and its growth were attributable to differences in student characteristics and school type. Results of the covariate-adjusted model from both grades indicated that students who were female, who came from high SES households, whose parents had higher level of satisfaction with student learning, who had expectation of college attendance and who always finished homework on time were predicted to have initially high achievement level. However, there were few student-level covariates that significantly explained the growth of achievement gap over time because more than 90 percent of the variance in growth rate occurred between schools. Since the main interest of this study is to investigate the school effect on the growth in achievement gap, in the following section, I discuss the magnitude of the achievement gap, the possible school assignment mechanism, patterns of achievement gap change in public schools and migrant schools, and some issues of statistical power.

Magnitude of Achievement Gap

The first research question addressed in the current study was the magnitude of the achievement gap between migrant students and urban students. Descriptive results consistently revealed that urban students achieved the highest on reading tests of three

waves; migrant students studying in migrant schools had the lowest achievement. In addition, t-test results indicated that there were significant differences between reading scores of migrant students studying in different types of schools at grade 3. A similar pattern held for grade 5 students, with the exception that there was no significant difference in the baseline scores. However, there are several possible factors that might complicate the interpretation of this achievement gap and might have important implications for the estimation of growth curve parameters.

Standardization of test scores

In the current study, raw test scores of all students were converted to z-scores. Since z-scores tell virtually nothing about a student's actual reading abilities, no substantive educational meaning can be attached to the urban-migrant achievement gap. Therefore, the interpretation of the urban-migrant achievement gap was complicated by the lack of standardized tests. Standardized tests are needed so that researchers can assess the reading skills of children relative to grade-specified proficiency standards—for example, using a state-developed criterion-referenced test or vertically equated scores obtained from a nationally-normed standardized assessment.

On the one hand, it might be the case that urban students read at grade level and migrant students read blow the grade level; if so, results from a criterion referenced standardized test could be used to determine whether a disproportionate share of migrant students failed to meet grade-level expectations. In addition to the well-documented urban-migrant achievement gap, Wang (2008) found that the distributions of reading achievement for migrant students studying in migrant schools and public schools were distinct. The standard deviation of reading achievement at grade 2 in migrant schools

(SD=12.8) was much larger than that in public schools (SD=5.26). The persistent low achievement levels by migrant students remain a neglected and unaddressed societal challenge. Therefore, standardized assessments which are aligned with national academic content standards are important to identify the extent of the disadvantage in educational quality faced by the migrant children, even when barriers to school access and attendance have been overcome.

In the U.S., No Child Left Behind Act (2001) required that all students reach proficiency in the state-specified standards by the spring of 2013-2014, as measured by performance on state tests. State assessments were generally designed to align with the state's curriculum and/or performance standards at each grade level. NCLB required states to develop a single accountability system to determine whether all students and key subgroups of students were meeting adequate yearly progress (AYP). Standardized tests were necessary for ensuring that education officials could not get way with inferior education for migrant children, especially when these were the children who need high-quality schooling the most. Through the use of standardized tests, schools can be held accountable for helping all migrant children reach higher levels of academic learning.

On the other hand, if the tests were normed on national sample, I might find that migrant students read at grade level, whereas urban students read above grade level. Results from vertically scaled standardized assessments could be used to investigate whether the widening of urban-migrant achievement gap is attributable to the fact that urban students' reading increases at an accelerating rate. For example, in the U.S., the National Assessment of Educational Progress (NAEP) is a federal standardized test administered to fourth- and eighth-grade students in reading and math. Research making use of NAEP data indicated that the racial achievement gap expanded during the 1990s

(Carnoy, 1994; Lee, 2002). However, every racial/ethnic subgroup has made gains in achievement during the past 30 years, especially in mathematics. The achievement gap has not narrowed because White students' gains exceeded those made by Black and Hispanic students (Kober, 2001).

It is interesting to consider factors that might have influenced the achievement gap between urban students and migrant students. In order to ensure school success, for example, urban parents at Beijing with high expectations may reinforce skills obtained in formal education and develop other talents of their children through out-of-school learning opportunities. For example, in this study, 75 percent of urban students took part in at least one after-school tutoring program. In contrast, only 37 percent of migrant students in public schools and 14 percent of migrant students in migrant schools had similar opportunities. Catsambis and Garland (1997) demonstrated the positive impact that this kind of out-of-school learning could have. I cannot rule out the possibility that migrant children met grade-level expectations; however, urban students' reading performance might exceed grade expectations—a situation that might have been influenced by students' taking advantage of learning opportunities out of school hours. If this were the case, it might have contributed to the achievement gap.

Representativeness of sample

The second factor is related to the possibility that the observed urban-migrant achievement gap might be underestimated in the current study because the sample was not representative of migrant and urban student population. On the one hand, all migrant schools in this sample have been granted license. In contrast, more than 80 percent of migrant schools in Beijing still do not meet certain criteria to be licensed. Due to their

unlicensed status, the adequacy of the administration, teacher quality and the contents of education offered in those migrant schools are not subject to regulation by education authorities. The poor infrastructure and teaching conditions of unlicensed migrant schools might be reflected in their students' academic performance. For example, a survey in Beijing showed that 63 percent of students at licensed migrant schools scored above 70 points on a math test compared with 40 percent at unlicensed migrant schools (Liu, 2009).

On the other hand, China's educational system is highly competitive and examination oriented. An elite education system had been instituted throughout the last century. From the 1950s, the Chinese government concentrated its tight education budget on a few schools, which were designated as ‘key schools’. Key schools are those with the best reputation, teaching staff and facilities, and these privileges have led to high student achievement. Along with key schools, in some large cities, public schools are also categorized as ordinary schools or weak schools. Weak schools are chronically low-performing schools in need of improvement. The student performance of ordinary schools is higher than that of weak schools, but lower than that of key schools. Stratification of schools according to students’ academic abilities is an entrenched practice in Beijing, and parents deliberately place their child in more prestigious schools. However, the space in key schools is limited. As a result, the competition for entrance to key schools is ferocious in Beijing. Meanwhile, key schools also make great efforts to maintain their academic standards in order to solicit higher school selection fees and donations. As migrant children are usually seen as low-achieving students, they are likely to be kept out of the best schools, and to be assigned to mediocre or poor quality schools (Dragon Tiger Net, 2005; Eastday, 2006). Therefore, in future studies, comparisons of

academic achievement of urban students and migrant students should be carried out with subsets of migrant schools categorized by license status, and subsets of public schools by the category of key schools, ordinary schools and weak schools.

Lack of psychometric equating

The third factor to consider is that the difficulty levels of distinct tests might vary considerably because of lack of formal psychometric equating. Therefore, the estimation of growth curve parameters is likely to be biased because the magnitude of urban-migrant achievement gap is sensitive to the difficulty levels of different tests. In this study, the rescaled z-score of migrant students represents their performance relative to urban students. From a conservative viewpoint, the lack of formal psychometric equating may preclude the rescaling approaches used in current study. From this perspective, results should never be combined across grades unless the tests can be formally equated using common items or common populations. However, reading tests of three waves were not explicitly linked through psychometric equating. Therefore, these tests might different in several ways, such as the difficulty level. In grade 5, for instance, there was no significant difference in baseline scores among urban students (0.00), migrant students studying in public schools (-0.09) and migrant students studying in migrant schools (-0.07). Figure 5.1 indicates that the left-skewed shape of distribution of baseline test is different from that of the later two tests, suggesting that the baseline test might be an easier one. Fischer (1976) demonstrated that an easy test will falsely favor low ability students. Therefore, the observed insignificant difference among three group students might be due to the ceiling effect of the baseline test. The most severe consequence of this possibility is that the initial status of migrant students might be substantially inflated; thus, both the

observed and estimated declining growth trajectories for migrant students studying in migrant schools might be artificial. In contrast, Figure 5.2 suggests that the difficulty levels of reading tests are relative consistent across three waves at grade 3 (see Appendix I).

SES and Public School Attendance

The second research question addressed in this study was whether migrant students benefited academically from public schools attendance. I made use of cross-sectional longitudinal data and applied hierarchical growth curve modeling to estimate the school effect on the change in urban-migrant achievement gap. I also demonstrated how hierarchical growth models were combined with propensity score matching to strengthen the causal inference of treatment effect in this observational study. Traditional covariate-adjusted regression model estimates treatment effect and controls for the confounders at the same step. In contrast, the propensity score approach is a two-step process: possible confounding variables are used to model the treatment assignment mechanism, and then treatment effects are estimated based on group membership. In addition to making it possible to draw credible inference about the school effect, the propensity score approach also helps me to reflect on the school assignment mechanism. A question of interest is whether the recent policy initiatives mitigated the negative effects of economic disadvantage of migrant households on the public school enrollment for migrant children in Beijing.

When examining the process of educational stratification, recent sociological studies stress the importance of institutional factors (Kerckhoff, 1995). Buchmann and Hannum (2001) argued that in developing countries, provision of educational opportunities by the

state through its educational policies exerted an influential impact on family decisions about education. When the state provides limited access to education, children's school enrollment mainly depends on family resources, thus exacerbating the educational inequality. A decade ago, as a means of deterring migrants from settling in the cities where they worked, several obstacles, such as prohibitively high extra fees for migrant children, were established in urban China to keep migrant children out of urban public schools. Previous research constantly revealed that household income was a strong determinant of school attendance among migrant children (Lu, 2007; Nielsen, 2006), and families' economic constraints greatly disadvantaged migrant children in public school enrollment (Sa, 2004). The 2003 Notice required urban public schools to accept migrant children and prohibited public schools from charging migrant children extra fees. The previous studies regarding the school attendance of migrant children in China were basically conducted before the year of 2002. An important question yet to be answered is whether the increased supply of education for migrant children in China has led to equal access to education.

Results from the propensity score models (see Table 4.12) indicated that family socioeconomic status was not significantly predictive of public school attendance. It seemed that the 2003 Notice did relieve the economic constraints to public school attendance for migrant families. From the preceding discussion, we know that migrant parents strongly hope to change their social situation and pin their hopes on the next generation. Migrant parents might spend a large fraction of their family incomes on sending their child to public school if they believed that the investment on education would be paid off in the form of a better jobs or social mobility for their child. Therefore,

future research needs to investigate whether a family's economic constraints really matter for migrant parents' decision about school choice for their child.

Public School Effect

Examination of the effect of public school attendance revealed that the relationship between school type and change in achievement gap was distinct across grades. For migrant students, public school was significantly associated with the change in achievement gap between students studying in different types of schools only at grade 5. In other words, the achievement gap between migrant students studying in public schools and migrant students studying in migrant schools widened at both grades; however, the increase was significant at grade 5, but not at grade 3. This pattern also held true for the change in the achievement gap between urban students and migrant students studying in migrant schools. There are several possible explanations for why public school effects are different for migrant students of different grades.

Cumulative teacher effect

The first explanation is that the influence that students received over the years from their teachers was presumably cumulative in nature (May & Supovitz, 2006). Recent studies of teacher effects at classroom level have found that differential teacher effectiveness is a strong determinant of differences in student learning, far outweighing effects of other classroom variables (Wright, Horn, & Sanders, 1997). Moreover, some non-experimental work (Ballou, Sanders, & Wright, 2004; Sanders & Rivers, 1996) and randomized experimental study (Konstantopoulos, 2007) indicated that teacher effects were cumulative and remained strong not only in the year of the study, but enduring up to several years in early elementary grades. If children living in poverty study in classrooms

staffed with unqualified teachers over years, their chances of achieving a quality education will diminish year by year. In one widely noted study, children who had the least effective teachers three years in a row posted academic achievement gains that were 54 percent lower than the gains of children who had the most effective teachers three years in a row (Sanders & Rivers, 1996). Haycock (2002) noted that "The implication is that not only does teaching quality matter—it matters a lot. Students unfortunate enough to face several bad teachers in a row face devastating odds against success."

Yet previous studies have rarely accounted for the cumulative nature of teacher effect. From the preceding discussion, we know that teachers differed considerably in their qualifications between public schools and migrant schools. Migrant schools were staffed with a large number of underprepared teachers. In addition, teacher turnover rates were exceptionally high in migrant schools. Finally, migrant students studying in migrant schools were likely to learn core academic subjects from teachers who did not major in these subjects in colleges. The pattern of out-of-field teaching was particularly severe in math and English classes (Han, 2001). Under these circumstances it was likely that migrant children with the greatest learning needs experienced repeated years of teaching by unqualified instructors. In contrast, if migrant students were taught by a series of high quality teachers in public schools, their benefits might be enormously larger than being taught by a series of less effective teachers in migrant schools. Therefore, in the current study, it might be the case that in migrant schools grade 5 migrant students were taught by unqualified teachers 5 years in a row and grade 3 migrant students were taught by unqualified teachers 3 years in a row. As migrant students progressed through the grades,

the deficits of low teacher quality accumulated, leaving migrant students studying in migrant schools further and further behind their counterparts studying in public schools.

Forth grade slump

Another possible explanation is that the reading materials that students encounter may differ at grade 3 and grade 5 in terms of difficulty levels and cognitive demands. In the U.S., educators have found that the achievement gap between students of low-income and middle-income families becomes especially evident after fourth grade (the forth-grade slump). Some studies (Chall & Jacobs, 2003; Chall et al., 1990) found that the reading achievement of second- and third-grade low-income children was comparable to the achievement of the normative population on all subtests of the Diagnostic Assessments of Reading. By fourth grade, however, some children's scores began to decline. Furthermore, whether using results of the National Assessment of Educational Progress, local standardized testing, or informal classroom assessment, this achievement gap becomes more noticeable by fourth grade and increases as children get older (Sanacore & Palumb, 2009).

In Chall's developmental stage model of reading (Chall, 1983), reading development is conceptualized as two major stages, which are "learning to read" and "reading to learn". Reading instruction from kindergarten to third grade can be characterized as the time of "learning to read"—the time when simple, familiar texts are read; reading instruction from grade 4-8 can be characterized as the "reading to learn" stage—when texts become more varied, complex, and challenging linguistically and cognitively. The forth-grade slump becomes noticeable, particularly for children at poverty, at the point of transition from "learning to read" stage to "reading to learn" stage. As students move through the

elementary grades, words and concepts in reading materials begin to be beyond the everyday experience of children. In order to comprehend and learn from these more demanding texts, students need to substantially expand their vocabulary and knowledge.

If children are unable to make the transition to the "reading to learn" stage as the content of texts become more complex in the upper elementary years, their academic success might be adversely affected. Perhaps that both migrant school teachers and public school teachers could help migrant students cope with simple texts during the early grades. In grade 4 and beyond, however, effective teachers in public schools might be able to ensure that migrant students have adequate background information and relevant hands-on experience as ways of preparing them to tackle more advanced academic texts. In contrast, migrant students studying in migrant schools might only manage simple texts because many of migrant school teachers did not possess substantial knowledge of how to teach reading. Inadequate school libraries in migrant schools, which limited students' access to reading materials, might exacerbate the fourth-grade slump, too. In my opinion, the reason for why the urban-migrant achievement gap significantly increased for grade 5 cohort at migrant schools might be attributable to the fact that it is extremely challenging for migrant school teachers to effectively compensate for deficits of migrant students in background knowledge and language development at the upper elementary grades.

More disadvantaged grade 5 migrant students

The third possible explanation is that the grade 3 migrant students and grade 5 migrant students were two heterogeneous groups. If these two groups differ from one another in several important respects, public school effects might present distinct pattern in two grades. Based on descriptive results presented at Table 5.1 (see Appendix J), grade

5 migrant students were significantly more disadvantaged in terms of SES (-.30 vs. -.22) and parental involvement (-.44 vs. -.07) than grade 3 migrant students. For disadvantaged students, the quality of education is more crucial: lower achieving students are the first to benefit as school quality increases (Sanders & Rivers, 1996), and the lowest income students suffer the most when the quality of education is weak (Van der Berg, 2008). As the most socially and economically disadvantaged group (SES=-0.4), grade 5 migrant students studying in migrant schools might be much more vulnerable to the quality of instruction in deficient schools because they did not have many resources and opportunities in their homes to cushion the low quality education. In contrast, grade 5 migrant students studying in public schools might be sensitive to the improvement in school quality, thus experiencing greater gains relative to their counterparts in migrant schools.

Within School Differences

Even though migrant students could benefit academically by attending a public school, the estimated growth rates for migrant students studying in public schools suggested that public schools failed to narrow the achievement gap. In other words, the urban-migrant achievement gap remained constant even when migrant students attended the same school as their urban peers. This finding would probably be disappointing for migrant parents. However, public school teachers might try to defend that they actually provided an educational environment that enabled disadvantaged migrant students to keep pace with their more advantaged urban peers, and public schools alone cannot overcome the effects of poverty on achievement of migrant students.

In the U.S., studies of school effects have consistently found that students' characteristics and their family backgrounds, rather than difference between schools were the primary determinant of student achievement (Aitkin & Longford, 1986; Bryk & Raudenbush, 1992; Central Advisory Council for Education, 1967; Coleman et al., 1966; Goldstein, 1987; Reynolds, 1992; Scheerens & Bosker, 1997; Schreiber & Griffin, 2004). Much earlier educational policy and the most recent No Child Left Behind (NCLB) Act required schools to close the achievement gaps among students who differed by poverty status, race, and language. Nonetheless, disparities in achievement were largely unaffected by these policy initiatives (Hanushek & Raymond, 2004). Some commentators have argued that the failure of NCLB and earlier accountability reforms reflects a flawed, implicit assumption that schools alone can close the achievement gaps (Karen, 2005; Rothstein, 2004). Regardless of what occurs at school, the broader structure of social stratification produces class and racial disparities in achievement, and school reforms cannot eliminate achievement gaps as long as those social inequalities are left intact (Wilson, 1998).

It appears that public schools have legitimate excuses for their failure to reduce achievement gap. However, after four decades of investigation into how the policy and practices of school personnel affect student performance, research clearly demonstrates that schools can have a powerful effect on student achievement (Ashton & Webb, 1986; Brookover et al., 1979; Lee & Bryk, 1989; Rowan et al., 1991; Teddlie & Reynolds, 2000). Moreover, previous school effect research has also been extended by other two lines of study. First, the achievement gap can be decomposed into within- and between-school differences. Some recent studies in the U.S. found that a substantial racial

achievement gap increased with age but that most of the increase occurred within schools (Fryer & Levitt, 2004, 2005). On the other hand, narrowing within-school inequality explained most of the decline in the black-white achievement gap. For example, Page (2008) found that 40 percent of the narrowing of the white-black achievement gap through the 1970s and 1980s was attributable to the narrowing of within-school differences. Second, the study of school effect on student achievement has a long history both domestically and abroad. Buchmann and Hannum (2001) reviewed research on education and inequality and found that, contrary to the pattern of industrialized countries, school factors were more important determinant of children's academic achievement than family background in developing countries.

Public schools are expected not to eliminate, but rather to narrow the urban-migrant achievement gap. If public school teachers did not feel that they were responsible for and competent in dealing with the achievement gap, they might not even bother to try. Even when migrant students had a chance to study in a public school, a number of studies documented that some public school teachers had low expectations for migrant children, and they were not expected to learn as well as urban children (Lu & Zhang, 2001; Zhang, 2009). The solidified belief that low-income children are not likely to do well academically—what Richard Valencia (1998) called deficit thinking or what Angela Valenzuela (1999) called subtractive schooling—was pervasive among some educators, which in turn resulted in particularly negative consequences for disadvantaged students. Moreover, some studies revealed that some migrant students were intentionally treated differently than were urban students when they attended the same schools. For example, in Wuhan, migrant students were assigned to segregated classes, which consisted of 100

percent of migrant children because local parents were strongly opposed to bringing migrant children into their children's class. In addition, poor teachers were assigned to these migrant classes (Xinhua Daily Dispatch, 2006). In sum, the differential access to quality teachers and to the most challenging curriculum, low teacher expectation, discrimination and social marginalization might hinder public schools from overcoming the achievement gap between urban students and migrant students. Fully addressing these barriers to learning of migrant students studying in public schools is a challenging next step, which requires that policy makers, researchers and school administrators, and teachers work together and do their part to ensure the equal treatment for migrant students during the schooling process.

Issues of Statistical Power

Although the estimates of public school effect on change in achievement gap were not consistent in both grades, these results were subject to uncertainty regarding whether a significant school effect was present at grade 3. It is important to note that sample sizes, including the number of children sampled per school and the number of schools sampled, frequency of observation and duration of a longitudinal study, affect statistical power (Raudenbush, 1997; Raudenbush & Liu, 2000, 2001). In the present study, the small school sample size and shortened duration of the study might have inflated the standard errors of school type contrast, thus leading to an insignificant school effect at grade 3.

In school effect studies, a key consideration in designing multi-level studies of school effect is choosing the sample size (n), the number of students per school as well as J, the number of schools because both can affect the power to detect treatment effects (Raudenbush & Bryk, 2002). In this study, school type, the key explanatory variable, lies

at level 3 in the hierarchical models. The effect of J on power depends on the magnitude of variances within and between schools and on the cost of sampling at school level. Researchers often regarded cluster randomized designs with suspicion due to the lack of statistical precision. Walsh (1947) showed that if the variability between clusters is larger, the p-values based on conventional analyses will be biased. When the analysis is done correctly, the standard error of the treatment contrast typically depends more heavily on the number of clusters. On the one hand, there was large interschool variation on student achievement resulting from the fact that migrant students were typically nonrandomly selected into public schools or migrant schools. On the other hand, the limited number of licensed migrant schools and voluntary participation at the school sampling stage resulted in a small school sample size of 7 migrant schools. The number of public schools (n=12) in the sample was an order of magnitude larger than the number of migrant schools. Meanwhile, it was expensive to sample a large number of schools. Consequently, the standard errors of the school type estimates might tend to be higher than one might expect, given the variability across schools and the small number of schools in the sample (Braun et al., 2006).

In repeated-measures studies, the analogous sample sizes are T, the number of time points per person and *n*, the number of students. Increasing the size of students will help most when variation between students in their growth rates is large (Bryk & Raudenbush, 1992). In this study, the number of students within each school is large enough to reliably estimate growth parameters and relation between student growth and student level controls. However, the effect of adding more time points on statistical power is complicated. One can increase the number of time points T, by increasing the frequency

of observation per unit time (holding constant the duration of the study, D) or increasing the duration, D (holding constant the frequency). In this study, the frequency of observation once per year was changed to a frequency of observation twice per year. In other words, rather than reaping student academic scores at the end of each academic year, students took reading tests each term, or twice a year. The shortened duration will reduce the current study's leverage in estimating person-specific growth rates (Raudenbush & Bryk, 2002). If dependent variable, which is student's growth trajectory in the present study, is not measured perfectly, the measurement error does not bias the slope coefficient, but leads to larger standard errors. Raudenbush and Liu (2000) also showed that changing the duration or frequency changed the statistical power to detect treatment effect. Fortunately, the project of Panel Study on the Development of Migrant Children conducted an additional wave of data collection in November 2008. Therefore, the problem associated with shortened duration of the study can be addressed by incorporating the fourth-wave data in future studies.

CHAPTER Ⅵ

Conclusion and Policy Recommendations

Conclusion

The present study was designed to investigate the extent to which student and school characteristics related to the magnitude of urban-migrant achievement gap and the pattern of achievement gap change for migrant students attending public schools or migrant schools. The study was facilitated by the use of three-level hierarchical growth models to estimate the growth trajectories of grade 3 and grade 5 migrant students in a large southwestern Beijing school district. Random effect results indicated that schools differed significantly in mean initial reading achievement level and mean growth rate. Results also indicated that the variation within schools was greater than the variation between schools on initial status. However, almost all variation in growth rates was attributable to between-school heterogeneity.

Fixed effect results revealed that the differences in initial reading achievement levels were not significant between migrant students studying in different types of schools, although migrant students studying in migrant schools consistently had the lowest initial status. On the other hand, examination of relationship between the school type and student growth rate revealed mixed evidence across grades. The achievement gaps between migrant students studying in migrant schools and both groups of public school students expanded at both grades. Moreover, the expansion of achievement gap was significant at grade 5, but not at grade 3. In addition, migrant students studying in public

schools demonstrated comparable growth trajectories in reading achievement with those of their urban peers at both grades.

Policy Recommendations

The results from this study might inform policymakers about measures that might be taken to develop effective policies and high-quality programs for migrant children. The most important step that the Chinese government might take is to substantially increase the allocation of government funds to education. The central government has promulgated a wide range of laws, regulations and directives to ensure the equal access to education for migrant children. Nevertheless, the local governments are almost entirely responsible for funding local schools in order to accommodate migrant children. As a result, many of these initiatives are not implemented fully at the local level. More equitable funding allocated to migrant children might be necessary in order to create a context in which the public school system could increase equity. Compulsory education is both compulsory and national education, and the central government is obligated to take more responsibilities for providing equal educational opportunities for all migrant children (Han, 2004). Government investment needs to increase considerably to support the education sector. Expanding the government budget on education can have a positive influence on the Chinese economy because the rate of economic return on education is extremely high (Heckman, 2005). Fortunately, in May of 2010, the Chinese government approved final version of the Medium and Long-term National Educational Reform and Development Plan (2010-2020), which promised to prioritize the development of education while ensuring fairness in the system. According to the plan, the ratio of

government's education expenditure in terms of gross domestic product (GDP) will reach to 4 percent by 2012 (China Daily, 2010).

A second recommendation is that public schools eliminate discrimination against migrant children in all aspects of schooling. At first, migrant children should be allowed to study in public schools near to their place of residence. In addition, the principals and teachers promote diversity and tolerance within public schools in order to eliminate discrimination against migrant children and prevent the potential resistance from migrant children toward urban children (Chen et al., 2006). Results from Table 4.13 indicated a slightly negative Type B effect for public schools, suggesting that migrant students might not be treated effectively during the instructional process. In addition to establishing an equitable school climate, school administrators in public schools might want to assure that public school teachers are equipped with adequate knowledge and skills to adapt teaching content and approaches to special learning needs of migrant children since migrant children have distinctive characteristics and cultural background. Therefore, professional development opportunities, which provide teachers with theoretical models, knowledge of principles of differentiated instruction are crucial for teachers in order to learn how to effectively educate the increasingly diverse student population without sacrificing the quality of instruction overall. Finally, results from the four three-level hierarchical models shown that the achievement gaps between urban students and migrant students studying in public schools were not narrowed. In order to catch up with their urban peers, remedial classes might be made available to help migrant students achieve the same academic standards as their urban peers.

Even though migrant students have more equal access to pubic school nowadays,

increasingly, people are realizing that public school can not accommodate all migrant children, particularly in cities with a high concentration of migrant workers. For example, the average class size in one district of Zhengzhou increased in one year to 72 students, and in some schools the class size exceeded 100 after the municipal government abolished temporary student fees in 2006 (Henan Commercial Daily, 2008). On the other hand, there are few studies that project the future influx of migrant children and the number of possible surplus spaces for migrant students in public schools. Without accurate information regarding the supply and demand of the urban education system, the municipal authorities can not plan ahead to provide equal access to compulsory education for all migrant children (Chen et al., 2006).

The majority of migrant parents have a high expectation for their child's educational attainment. Migrant parents may also choose to send their child to migrant schools due to a practical concern about secondary and higher education. China's compulsory education ends after ninth grade. According to Ministry of Education, all students must take high school entrance exam and college entrance exam in their place of permanent residence. As such, most migrant students have to return to their hometowns to study in high school. However, different provinces have their own entrance exam based on different curriculum. These returning migrant students are likely to be disadvantaged because the differences with curriculum content, teaching practices and changes in standards might cause acute educational disruptions. In contrast, many migrant schools use teachers, or teaching materials and even school systems from the place of origin of the migrants (HRIC, 2002). With concern about the curriculum compatibility, many parents may decide to choose migrant schools.

The declining growth trajectories for migrant students studying in migrant schools revealed in this study were also noticeable. However, these results are inappropriate to be used to discredit or sanction migrant schools; rather, they suggest that the government needs to take steps to ensure comparability in resources between migrant schools and public schools, by means of providing the lowest-performing migrant schools with more support they desire to made progress over time. Inadequate funding and resources are a major challenge or many migrant schools. Currently government funding towards migrant schools is fairly limited. For example, Beijing government is subsidizing privately-run migrant schools. However the subsidies are small (about 80 yuan per student per semester) and are limited to schools approved by the government (CLB, 2009). The equal funding for migrant schools might be crucial for the continuous school improvement. Local government subsidies for migrant schools should be included in the city's annual budget, and should be sufficient to cover all of the students' costs. Ideally, education migrant children received are indeed compulsory and free, and the teachers of migrant schools are as capable as their colleagues in urban schools.

Despite their appeal to migrant families, the privately-run migrant schools are primarily led by all kinds of entrepreneurs. With the absence of supervision of school finance, there is the likelihood that unscrupulous school operators might appropriate government subsidies in order to maximize the profit at the expense of school quality. Some researchers advocate turning the privately-run migrant schools into something more akin to the charter school model in the United States—with greater public funding and oversight (Carr, 2007). Narada Foundation is a private foundation aiming to provide migrant children, who typically experience financial and social barriers to public

education, with equal opportunities to enter qualified schools through the New Citizen School Project. Rather than government- and privately-run schools, Narada Foundation is exploring an innovative school-running approach, NGO-run school, which is funded by the society, subsidized by the government, and managed by the non-government sector. The Narada Foundation has set up three New Citizen Schools in Beijing, and plans to establish 100 New Citizen Schools in the next decade.

Future Directions

A further line of inquiry might focus on heterogeneous school effects on achievement of migrant children; of particular importance is whether public schools improve the performance of low-achieving migrant students. As is well known in the causal inference literature, there are actually two types of selection bias in observational data, pre-treatment heterogeneity bias and treatment-effect heterogeneity bias (Morgan & Winship, 2007). In this study, the first type refers to individual attributes such as educational expectation that may be positively associated with the likelihood of enrolling in a public school. The second type suggests that public school attendance means different treatments for different migrant students. It would be a misconception to assume that the impact of public school attendance on achievement is identical across different migrant students. Although lower achieving students have been shown to gain the most as quality of education increases (Sanders & Rivers, 1996), low-achieving migrant children in China might be left further behind if they move to public schools. My concern stems from the fact that whole class instruction is still the dominant approach to instruction in China; therefore, migrant children might face tremendous difficulties with class

participation. In addition, public school teachers are less likely to engage each migrant student to ensure that their learning needs are met.

Future research might also investigate whether public schools make education more equitable and effective for migrant students at the expense of urban students. Desegregation of schools was often the catalyst for white flight in 1950s in the U.S.. When some public schools tried to integrate migrant children into local children's class, the mobility rate of local students just rose. Local parents had serious concerns about the detrimental effects of increased class size, diluted school recourses, and interrupted classroom instruction on their child's learning. A useful next step would show whether test scores of local students suffer from a mixed class.

English, math, reading (Chinese Language Arts) are categorized as core subjects in China. Therefore, taking into consideration of migrant students' performance in these three core subjects and other optional subjects would lead to a thorough understanding of how different types of schools influence academic achievement of migrant children. In the further study, I will examine the school effect on math achievement gap since students in this sample took both reading and math tests during each wave of data collection. For mathematics, migrant children outperformed even urban children in some studies (Liu, 2009). I speculate that the school effects might vary across subjects.

At the present study, no school-related factors other than aggregated student-level data were included, which made it impossible to credibly and specifically explicate how school recourses and teacher practices contributed to widening or narrowing of achievement gaps. Recent studies examining relationships between teacher characteristics and teaching practices and student growth in achievement have consistently identified the

influence of teachers as one of the most important factors in promoting student achievement progress (Hanushek, Kain, & Rivkin, 1998; Rowan et al., 2002; Wright, Horn, & Sanders, 1997). Although research has demonstrated that some schools in disadvantaged neighborhoods performed above expectations (Kannapel, Clements, Taylor, & Hibpshman, 2005; The Education Trust, 1999), Levin (2004) summarized US evidence and noted, "Sustained improvement over time in high-poverty schools is rare, despite claims by studies of exceptional schools (p. 47)." Therefore, the more interesting and formidable challenge is to determine the factors that lead to improved school effectiveness and to replicate these factors for many students across schools, by improving the performance of many average teachers and administrators (Ferguson, 1998). Further research that better measures the complex and dynamic nature of schools would deepen our understanding of the characteristics and processes of effective schools and identify effective teaching practices that promote growth in achievement for migrant students.

APPENDICES

Appendix A

Figure 3.3: Kernel Density Plots of Distributions of Baseline Reading Achievement for Migrant Students by Grade

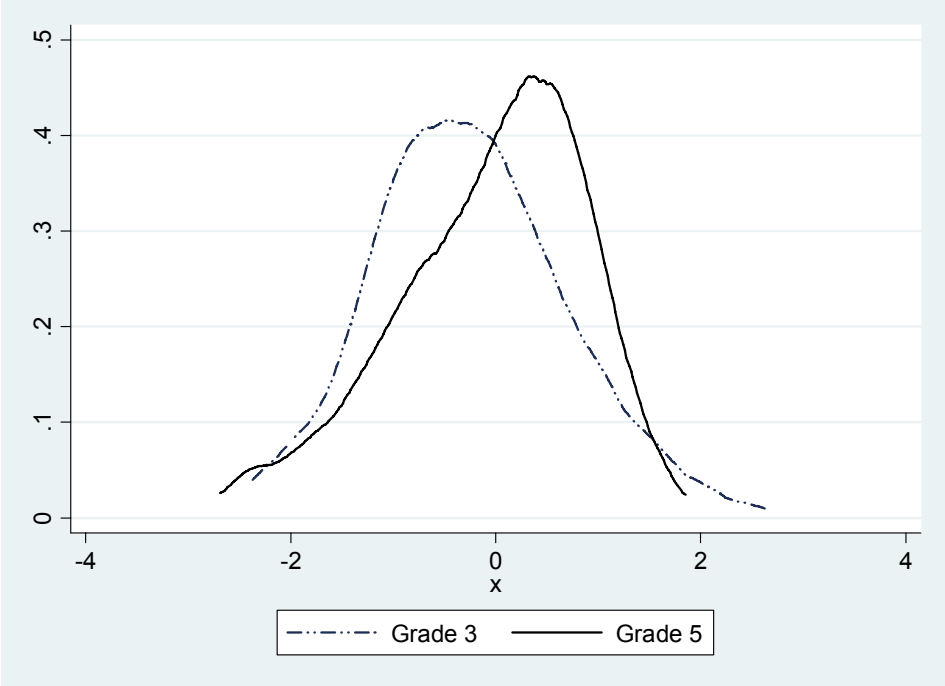


Figure 3.4: Kernel Density Plots of Distributions of Baseline Reading Achievement for Grade 3 Students by Group Membership

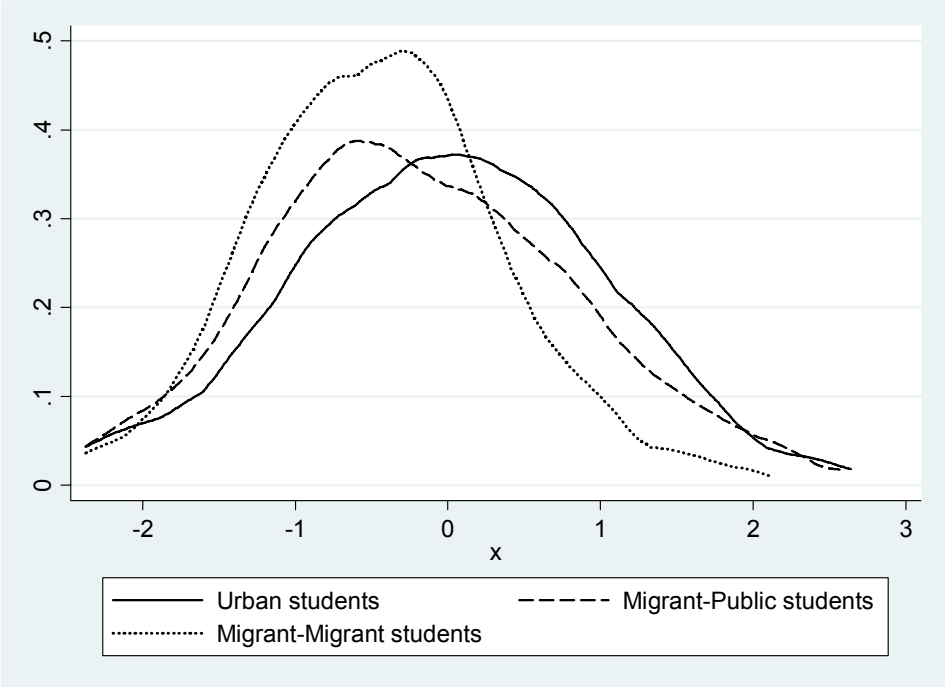
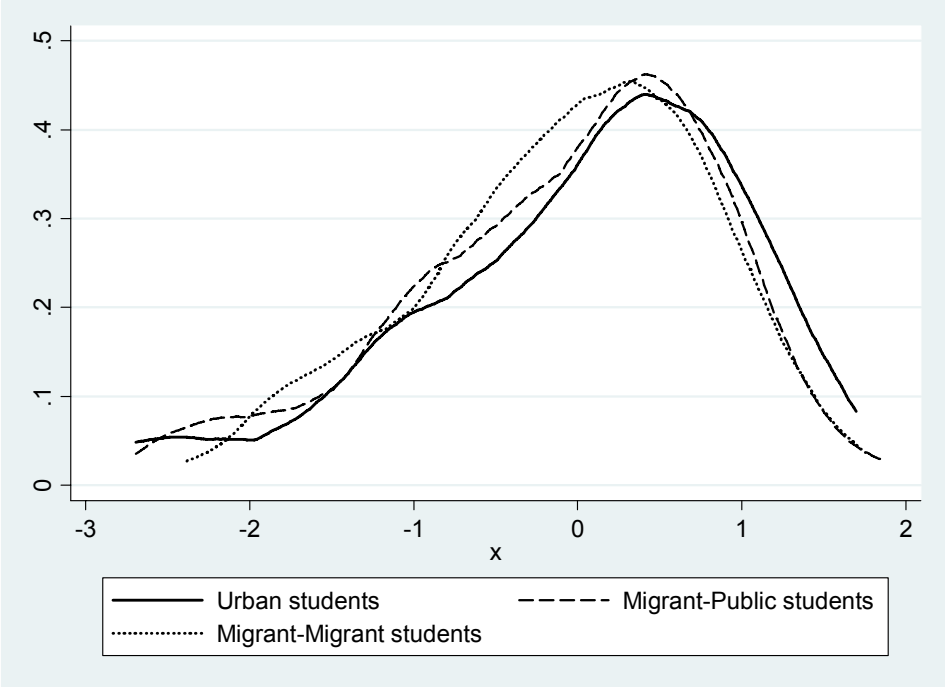


Figure 3.5: Kernel Density Plots of Distributions of Baseline Reading Achievement for Grade 5 Students by Group Membership



Appendix B

Table 4.1: Descriptive Statistics for Student Measures of Grade 3

Variable	urban students	migrant-public	migrant-migrant	p-value*	p-value**
Child demographics					
gender: male	.55(.50)	.55(.50)	.56(.50)	.966	.934
age in years	8.42(.59)	8.45(.73)	8.68(.92)	.000	.000
Human and financial capital					
SES	.95(1.15)	-.02(.86)	-.34(.71)	.000	.000
student buy books	.59(.49)	.33(.47)	.23(.42)	.000	.005
student speak mandarin well	.91(.28)	.85(.36)	.74(.44)	.000	.001
Social capital: family					
only-child	.74(.44)	.35(.48)	.12(.33)	.000	.000
student live with parents	.96(.19)	.95(.21)	.92(.28)	.031	.044
parental expectation	.98(.16)	.95(.22)	.87(.33)	.000	.001
parental involvement	.80(.63)	.18(.78)	-.21(.78)	.000	.000
parental satisfaction	.12(.95)	-.07(.87)	-.23(.79)	.000	.012
Social capital: school					
teacher and peer relationship	.21(.85)	.12(.83)	-.06(.88)	.001	.006
student school attachment	.69(.46)	.82(.39)	.73(.44)	.006	.008
Social capital: community					
live in a urban community	.80(.40)	.40(.49)	.35(.48)	.000	.172
Student as individual agent					
student education expectation	.94(.24)	.94(.24)	.85(.35)	.000	.000
student finish homework	.86(.35)	.77(.42)	.75(.43)	.013	.506
n	163	265	484		

Notes:
1. Standard deviations are presented in parentheses.
2. p-value* is calculated from one-way ANOVA for testing whether there are significant difference among urban students, migrant-public students and migrant-migrant students.
3. p-value** is calculated from t-test for testing whether there are significant difference between migrant-public students and migrant-migrant students.

Table 4.2: Descriptive Statistics for Student Measures of Grade 5

Variable	urban students	migrant-public	migrant-migrant	p-value*	p-value**
Child demographics					
gender: male	.47(.50)	.56(.50)	.56(.50)	.092	.964
age in years	10.3(.61)	10.6(.77)	10.9(.93)	.000	.001
Human and financial capital					
SES	1.03(1.04)	-.12(.78)	-.40(.73)	.000	.000
student buy books	.67(.47)	.47(.50)	.26(.44)	.000	.000
student speak mandarin well	.94(.24)	.87(.33)	.65(.48)	.000	.000
Social capital: family					
only-child	.81(.39)	.30(.46)	.13(.34)	.000	.000
student live with parents	.94(.24)	.97(.18)	.94(.23)	.371	.189
parental expectation	.94(.25)	.92(.26)	.85(.36)	.001	.006
parental involvement	.41(.71)	-.21(.84)	-.56(.80)	.000	.000
parental satisfaction	.23(.96)	.08(.86)	-.16(.84)	.000	.000
Social capital: school					
teacher and peer relationship	.10(.86)	.07(.82)	-.24(.82)	.000	.000
student school attachment	.63(.48)	.72(.45)	.65(.48)	.091	.050
Social capital: community					
live in a urban community	.85(.36)	.40(.49)	.22(.41)	.000	.000
Student as individual agent					
student education expectation	.95(.23)	.95(.22)	.84(.37)	.000	.000
student finish homework	.85(.36)	.87(.33)	.73(.45)	.000	.000
n	188	239	446		

Notes:
1. Standard deviations are presented in parentheses.
2. p-value* is calculated from one-way ANOVA for testing whether there are significant difference among urban students, migrant-public students and migrant-migrant students.
3. p-value** is calculated from t-test for testing whether there are significant difference between migrant-public students and migrant-migrant students.

Table 4.3: Descriptive Statistics for School Measures of Grade 3

Variable	*migrant school*	*SD*	*public school*	*SD*	*p-value*
% of migrant students	1.00	.00	.59	.31	.003
% of male students	.55	.04	.55	.09	.900
% of mobility students	.33	.12	.06	.05	.000
mean class SES	-.38	.15	.42	.80	.019
mean class prior achievement	-.47	.37	-.13	.40	.085
n	7		12		

Table 4.4: Descriptive Statistics for School Measures of Grade 5

Variable	*migrant school*	*SD*	*public school*	*SD*	*p-value*
% of migrant students	1.00	.00	.54	.31	.001
% of male students	.55	.04	.52	.09	.365
% of mobility students	.25	.11	.04	.03	.000
mean class SES	-.45	.17	.41	.72	.007
mean class prior achievement	-.11	.22	-.10	.38	.576
n	7		12		

Appendix C

Figure 4.1: Observed Growth in Reading Achievement for Grade 3

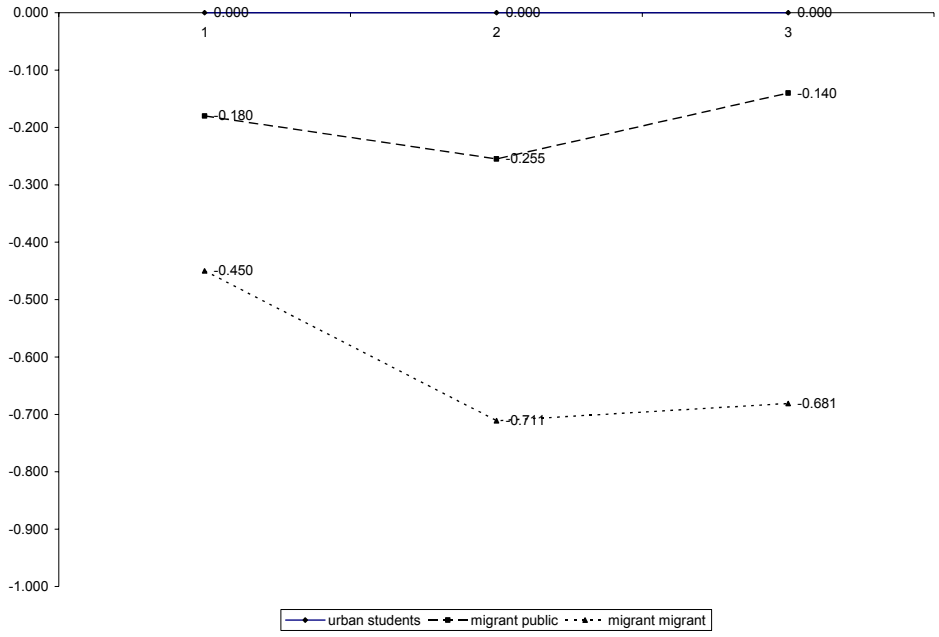
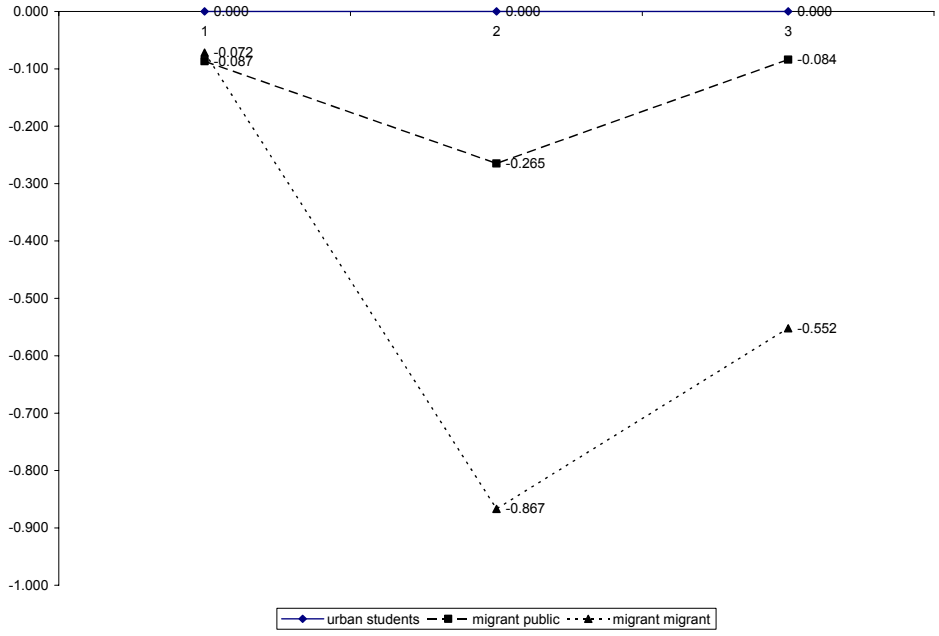


Figure 4.2: Observed Growth in Reading Achievement for Grade **5**



Appendix D

Table 4.7: Average Reading Achievement of Grade 3 Migrant Students by Missing Data Patter

	Average Reading Achievement			*% public*
Response Pattern	*wave 1*	*wave 2*	*wave 3*	*school*
All three waves	-0.15	-0.24	-0.16	1.00
All three waves	-0.43	-0.82	-0.57	0.00
Wave 1 & 2	-0.51	-0.55		0.40
Wave 2 & 3		-0.37	-0.53	0.44
Wave 1 only	-0.42			0.33
Wave 2 only		-0.90		0.00
Wave 3 only			-0.67	0.35

Table 4.8: Average Reading Achievement of Grade 5 Migrant Students by Missing Data Pattern

	Average Reading Achievement			*% public*
Response Pattern	*wave 1*	*wave 2*	*wave 3*	*school*
All three waves	-0.03	-0.21	-0.13	1.00
All three waves	0.02	-0.79	-0.67	0.00
Wave 1 & 2	-0.23	-0.75		0.33
Wave 2 & 3		-0.88	-0.16	0.11
Wave 1 only	-0.20			0.25
Wave 2 only		-1.19		0.00
Wave 3 only			-0.62	0.09

Appendix E

Table 4.9: School-by-School Descriptive Results for Grade 3

School code	Public school	% migrant children	Class mean SES	Class mean baseline scores	Migrant mean baseline score
57	0	100%	-0.40	-0.63	-0.63
52	0	100%	-0.29	-0.44	-0.44
54	0	100%	-0.30	-0.89	-0.89
56	0	100%	-0.54	-0.87	-0.87
3	1	100%	-0.13	-0.01	-0.01
55	0	100%	-0.53	-0.14	-0.14
51	0	100%	-0.27	-0.41	-0.41
53	0	100%	-0.19	0.10	0.10
2	1	94%	-0.25	-0.37	-0.42
11	1	84%	-0.59	-0.81	-0.78
12	1	82%	0.01	-0.13	-0.02
6	1	77%	0.43	0.49	0.64
4	1	62%	0.23	-0.18	-0.19
10	1	61%	0.32	-0.66	-0.64
1	1	58%	-0.18	-0.29	-0.15
5	1	34%	0.92	0.07	0.00
7	1	31%	0.61	-0.11	-0.44
9	1	15%	1.35	0.60	0.78
8	1	8%	2.32	-0.13	-1.76

Table 4.10: School-by-School Descriptive Results for Grade 5

School code	Public school	% migrant children	Class mean SES	Class mean baseline scores	Migrant mean baseline score
56	0	100%	-0.75	-0.29	-0.29
53	0	100%	-0.57	-0.02	-0.02
51	0	100%	-0.43	-0.28	-0.28
55	0	100%	-0.40	-0.12	-0.12
52	0	100%	-0.39	0.35	0.35
54	0	100%	-0.31	-0.20	-0.20
57	0	100%	-0.28	-0.15	-0.15
3	1	97%	-0.31	-0.16	-0.17
11	1	91%	-0.42	-0.76	-0.72
2	1	86%	-0.17	-0.36	-0.23
6	1	72%	0.25	0.33	0.58
12	1	69%	-0.36	0.20	0.16
4	1	68%	0.30	0.00	0.03
1	1	58%	0.14	0.20	0.17
10	1	38%	0.38	-0.21	-0.12
5	1	29%	1.18	0.51	0.73
8	1	21%	1.69	-0.01	-0.41
7	1	17%	0.84	-0.37	-0.10
9	1	8%	1.45	0.51	0.77

Appendix F

Table 4.11: Descriptive Statistics of Variables Used Only in Propensity Score Model

variable	*range*	*migrant-public*	*migrant-migrant*	*p-value*
student: born in Beijing	(0,1)	.24	.18	.009
student: love Beijing and Beijing local people	(-4.5, 1.1)	.04	-.24	.000
student: having studying room	(0,1)	.71	.52	.000
student: transportation time	(10,90)	19	20	.042
student: after-class tutoring	(0,1)	.37	.14	.000
student: child-parent relation	(1,6)	2.1	1.6	.000
student: satisfaction with achievement	(-3.2,2.1),	-.01	-.08	.155
Parent: non-agriculture hukou	(0,1)	.18	.09	.000
parent: educational expenditure	(-2.3,2.3)	-.05	-.23	.000
parent: hard to find a suitable school	(1,5)	3.5	3.7	.000
parent: satisfaction with current school	(1,5)	3.7	3.3	.000
parent: the quality of public school is high	(1,5)	3.8	3.7	.140
parent: knowing the policy of tuition waive	(0,1)	.39	.26	.000
parent: education is important for future success	(0,1)	.77	.78	.913

Appendix G

Table 4.12: Propensity Score Models for Migrant Children Attending Public Schools by Grade

Predictors	*Grade 3*	*Grade5*
SES	.201	.056
Male	.188	.193
Age	-.321*	-.177
Only-child	.699**	.187
Born in Beijing	.434$^{\sim}$	.266
Love Beijing	-.137	.441**
Teacher-peer relation	-.029	-.002
Live with two parents	.902$^{\sim}$	1.02
Studying room	.359	.681**
Speak Mandarin well	.154	.775**
Student educational expectation	.666$^{\sim}$	.498
Child parent interaction	.086	.236*
Finish homework	-.227	.491
Student like school	.324$^{\sim}$	.425*
Live in local community	-.170	.555*
Transportation time	-.005	-.029**
Tutoring after class	.762$^{\sim}$	1.73***
Parent non-agricultural hukou	.274	.358
Parent educational expenditure	-.543***	-.313$^{\sim}$
Parent involvement	.391**	.140
Parent educational expectation	.574	-.101
Parent hard to find public school	-.142	-.287*
Parent satisfaction with school	1.119***	.677***
Student satisfaction with achievement	-.424***	-.818***
parent satisfaction with achievement	-.232	.059
Student: buy book	.175	.126
Parent: Beijing public school is high-quality	-.167	.151
Parent: know the policy	.193	.151
Parent: education is important	.367$^{\sim}$	-.011
Baseline reading achievement	.010	-.007
constant	-6.18***	-8.21***
N	526	511
Pseudo R^2	.240	.333

Note: Outcome was coded as 1 if a migrant student attended public school and 0 otherwise.

$\sim p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Appendix H

Figure 4.5: Histogram of Propensity Scores for Grade 3 Migrant Students

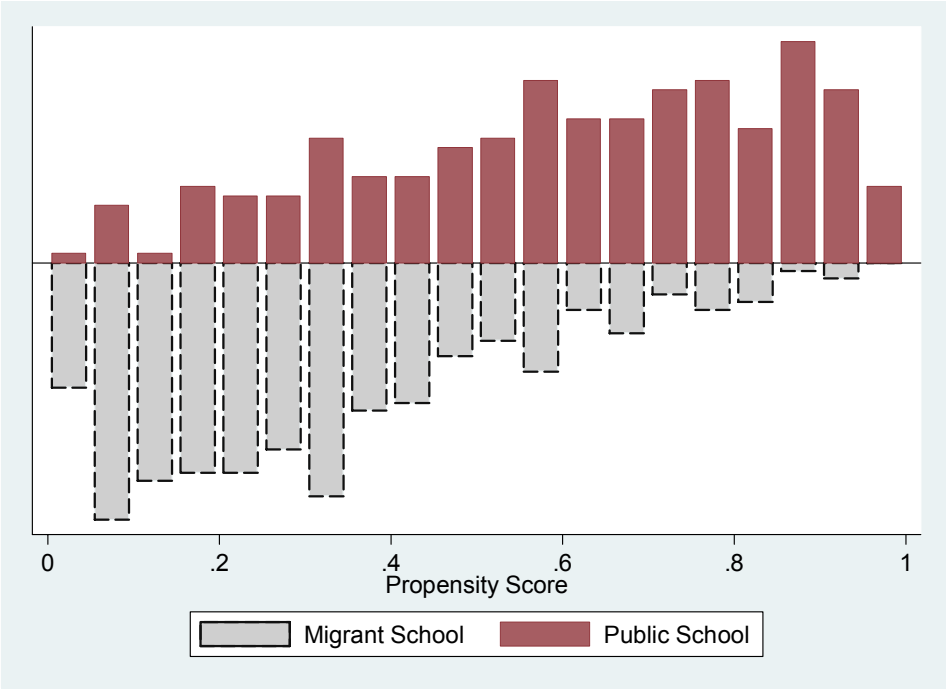
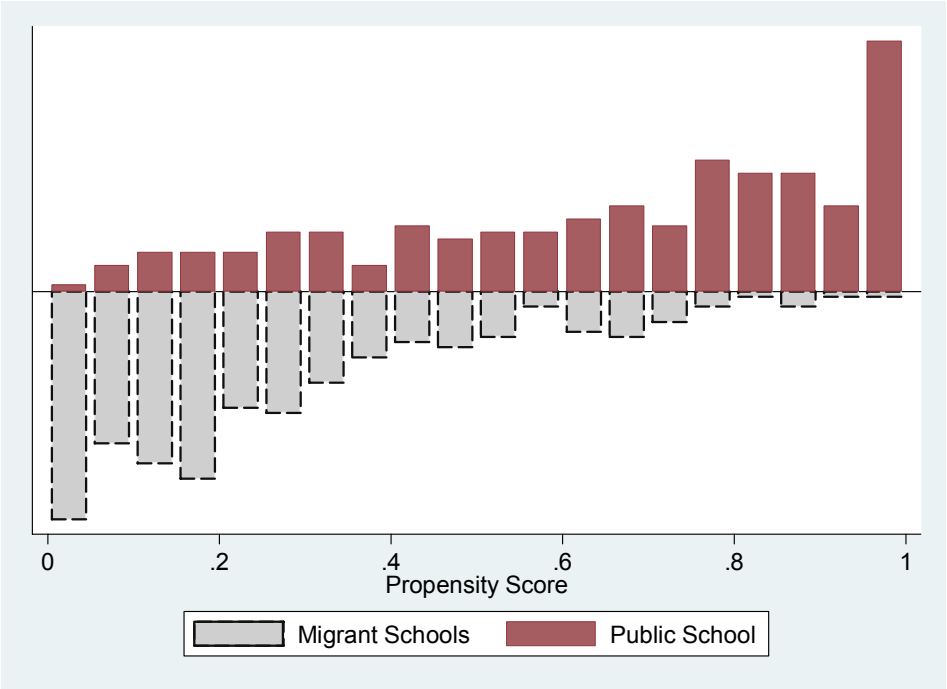


Figure 4.6: Histogram of Propensity Scores for Grade 5 Migrant Students



Appendix I

Figure 5.1: Kernel Density Plots of Distributions of Reading Achievement for Grade 5 Students by Waves

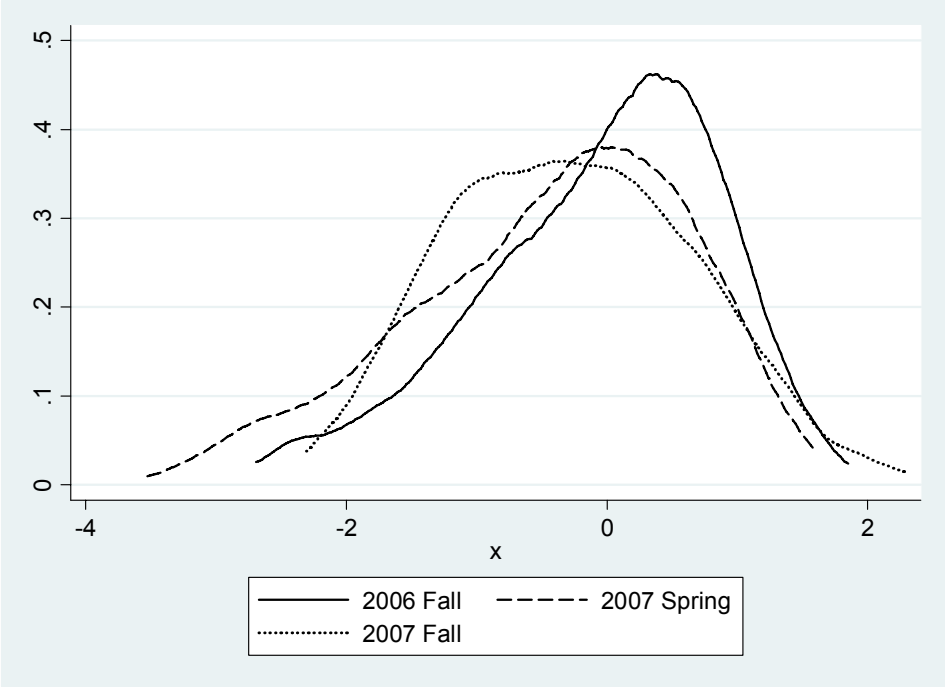
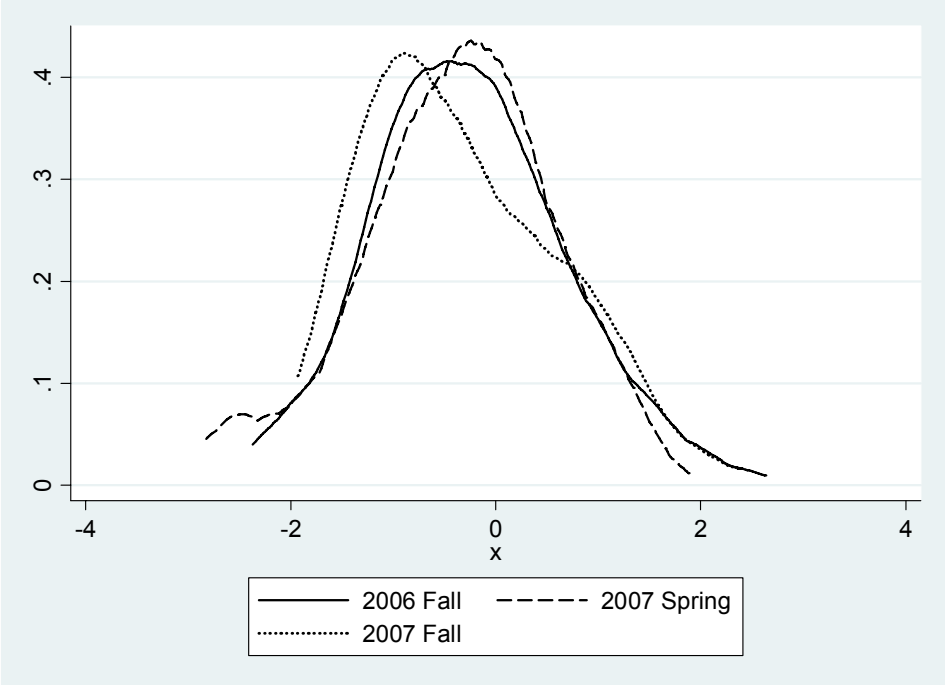


Figure 5.2: Kernel Density Plots of Distributions of Reading Achievement for Grade 3 Students by Waves



Appendix J

Table 5.1: Descriptive Statistics for Measures of Migrant Students by Grade

Variable	*Grade 3*	*Grade 5*	*p-value*
Child characteristics			
gender: male	.56(.50)	.56(.50)	.972
age in years	8.6(.87)	10.8(.89)	.000
Human and financial capital			
SES	-.22(.78)	-.30(.76)	.046
student buy books	.27(.44)	.33(.47)	.008
student speak mandarin well	.78(.42)	.73(.44)	.038
Social capital: family			
only-child	.20(.40)	.19(.39)	.627
student live with parents	.93(.26)	.95(.21)	.072
parental expectation	.90(.30)	.88(.33)	.176
parental involvement	-.07(.80)	-.44(.83)	.000
parental satisfaction	-.17(.82)	-.08(.86)	.038
Social capital: school			
teacher and peer relationship	.01(.87)	-.14(.84)	.002
student school attachment	.76(.43)	.67(.47)	.000
Social capital: community			
live in a urban community	.37(.48)	.28(.45)	.000
Student as individual agent			
student education expectation	.88(.32)	.88(.33)	.644
student finish homework	.76(.43)	.78(.42)	.316

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