Migration and Education Attainment: A Case Study of Migrant Workers' Children in China

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Abstract

Institutional barriers in accessing public education force many domestic migrant workers in China to choose between migrating with or without their children. I examine whether recent policy reforms that opened up high school enrollment to non-local residents motivate any changes in the migration status of migrant workers' children. I find a significant positive relationship between the reduction of barriers to high school education and children's migration with migrant worker parents. One additional year of policy reform increases the chance of children migrating with parents by 3.7 percentage points, with the largest effect on primary and middle school-aged boys. I find that children's academic performance prior to the policy enactment does not play a significant role in determining their migration status, suggesting that the policy-induced migration is not positively selected based on previous schooling achievements.

Additionally, I investigate how children's migration status impacts their education outcomes. I exploit the cross-province variations in the timing of the policy announcement to instrument for children's migration status. While children's math test scores see significant improvement as a result of migration, I do not find that children's migration has a statistically significant impact on other schooling outcomes such as the reading test scores, dropout rate, and high school enrollment. Despite having induced more children to migrate with parents, the policy change failed to improve children's education persistence, suggesting that policymakers need to pay more attention to the quality of schooling and other barriers to enrollment such as capacity constraints in the expansion of access to secondary education for non-local residents.

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1. Introduction

"I advise you not to entertain any blind faith in the Chinese educational system. Do not regard it as a good system. Any drastic change is difficult, as many people would oppose it."

—Mao Zedong[1]

For decades, local governments in China were only responsible for providing social services, including public education, to those with permanent local registered residency, *hukou*.[2] This meant that domestic migrants who left home for better employment opportunities in the cities could not enroll their children in public schools in migration destinations. As a result, domestic migrant workers in China had to choose between leaving their children at home or migrating with them and sending their children to private schools that were of much poorer quality. Starting from the early 2000s, the central government demanded local governments provide migrant children access to primary and secondary public education.[3] However, opening up primary and middle school access to migrant children did little to mitigate the left-behind children issue. Even though children could theoretically attend public primary and middle schools in host cities, since quality public schools were competitive to get in and high school enrollment was only open to local *hukou* holders, many migrant workers still chose to leave their children behind. As a result, 69 million children were left behind at home and only 34 million children traveled along with their migrant parents in 2015, together constituting 30% of the total population of children in China (UNICEF, 2015).

With growing public attention on tragedies caused by migrant family separation,[4] both the central government and regional administrations began to address institutional barriers to high school education to encourage migrant family reunification. Starting from the mid-2000s,

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[1] *On Education--Conversation With The Nepalese Delegation Of Educationists*, 1964

[2] The residency registration is usually one's birth county with either an urban or rural designation.

[3] *Compulsory Education Law* (2006 Revision)*, Decision of the State Council on Education Reform and Development*, *National Education Ministry's Guidelines for Providing Compulsory Education to Children of Rural Migrant Workers*, *Guidelines on Further Promoting the Balanced Development of Compulsory Education*

[4] China Youth Daily reports that between 2010 to 2015, there are 206 cases of sexual violence, suicide, homicide committed by or experienced by left-behind children. There were around 33 similar cases from 2006 to 2010.

provinces opened up enrollment to academic and vocational high schools for non-local *hukou* holders. This policy change sparked much anxiety among local residents who feared that the reform would lead to an overcrowding of migrant children and fierce competition for educational resources.[5] However, it is unclear to what extent migrant workers' children are actually responding to and benefiting from this policy reform. In some regions, the reform is incomplete: megacities such as Beijing and Shanghai only opened vocational-technical schools to migrant children to control population inflow (Wang, 2019). Some provinces require enrollment in middle school in migration destinations for at least a year as a prerequisite for high school enrollment. Under the partial or conditional nature of the reform, whether migrant worker parents are motivated to migrate with their children due to the reforms remains unclear.

The current literature on the linkage between migration and education rarely looks at the causal mechanism of education policy changes and tends to focus on early-stage education such as primary and middle schools. As enrollment in and completion of primary and middle schools becomes close to universal nationwide, more and more migrant children express interest in pursuing higher education in migration destinations.[6] In 2010, the net enrollment rate in primary school reached 99.7%, and the gross enrollment rate for middle school reached 100.1% (Ministry of Education, 2010).[7] The completion rate for 9-year-compulsory education[8] reached 93.8% in

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[5] A survey conducted in nine cities finds that 29.4% of local high school students' parents and 19.1% of the local middle school students' parents "strongly oppose" the policy change (Zhu and Wu, 2016).

[6] A survey of migrant children finds that about 80.1% of middle-school-aged children want to continue into upper secondary education at migration destination and about 40% want to continue on to tertiary education (Zhu and Wu, 2016).

[7] The net enrollment rate is defined as percentage of children of official primary school age who are enrolled to the total number of children of official primary school age, adjusted by regional differences in schooling systems. The gross enrollment is defined as the ratio of number of students enrolled in middle school to the total number of children of official middle school age. Because there are over-age and under-age enrollment in schools, gross enrollment may exceed 100%.

[8] *Compulsory Education Law* stipulates that all children aged 6 should receive 9 years of free and compulsory education, which include 6 years of primary education and 3 years of middle school education.

2017 (Ministry of Education). It is thus appropriate to shift our attention to how children of migrant workers can access upper secondary education in migration destinations.

Despite the gradual improvement in migrant children's access to education, migrant workers still face a dilemma: in leaving their children behind, they can send home more remittances to invest in their children's education; in bringing their children along in migration, they can supervise their children's education but access to high-quality public schools in migration destinations is not guaranteed. Which is the better option? Regional inequality in educational resources along with institutional barriers to schooling in the cities, both inextricably linked to *hukou*, leave migrant workers with no good choice: empirical studies find negative effects on children's educational attainment both when they are left behind and when they migrate with parents. An overwhelming number of studies find that parental migration has adverse effects on left-behind children's school attendance and enrollment (Meyerhoefer et al.,2011; Hu, 2012; Lu et al.,2016), and the effects are particularly detrimental to girls' education (Brown and Park, 2002; Meyerhoefer et al., 2011). For children who migrate with parents, studies find that they are less likely to enroll in schools than their counterparts who stay behind (Wu and Zhang, 2015), and they face significant obstacles in accessing public education, especially on the east coast (Liang et al., 2019).

This thesis investigates the effect of providing access to urban high schools for migrant children on migrant workers' decisions regarding their children's migration status as well as the effect of children's migration on their schooling outcomes. I use an instrumental variables approach and exploit the varying timing of policy announcements across provinces for identification. The assumption is that policy change has reduced the cost of migration with children because migrant parents no longer need to worry about relocating children post-compulsory

education.[9] This may induce some migrant worker parents who otherwise would have not moved with children to now migrate with them.

I find a significant increase in children's migration with migrant parents as a result of the policy changes: an additional year of policy reform increases the chance of children migrating with parents by 3.7 percentage points. There is significant gender disparity in the migration patterns: the positive effects of the policy on migration are mainly driven by migrant families with primary school and middle school-aged boys. For girls, the policy only has effects if they are high school-aged. This is likely a result of rural families' preference for sons' educations. Fathers' education backgrounds are major determinants in girls' migration status but have no significant impact on boys' migration status. Contrary to the existing literature, while the number of siblings has a significant negative relationship with migration for boys, it does not impact girls' migration status. Children's academic achievement before the policy reform does not impact their migration status, suggesting that positive selection of migration is not a major concern.

Regarding academic outcomes, children's migration significantly improves performance on math tests by 1.07 standard deviations, and the effect is even larger for girls at 1.17 standard deviations. However, I do not find that migration has a statistically significant impact on children's reading test scores or their persistence in schooling. In particular, migration has no significant impact on children's high school enrollment or years of schooling attended. This is a surprising result given that the policy is designed to improve high school access and encourage additional education beyond the primary and middle school level.

Given the null effect of policy reform on migrant children's education attainment, policymakers should consider whether the reform has truly opened up access to high schools. The

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[9] Prior to the policy change, migrant children could attend primary and middle schools at host cities but if they wanted to continue into high school education, they had to transfer back to their *hukou* origins.

results suggest that school-aged children indeed responded to the policy reform. They migrated with parents and saw improvement in academic performance, but in the end, failed to continue into high school. This result indicates that although the institutional barriers have been reduced, this policy reform alone is insufficient in improving the duration of migrant children's education, and additional efforts should be made to reduce non-legislative barriers to high school education.

The paper proceeds as follows. In the next section, I provide background on the institutional barriers to education that migrant children face and detail recent policy changes that remediate this lack of access. I next review the current literature, introduce the data source used for analysis, and provide descriptive evidence on children's education attainment and gendered patterns in migration. Section 5 presents the empirical strategy. In sections 6 and 7, I present results and robustness checks. I discuss the policy implications and limitations in section 8. Section 9 concludes.

2. Policy Background

Established in 1958, *hukou* was set up to control internal migration and ensure agricultural production in the Great Leap Forward movement. The "reform and opening" in 1979 generated an increasing demand for labor in the cities and led to the loosening of migration controls. However, migrants still could not access public services in the cities, including public education. For instance, even though the *Compulsory Education Law* issued in 1986 mandates 9-year compulsory education for school-age children, the implementation was far from complete even until the early 2000s in rural regions and for migrant children (Tang et al., 2019; Goodburn, 2009). This is because the law only specified local governments' responsibilities over local *hukou* holders (Article 9). The unequal access to education was further exacerbated as *The Rules for Implementing the Compulsory Education Law* published in 1992 specifies that "temporary

students", school-age children receiving education outside of their *hukou* residency, can enroll in public schools if they obtain approval documents from both the *hukou* origin government and local government at the migration destination (Article 14). Furthermore, schools that accept temporary students may charge the students a "temporary schooling fee" for education that would be free to local students. A study conducted in 2002 in nine cities shows that the annual temporary schooling fees ranged from 400 yuan to over 2000 yuan (He & Li, 2007). This was an overbearing financial burden for most migrant families given that the average annual income in 2002 was 7703 yuan for urban residents and 2476 yuan for rural residents (National Bureau of Statistics, 2002).

The bureaucratic and financial barriers for migrant children to attend public schools outside of *hukou* origins caused many migrant workers to leave their children behind in rural hometowns without parental oversight, to send their children to lower quality private schools in the cities, or to let their children join the workforce early. The institutional barriers had a huge toll on the educational attainment of migrant workers' children. A 2000 study finds that although enrollment in primary schools is close to universal, 12% of the left-behind children in rural areas dropped out of middle school (Duan and Zhou, 2000). A 2003 survey conducted by China Children's Center on migrant children in nine cities in China documents that 9.3% of migrant children dropped out before finishing middle school and only 20% successfully enrolled in middle schools at migration destinations. Late enrollment was very common, with 31% of the 13-year-olds and 10% of the 14-year-olds who should have already been in middle schools still attending primary schools. Over 60% of children who dropped out of school between the age of 12 and 14 began working.

Beginning as early as 2005, Tianjin province fully opened up vocational-technical high school enrollment to non-local residents. Vocational high schools do not require admission tests like

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academic high schools and therefore are much easier to get into. [10] In 2008, Anhui and Fujian provinces not only opened up vocational high schools but also academic high schools by allowing migrant children to take admission tests for any high school. The State Council[11] published *The National Outline for Medium and Long-term Education Reform and Development 2010-2020* in 2010 and *Opinions on Good Implementation of High School Entrance Examination for Children of Migrant Workers after Receiving Compulsory Education* in 2012 to urge more regional governments to open high school entrance examinations for migrant children to encourage the continuation of education beyond the required nine years. Jiangsu, Jilin, and Shaanxi provinces pursued similar policies during 2010 and 2011. Most provinces announced similar policies by the end of 2013, with a few exceptions passing similar directives later in 2015 and 2016.

This thesis looks at the province-wide policy reform that opens up academic and vocational-technical high school enrollment to migrant children. In their final year of middle school, all students take an examination, *zhongkao*, which is required for graduation from middle school and admission into academic high schools. *Zhongkao* for high school admission purposes used to be open to only local *hukou* holders. Therefore, a migrant child would take the *zhongkao* examination at her migration destination to obtain a middle school degree but could not use the test scores to enroll in any high school in her migration destination. If a migrant child enrolled in a middle school at a migration destination wished to continue into high school, they had to transfer back to a middle school at their *hukou* origin before their last year of middle school and take the exam at their *hukou* origin for high school admission. In other words, by restricting who could take *zhongkao* and who

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[10] Nation-wide, the gross enrollment rate in high school is 82.5%, and 50.94% of high school students attended vocational high school in 2010. Central government stipulates that academic high school and vocational high school should each account for half of the entire high school population.

[11] The main administrative arm of the Chinese government, the State Council is responsible for ensuring implementation of laws and supervising the government bureaucracy.

could not, *zhongkao* policy limited enrollment in high schools to local residents. Even though the majority of vocational-technical schools did not select students based on their *zhongkao* scores, they still required applicants to take the exam, and, as a result, migrant children still could not enroll in these schools. As a result, the migration rate for middle-school-age children is much lower than the migration rate for primary school-age children nationally because if migrant children hope to continue into high school, they eventually have to deal with the hassle of transferring back to schools at home (UNICEF, 2017).

Given that a comprehensive compiling of provincial-level policy reform dates and details does not exist in the literature, I gathered provincial-level administrative documents [12] and cross-checked policy information that I collected with the existing literature that contains a partial

Figure 1: Roll Out of the High School Enrollment Reform
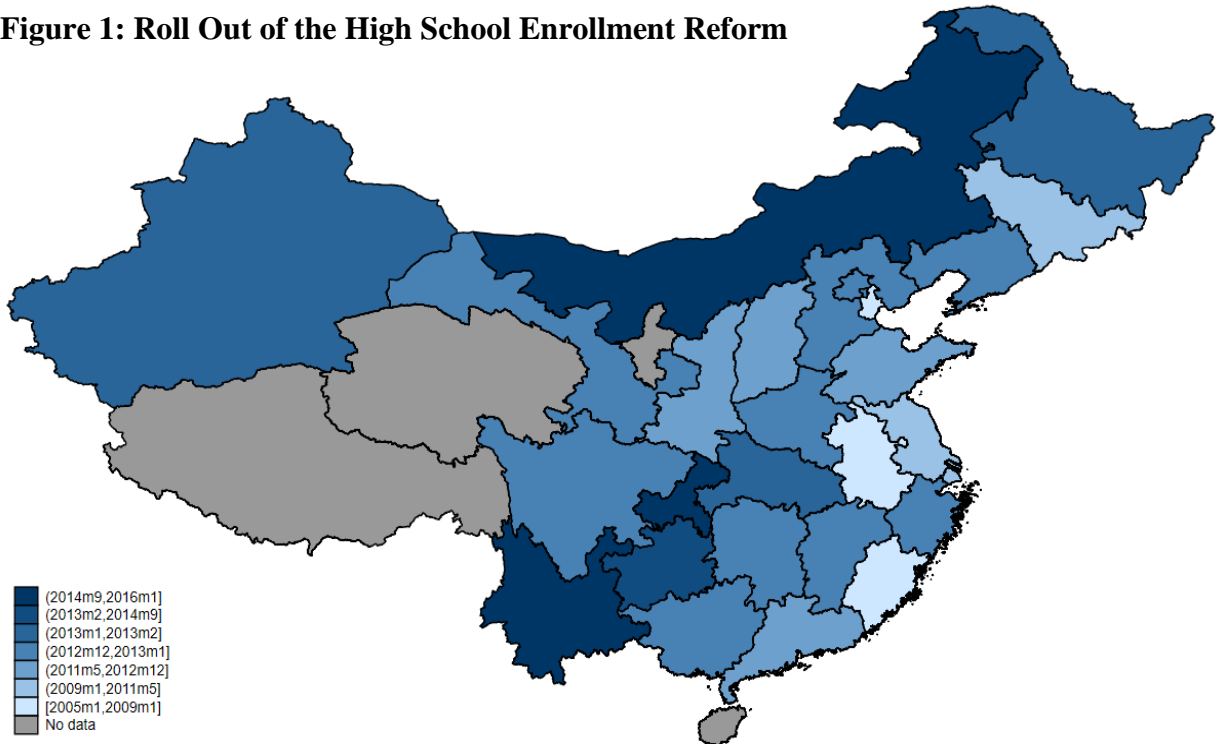
Source: Author's own construction based on various legal and administrative documents
Note: This map displays the date of policy reform regarding lifting restrictions for migrant children to enroll in high schools. "2005m1" in the legend means first month in 2005.

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[12] I compiled this list by searching keywords such as "migrant workers" "migrant children" "left-behind children" "floating children" "rural workers" using China Law Info, a database provided by Peking University. I compiled all policy announcements relevant to the issue of migrant workers' children's access to education and selected the ones at province-level to be presented in the policy timetable.

compilation of the policy changes (Wu, 2011). Figure 1 demonstrates the regional heterogeneity in the timing of the policy announcement. The detailed policy timetable is attached in the appendix.

3. Literature Review

The current literature on migration and education linkage usually focuses on either migrant children or left-behind children, and empirical evidence of parental migration on the education attainment of both groups of children shows mixed results. Chen et al. (2009) use difference-in-difference to compare schooling outcomes before and after parental migration between left-behind children and children from non-migrant households in Shaanxi province. They find that parental migration has no significant impact on children's academic performance and suggest that the income effect of migration outweighs the reduced parental supervision. Antman (2012) uses siblings' differential exposures to parental migration and finds that parents' migration to the U.S. increases the educational attainments of girls who are left behind. Antman also finds differential impacts on children's education outcomes from international versus domestic migration within Mexico. While international migration to the U.S. has positive effects on children's education outcomes, domestic migration within Mexico has no significant impact. Given that parents migrating internationally cannot visit their children as often as parents migrating domestically, the positive impact of parental international migration suggests that parental absence does not have a huge impact on children's educational outcomes.

In contrast to the previous two studies, Hu (2012) finds that the absence of household members due to domestic migration has a negative effect on school attendance, especially for children from poor households and girls. The negative impact stems from the labor pressure imposed upon the rest of the family when a member migrates, and remittances can only partially mitigate the effect. Hu also finds that having additional siblings pressures girls and children from poor households to

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drop out of high school, underscoring the unfair treatment of girls in rural China and the liquidity constraints of poorer households. For all households, maternal education is a strong determinant of children's high school attendance. The gendered pattern in the impact of migration is consistent with previous literature that also finds a preference for sons in education investment (Brown and Park 2002; Meyerhoefer and Chen, 2011). Looking beyond the contemporaneous parental migration, Meng and Yamauchi (2017) use weather and distance to provincial capital cities as two instruments for parental migration to investigate how children's lifetime cumulative exposure to parental migration impacts their education outcomes. They find that longer lifetime exposure reduces children's after-school study time and delays their grade progression given their age.

The literature on educational outcomes of migrant children in China is relatively scarce, and most of the studies are descriptive, so evidence in this branch of literature is still inconclusive. To compare the education outcomes of migrant children enrolled in local public schools versus private migrant schools that were built to serve migrant children, Chen and Feng (2013) exploit a sudden policy change in Shanghai that shut down migrant schools in the central city districts and enrolled migrant children previously registered at the migrant schools in public schools. The study uses the location of parents' residency to instrument for whether children were impacted by the policy change. They find that school type is the most important determinant in the academic performance of migrant children: the score gap between migrant children in public versus migrant schools is much larger than that between migrant children and local Shanghai students in public schools. The results suggest that the discriminatory enrollment policy of public schools has a severe negative impact on the human capital accumulation of migrant children.

Until more recently, there has not been much attention on how parents make decisions regarding children's migration status and how this migration decision impacts migrant children

and left-behind children differently. Song and Li (2014) analyze the characteristics of migrant parents who migrate with their children and migrant parents who do not and find that the household head's employment contract type, their spouse's education level, and migration distance are important determinants of the children's migration status. Song and Li hypothesize that migrant workers are trading off between a higher wage received from inter-province migration and being with their children but receiving a lower wage by migrating within the province.

Building on existing literature, this thesis proceeds to examine whether education policy reforms impact migrant parents' decision-making regarding their children's migration status and whether children's migration affects their educational outcomes.

4. Data

4.1. Data Description

The household-level data used to trace family migration, children's education performance, family composition, economic activities, and education background come from the China Family Panel Studies dataset (CFPS), which is a biennial longitudinal survey conducted by the Institute of Social Science Survey at the Peking University. Starting in 2010, CFPS samples from 25 provinces/autonomous regions,[13] which collectively contain 95% of the total Chinese population. CFPS uses stratified, multi-stage, probability-proportional-to-size sampling with administrative units and socioeconomic status as the stratification variables. Each member of the family is given an individual survey, including members who are part of the family but are not currently residing in the household, which provides rare insights into not only the migrant population but also their ties to and interactions with their immediate families. CFPS 2010 conducted interviews with 33,600 adults and 8,990 youths within 14,960 households. Among existing publicly available

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[13] Excluding Hong Kong, Macao, Xinjiang, Tibet, Qinghai, Inner Mongolia, Ningxia, and Hainan.

datasets on domestic migrant workers in China, CFPS is the only dataset with consistent measures of schooling outcomes for the children of migrant workers including enrollment, attendance, self-reported test scores in school (only in the baseline year), and CFPS administered reading and math test scores.[14] In this study, I focus on migrant families with rural *hukou* because they tend to be less educated and face greater challenges in obtaining local *hukou* and enrolling children into quality high schools.

4.2. Summary Statistics

Table 1 provides the summary statistics for children of migrant workers age 0-18 from 2010 to 2018. On average, 31% of children migrate with parents and 21% of the migrant children migrate outside of their *hukou* province. This is largely in line with the national data where 34% children age 0-17 with rural *hukou* migrate with their parents (UNICEF, 2015) and 28.8% of the migrant children migrate outside of their *hukou* province (2015 Census Data). In terms of educational attainment, 5% of the children in the sample dropped out of the 9-year compulsory education while 47% of the children between age 15-18 ended up attending high school. The dropout rate nationwide was 5.8% in 2018 and the gross enrollment rate for high school reached 88.8% in 2018 (Ministry of Education, 2018). The high school attendance rate in the sample is almost half of the national enrollment rate but it is consistent with results found in descriptive studies on migrant children.[15] Rural migrants have relatively limited education: a typical migrant father finishes only the first semester of middle school and a migrant mother has only a primary school education on average.

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[14] CFPS also contains self-assessment of schooling performance and parental perception of children's schooling performance, extracurricular activities involvement etc. Given that these outcome variables have severe non-response issues, they are not used in this thesis. Attendance data is self-reported and very rarely do children report any missing attendance in this dataset.

[15] A study reports that 39.3% of the migrant children in Beijing enroll in high school (both academic and vocational) and this is much closer to my sample than the national figure reported by the Ministry of Education (Song et al., 2016)

Columns 3 and 4 compare left-behind children and migrant children while column 5 shows t-tests and chi-square test results which assess the significance of the group differences. Left-behind children tend to be younger and have more siblings than migrant children. There's no significant difference in gender distribution between the two groups. As a whole, the two groups have similar dropout rates from compulsory education, but migrant children on average stay in school longer, with over half of the migrant children attending high school and only 44% of school-age left-behind children attending high school. The significant differences in test scores between the two groups suggest that migrant children may have benefited from higher quality urban education. Interestingly, the scoring gap for math between migrant children and left-behind children is slightly larger than that of the reading test.

Table 1: Summary Statistics 2010-2018

| | Full Sample | Migration Status | | |
| | | Left-Behind Children | Migrant Children | Difference |
	(1)	(2)	(3)	(4)
Child's Characteristics				
Migrate with Parents	0.31	—	—	—
	(0.462)	—	—	—
Cross-Province Migration	0.21	—	0.21	—
	(0.408)	—	(0.408)	—
Child's Age	9.00	8.87	9.29	-0.413***
	(5.302)	(5.297)	(5.302)	(0.098)
Gender (1=Male, 0=Female)	0.54	0.54	0.53	0.005
	(0.499)	(0.499)	(0.499)	(0.009)
Number of Siblings	1.08	1.15	0.94	0.207***
	(0.907)	(0.893)	(0.924)	(0.017)
Schooling Outcomes				
Years of Schooling Attended†	3.32	3.25	3.49	-0.249***
	(3.721)	(3.690)	(3.784)	(0.070)
Drop Out of School††	0.05	0.05	0.05	0.003
	(0.213)	(0.215)	(0.209)	(0.005)
Attended High School‡	0.47	0.44	0.52	-0.081***
	(0.499)	(0.497)	(0.500)	(0.020)
Survey Reading Test	0.11	0.09	0.18	-0.091***
	(0.953)	(0.968)	(0.915)	(0.023)
Survey Math Test	0.09	0.05	0.17	-0.115***
	(0.968)	(0.991)	(0.907)	(0.023)
Family Characteristics				
Father's Age	36.88	36.59	37.55	-0.957***
	(7.146)	(7.207)	(6.956)	(0.133)

Mother's Age	35.02	34.87	35.35	-0.483***
	(7.117)	(7.184)	(6.952)	(0.132)
Father's Years of Schooling	7.69	7.47	8.21	-0.737***
	(3.639)	(3.536)	(3.820)	(0.070)
Mother's Years of Schooling	6.41	6.05	7.22	-1.176***
	(4.166)	(4.099)	(4.199)	(0.078)
Education Spending on Child	2734.60	2390.71	3475.53	-1.1e+03***
	(4811.310)	(3611.308)	(6643.057)	(112.402)
Family Income	50956.17	50595.15	51768.16	-1.2e+03
	(4.5e+04)	(4.0e+04)	(5.5e+04)	(940.246)
Father Stays Home	0.36	0.19	0.73	-0.546***
	(0.479)	(0.391)	(0.442)	(0.008)
Mother Stays Home	0.69	0.62	0.85	-0.234***
	(0.463)	(0.486)	(0.357)	(0.007)
Weekly Hours Father Spends	0.37	0.27	0.59	-0.322***
on Tutoring School Work	(1.713)	(1.494)	(2.121)	(0.040)
Weekly Hours Mother Spent	1.16	1.01	1.49	-0.480***
on Tutoring School Work	(3.124)	(2.928)	(3.516)	(0.068)
Weekly Hours of Tutoring	2.42	2.15	3.05	-0.902***
Child Receives from Family	(4.619)	(4.357)	(5.123)	(0.100)
N	13739	9491	4248	13739

Note: The statistics displayed here are means across 2010 to 2018. Data comes from China Family Panel Studies. The unit of observation is individual-year. *** p<0.01, ** p<0.05, * p<0.1 †Years of schooling attended notes the highest level of education that the observation has attended. In other words, if an observation repeats 6th grade, the years of schooling attended would be 6, not 7. ††Drop out is defined as dropping out of the 9-year compulsory education. ‡High school attendance calculation only looks at observations over age 14.

In terms of family characteristics, migrant children on average have older and more educated parents, with migrant children's parents having one additional year of schooling on average. The education spending for migrant children on average is 50% more than the amount spent for left-behind children. The proportion of education spending to total family income for migrant children is about 2% higher (6.7% vs 4.7%). This difference may be a result of higher costs of living and afterschool courses in the cities and/or of migrant parents' caring more about their children's education. Song and Li (2014) describe migrant workers' decisions regarding their children's migration as a trade-off between income and time spent with their children. However, in this dataset, the difference between migrant children's and left-behind children's family incomes is not statistically significant. Because migrant children are much more likely to reside with their parents, migrant children receive more help from their parents than their counterparts. The significant differences in total hours of tutoring received from all family members between the two groups

suggest that left-behind children do not receive much guidance from the rest of the family in their studying.

CFPS administers a reading test and a math test to all survey respondents in each survey wave. Although CFPS collected school test scores in the baseline year, the survey took out questions on school test scores after the baseline year. The survey tests have the benefit of consistency across different regions and across time. However, it is reasonable to doubt just how reflective the survey test scores are in portraying children's academic performance. School math scores and survey math scores at the baseline year have a moderate correlation of 0.33; school Chinese test scores and survey reading test scores at the baseline have a correlation of 0.43, suggesting that the survey test scores are a moderately good measure for schooling performance. The survey test scores, however, have a non-random non-response issue.[16] This is because, after the baseline year of the survey, CFPS allows survey respondents to take a short sample test and then decide whether or not they want to complete the entire test and have their scores recorded. Respondents who do not finish the entire test thus have missing observations. Given this survey setup, it is highly plausible that the current test scores are only from positively self-select individuals who feel confident about their test scores. In the robustness section, Manski bounds are employed to provide reasonable ranges of the true effect.

4.3. Migration Pattern

To better understand the demographic of migrant children and the pattern of children's migration, Figures 2 and 3 below explore the relationship between children's migration patterns and children's age and gender. Figure 2 shows the percentage of children who migrate with their parents in each age group by gender. For both genders, there is a noticeable increase in the level

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[16] About 8.37% of the respondents do not have math test scores and 7.56% do not have reading test scores. The respondents here are restricted to those over age 10 since CFPS only administers tests to those over age 10.

of migration with parents during the primary school period and a noticeable decrease in the middle school period. This may be a result of barriers to enrollment: while primary schools are generally accessible to migrant children, middle schools face more issues of capacity constraints and more implicit entry barriers (Li, 2018). Given that only about half of the sample attends high schools (both academic and vocational high schools), the sharp increase in the proportion of migrant children as they reach 16 may be a result of children reuniting with parents in the cities for employment purposes. Boys have higher migration rates during the primary school period, while

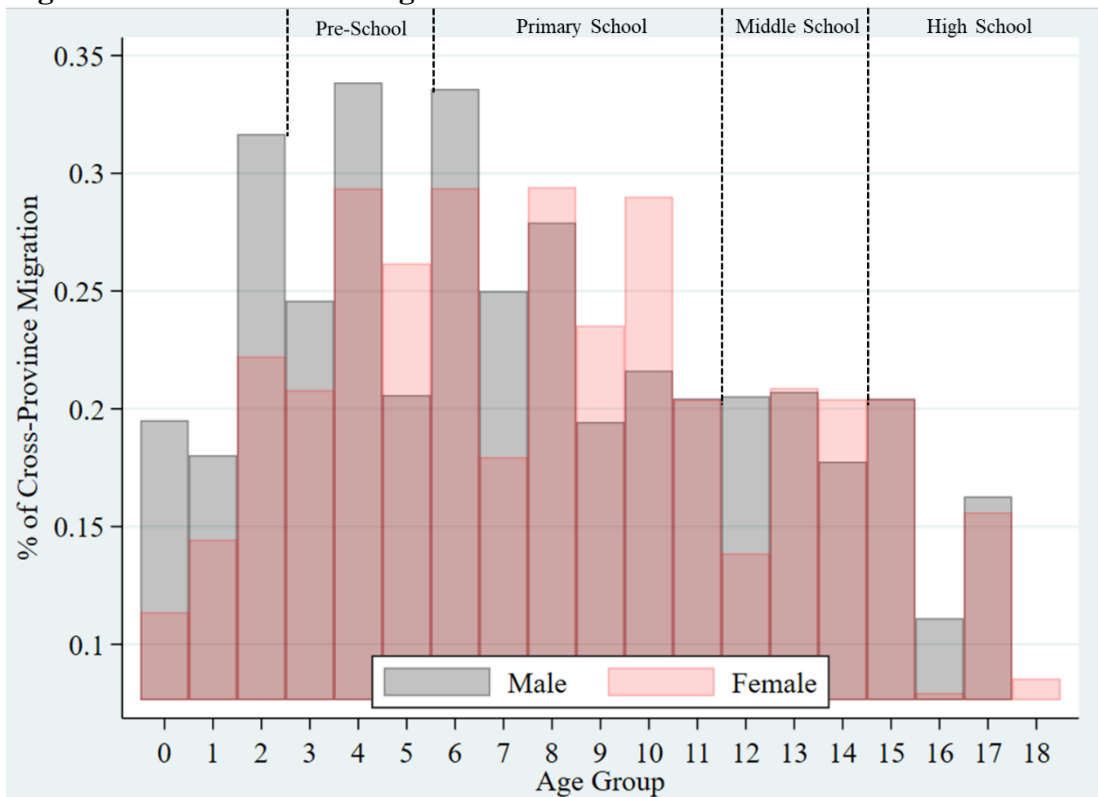**Figure 2: Migrant Children Share of Population by Age Group & Gender**
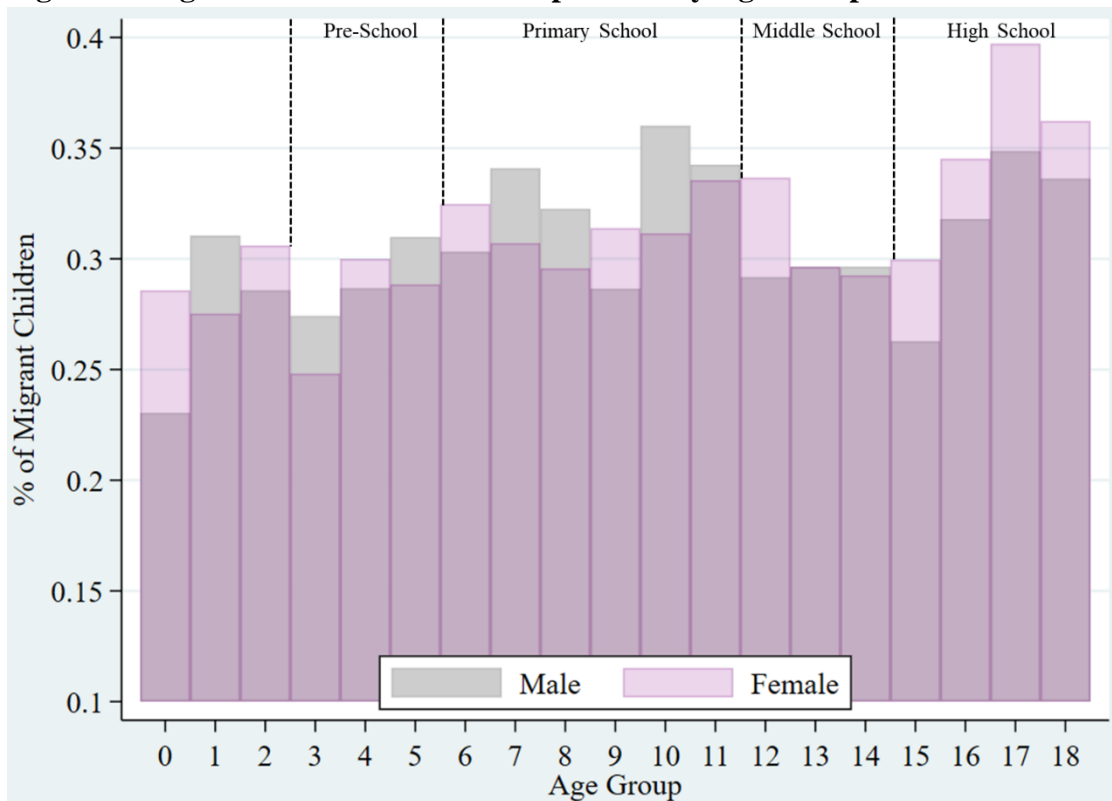
Note: Each bar represents percentage of children who migrate with parents in each age group averaged from 2010-2018 data. Author adds dash line according to the legal age of enrollment in different stages of schooling. Chinese school system has 6 years of primary school education, 3 years of middle school education and 4 years of high school education. Note that it is common for children to be one year behind the legal age of enrollment. Thus, the dash lines are not indication of an observation's true grade level. CPFS has severe missing data issue with children's actual grade level so the actual grade levels are not displayed here.

girls have higher migration rates after age 15. This is likely due to migrant families valuing

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education for sons more, so sons are brought to the cities to be educated while daughters are more likely to be sent away for work once compulsory education ends at middle school.

Figure 3 examines how gender and age impact the probability of migrant children migrating outside of their home province with their parents. Consistent with national-level data, few migrant children—only 10 to 30 percent—migrate between provinces with their parents. Boys are generally much more likely to join parents' cross-province migration, but the gender gap closes in later elementary school and middle school periods. Cross-province migration is very rare for middle-school and high-school-aged children.

Figure 3: Cross-Province Migration

Note: Each bar represents percentage of children who migrate outside of their *hukou* province with parents in each age group averaged from 2010-2018 data. Author adds dash line according to the legal age of enrollment in different stages of schooling.

Regional heterogeneity is prominent in children's migration patterns. The map below plots the percentage of children of migrant workers who migrate with parents by children's *hukou* origin province. Children from the northwestern region, northeastern region, southwestern region, and

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Zhejiang province are most likely to migrate along with their parents. In comparison, children from

the central region are much more likely to be left behind.

Figure 4: Children's Migration Rate by *Hukou* Province
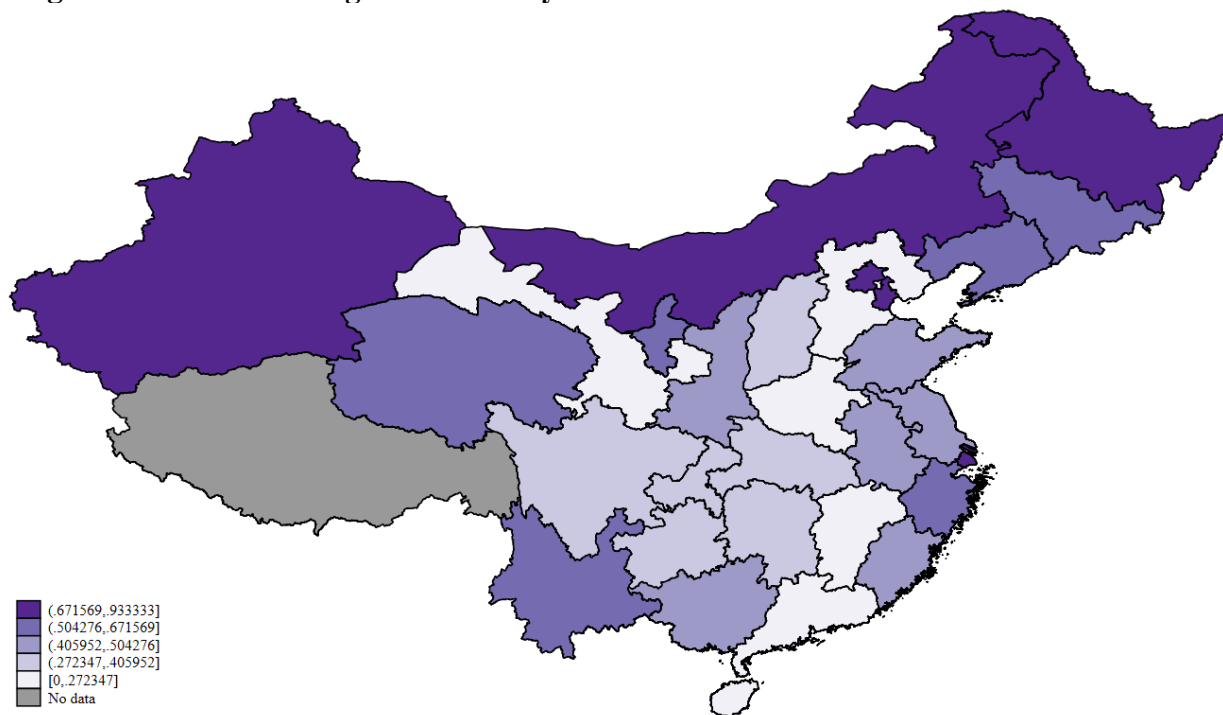
Note: Children's migration rate is defined as percentage of children in migrant families who migrate with at least one of their parents outside of their registered *hukou* locations.

5. Empirical Strategy

To estimate the effect of children's migration on their educational outcomes, consider the

following equation:

$$(1)\ y_{ihpt} = \beta_0 + \beta_1 Kid\_Mig_{ihpt} + \beta_2 X_{iht} + e_{ihpt}$$

where y_{ihpt} denotes schooling outcomes for child i in household h from province p at time t,

measuring both the persistence and performance of education including test scores, drop out of 9-

year compulsory education, years of schooling attended, and high school enrollment. Kid_Mig_{ihpt}

is a binary variable equal to 1 if the child migrates with at least one parent outside of their *hukou*

registration and 0 if the child is left behind.[17] β_1 is the coefficient of interest and measures the direct influence of children's migratory status on their educational outcomes. A vector of household and individual characteristics, X_{iht}, is introduced to control for factors that may influence parents' decisions regarding their children's migration status such as child i's age, gender, number of siblings, and parental years of education.[18] Standard errors are clustered at the province level.

Estimating equation 1 using OLS will be biased because children's migration status is an endogenous variable under several plausible scenarios: first, parents who migrate with their children may value education more. Second, only children with excellent academic performance may be brought to the city. In both cases, there's a positive selection of migrant children, and the OLS results overestimate the effects of children's migration on schooling outcomes, assuming that children's migration has positive effects through access to better quality education in host cities and increased parental guidance in education.

5.1. Identification Strategy

Given these concerns of endogeneity, I use an instrumental variables approach to estimate equation 1. To identify how children's migration status affects their schooling outcomes, I need an instrument that is correlated with children's migration status but unrelated to unobserved individual, household, and community factors influencing schooling outcomes. I make use of the policy reform that opened up enrollment in academic and vocational high schools to non-local *hukou* holders. The policy reform has two effects. First, the policy change reduces the costs for migrant parents to migrate with their children because parents no longer have to worry about the

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[17] Left-behind children are defined as children remain in their *hukou* registration county and at least one parent does not co-reside with the family for at least four months a year as a result of work outside of the *hukou* county.
[18] To avoid endogeneity, household income is not included in the model since it might be affected by whether the parents migrate with their children or not.

continuation of school post-compulsory education. Knowing that their children will no longer be forced back home beyond middle school, migrant parents who previously would have left children behind may now choose to migrate with children. Second, removing barriers to education in host cities increases the return to high school education for migrant children can now attend high-quality urban public schools.

I exploit variation in the timing of policy rollout across different provinces to instrument for children's migration status. The policy treatment assignment is based on provincial-level policies[19] that allow non-local residents to enroll in high schools[20] in migration destinations. The assumption is that this policy change induces some migrant families to migrate within the province with children who otherwise would not have done so, particularly migrant parents with older school-age children.

5.2. 2SLS Specification

The first stage assesses the extent to which policy reforms influence migration with children among migrant families. In the first stage equation shown below, $policy_{pt}$ is an indicator variable for policy reform and $policy_{pt} = 1$ when the *hukou* province p adopts policy reform in year t and the years after. Survey wave fixed effects are added to control for factors changing in each survey wave that are common to all regions for a given survey.

2) $Kid\_Mig_{ihpt} = \alpha_0 + \alpha_1 * policy_{pt} + \alpha_2 X_{iht} + \varepsilon_{ihpt}$

The policy instrument is constructed using *hukou* origin policy to avoid endogeneity. For most rural *hukou* holders, *hukou* status and location cannot be changed easily, and thus their *hukou* origin is largely exogenous rather than a result of conscious selection. Thus, the treatment

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[19] See appendix for the full list of policies.
[20] High school here also includes vocational high school. Note that while there's minimum scoring requirement in middle matriculation tests to attend regular high school, vocational schools usually do not have any requirement.

assignment, policy reform of high school enrollment in one's *hukou* province, is exogenous to personal and household characteristics. Nationally, close to 60% of the rural migrant workers migrate within their *hukou* provinces, and very rarely do middle-school or high-school-aged children migrate across-province with parents (National Bureau of Statistics, 2019). This migration pattern indicates that the policy changes within children's origin provinces are the relevant exposure that influences migrant parents' decision to migrate with their children. The prevalence of parents' and children's intra-province migration indicates that the relevance condition should hold.

The second stage assesses the causal link between the migration decision and the schooling outcomes of migrants' children by regressing the schooling outcomes on the predicted values of children's migration status:

3) $y_{ihpt} = \gamma_0 + \gamma_1 Kid\_\widehat{Mig}_{ihpt} + \gamma_2 X_{iht} + e_{ihpt}$

γ_1 can be interpreted as the Local Average Treatment Effect (LATE), which estimates the treatment effect on the complier subgroup—people who would not have migrated with children without this policy change. Although the LATE interpretation has limitations in its applicability, given that lifting high school enrollment restriction to migrant children has been a hugely controversial topic, learning whether this policy has any effect on children's educational outcomes is still valuable. I assume the monotonicity condition holds for the policy instrument—policy changes induce people who previously would not have migrated with children to migrate with them and do not prompt those who previously chose to migrate with children to now decide to not migrate with them. Since high school attainment and dropout status are both binary variables, a non-linear model such as probit may be more appropriate. However, given that the IV probit model requires restrictive normality assumptions on the error terms, this thesis employs a linear probability model in the first stage.

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For the instrument to be valid, two conditions must be met: relevance and exogeneity. The first stage regression checks the relevance condition by exploring whether the policy changes influence parents' decisions regarding their children's migration status.

The exogeneity condition requires that the treatment affects students' education outcomes only through the single channel specified—children's relocation with migrant parents—and not via some other channels. There are some scenarios where this condition could be threatened: first, if the policy reform regarding migrant children's access to high school is part of broader initiatives to improve basic education for all school-age children, including those in rural regions who do not relocate with their migrant families. For instance, if the migration destination city allows migrant children's enrollment in urban public high schools while new schools are being built in the rural regions, children who remain behind may still reap the benefits of the broader policy initiative without migrating with their families. This should not be a serious concern as rural education reform took place around the early 2000s, which is much earlier than reforms addressing migrant children's education. [21] However, any remaining threats of this nature would lead to an underestimation of the effects, assuming that migration to urban regions and access to urban public schools bring larger positive effects on education than if they were to stay behind.

The effects may also be biased if migration is induced by earlier policy changes since the current policy is not the first policy to address migrant children's education. One example of a policy implemented at the province level prior to the policy that I am examining is the waiving of temporary student fees. In 2008, the State Council waived tuition and miscellaneous expenses for

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[21] In 2005, the central government fully incorporated the rural compulsory education funding into the national public financial system that guarantees ample funding. Tuition, miscellaneous fees, and textbook fees were waived for compulsory education in rural areas and residential students received subsidized living expenses (UN Millennium Development Goals).

all students receiving compulsory education, [22] thus eliminating the legality of the temporary schooling fees that migrant children previously had to pay. For the majority of the provinces, this policy occurred four years before the high school reform policy analyzed here. If the implementation of later policies correlates with earlier policies, the estimated effects will be an overestimate, assuming that prior policies exert positive influences on children's schooling. To check whether this is a valid concern, age dummies are added and interacted with policy implementation to check for heterogeneous effects on migrant children. Relaxing high school enrollment should have a larger impact on older school-age children than on younger children, and the coefficients of the interaction terms should reflect this uneven impact.

5.3. Alternative IV Specification

In addition to looking at policy changes contemporaneously ($policy_{pt} = 1$ when province p adopts reform in year t and remains 1 in the years after), I also want to account for the fact that it takes time for people to learn about new policies, make migration decisions based on the policy, and put their decisions into actions. A survey done at a middle school in Guizhou province in December of 2014 found that only 6.5% of the migrant worker parents were aware of the policy change that took place at the beginning of 2014. The parents who were aware of the policy change learned this information from the newspaper (Wu and Diao, 2014). A study conducted by the National Institute of Education Science in nine cities in June of 2015 found although many were aware of the existence of the policy change, less than 30% of migrant children and their parents correctly judged when policy changes occurred and described the content of the policy.

Both studies support my hypothesis that it is unrealistic to expect rural migrant parents, most of whom had limited education, to learn about the policy change soon after the policy enactment.

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[22] *Notice of the State Council on Eliminating Tuition and Miscellaneous Expenses for Students in Compulsory Education*

The current construction of the policy instrument assumes that the effect takes place immediately and does not account for the delayed response. Therefore, I propose two additional specifications for the policy instrument by lagging the policy change by one and two years respectively: $Lag1$ equals one if province p adopts reform in year $t-1$ and remains one in the years following. $Lag2$ equals one if province p adopts reform in year $t-2$ and remains one in the years following.

Furthermore, data suggests that the longer the policy has been implemented, the more likely a migrant worker would get to learn about the policy. An article published in the South Review Weekly by economist Feng Shuaizhang reports that the number of migrant children enrolling in academic high school reached 89,000 in 2013 and rose to 107,000 in 2014. In 2015, the number jumped to 350,000. The knowledge of policy change is a function of not only whether or not the policy is enacted but also how long the policy has been enacted. Thus, I propose a third IV specification using years since the policy announcement as an alternative instrument.[23]

6. Results

6.1. First-Stage Results

Table 2 presents the first stage results assessing the effect of the policy reform on children's migration status. Column 1 shows the original construction of the policy indicator, $policy_{pt}$, as the instrument. The estimated coefficient on children's migration status is 0.068, indicating that a contemporaneous policy reform leads to a roughly 7 percentage points increase in the chance of children migrating with parents. However, this coefficient is not statistically significant. In addition, with the cluster-robust first-stage F statistic (Kleibergen-Paap rk Wald F statistic) values

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[23] The current construction of the instrument uses the policy announcement date as the starting date of the policy. Given that a handful a province delays the actual implementation until one or two years, it is plausible that effects are delayed in these particular provinces. To test the robustness of my results, I replace the policy announcement date with the policy implementation date. The results are consistent with those derived using announcement dates. Results are attached in the appendix.

varying between 0.665 and 4.438 in the first three columns, regressions in the first three columns all suffer from a weak instrument problem, which means that we should not attach too much importance to the interpretations of these coefficients.

Columns 2 and 3 present first-stage results with the lagged policy reform instruments discussed in the previous section. Lagging the policy changes augments the strength of the first stage with increased F-statistics of 3.212 and 4.438 for $Lag1$ and $Lag2$ respectively. The results suggest that a policy reform that occurred a year or two years ago increases the probability of a child migrating by 9.95 percentage points and 11.4 percentage points, respectively. Although the relevance of the instruments is improved from that of the original policy instrument construction, the first-stage F-statistics are still below the Stock-Yogo (2005) threshold of 10. Given the low KP F-statistics, the estimates are likely biased and should be interpreted with caution.

When year-since-policy is used as the IV specification, policy reform has a positive and statistically significant effect on children's migration status as shown in column 4. The coefficient is 0.0370 and significant at the 0.01 level, meaning that for every additional year of the policy being passed, the chance of children migrating with parents increases by 3.7 percentage points. The relevance of the instrument is much stronger with F-statistics of 15.425, reducing concerns about weak instruments.

In all columns, the coefficients of children's age, number of siblings, and parental education are significant. Age and parents' education are positively associated with children's migration status. Consistent with prior literature, having more siblings decreases children's chance of migrating with parents, possibly due to the increase in household chores and living expenses if all children are brought to the city. Gender does not seem to play a significant role in determining children's migration status.

Table 2: Policy Effects on Children's Migration Status

	Policy Indicator (1)	Lag 1 (2)	Lag 2 (3)	Years Since Policy (4)
Outcome: Children's Migration Status, Migrate=1				
IV Specification	0.0680	0.0995*	0.114**	0.0370***
	(0.0835)	(0.0555)	(0.0542)	(0.00943)
Gender (1=Male, 0=Female)	-0.00223	-0.00161	-0.00237	-0.00297
	(0.00658)	(0.00679)	(0.00679)	(0.00682)
Age	0.0104***	0.0103***	0.0104***	0.0102***
	(0.00123)	(0.00124)	(0.00122)	(0.00120)
Number of Siblings	-0.0389*	-0.0369*	-0.0381*	-0.0358*
	(0.0194)	(0.0194)	(0.0198)	(0.0202)
Father's Years of Schooling	0.00671**	0.00665**	0.00660**	0.00640**
	(0.00291)	(0.00290)	(0.00287)	(0.00286)
Mother's Years of Schooling	0.0142***	0.0141***	0.0141***	0.0137***
	(0.00327)	(0.00334)	(0.00330)	(0.00328)
Constant	0.206***	0.204**	0.205**	0.209***
	(0.0744)	(0.0751)	(0.0745)	(0.0739)
Observations	12,621	12,621	12,621	12,621
F statistic	0.665	3.212	4.438	15.425

Note: Table 2 presents the results of equation 2 with four different specifications for the policy instrument. Columns 2, 3, 4 present results from alternative IV specifications discussed in the empirical strategy section. *** p<0.01, ** p<0.05, * p<0.1 Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard errors clustered at the province level are in parentheses. Regressions all contain survey wave fixed effects.

To further explore the observed gendered pattern in children's migration described in the literature, I present first stage results separately by gender in Table 3. Similar to estimates obtained using the full sample, contemporaneous policy reform has an insignificant impact on migration as shown in column 1. The coefficients of interest estimated by $Lag1$ and $Lag2$ are significant for girls and are larger in magnitude for girls compared to estimates derived using the contemporaneous policy instrument. Contrary to the literature which finds an increase of siblings mainly affects girls, I find that the number of siblings has a significant negative relationship with boys' migration status but not girls' migration status. Maternal education background is a crucial factor in influencing children's migration regardless of children's gender. While fathers' educational backgrounds do not significantly impact the chance of migration for their sons, they do impact that of their daughters. Given that the F statistics in columns 1 to 3 remain low, moving forward, the preferred IV specification will be years-since-policy.

Table 3: Gender & Children's Migration Status

	Policy Indicator (1)	Lag 1 (2)	Lag 2 (3)	Years Since Policy (4)
Panel A: Male				
Children's Migration Status	0.0531	0.0958	0.105*	0.0369***
	(0.0844)	(0.0618)	(0.0613)	(0.00989)
Age	0.00908***	0.00903***	0.00908***	0.00897***
	(0.00122)	(0.00123)	(0.00121)	(0.00117)
Number of Siblings	-0.0434**	-0.0415**	-0.0424**	-0.0397**
	(0.0180)	(0.0181)	(0.0184)	(0.0188)
Father's Years of Schooling	0.00480	0.00476	0.00479*	0.00470
	(0.00284)	(0.00283)	(0.00281)	(0.00281)
Mother's Years of Schooling	0.0145***	0.0144***	0.0143***	0.0139***
	(0.00390)	(0.00391)	(0.00393)	(0.00386)
Constant	0.255***	0.252***	0.252***	0.255***
Observations	6,791	6,791	6,791	6,791
F statistic	0.396	2.401	2.92	13.957
Panel B: Female				
Children's Migration Status	0.0878	0.104*	0.125**	0.0370***
	(0.0854)	(0.0555)	(0.0502)	(0.0104)
Age	0.0118***	0.0118***	0.0118***	0.0117***
	(0.00168)	(0.00167)	(0.00168)	(0.00167)
Number of Siblings	-0.0352	-0.0333	-0.0349	-0.0328
	(0.0214)	(0.0212)	(0.0218)	(0.0221)
Father's Years of Schooling	0.00909**	0.00900**	0.00884**	0.00853**
	(0.00361)	(0.00362)	(0.00360)	(0.00356)
Mother's Years of Schooling	0.0136***	0.0136***	0.0136***	0.0133***
	(0.00315)	(0.00326)	(0.00315)	(0.00319)
Constant	0.148*	0.146*	0.148*	0.153*
	(0.0799)	(0.0803)	(0.0798)	(0.0793)
Observations	5,830	5,830	5,830	5,830
F statistic	1.057	3.509	6.21	12.714

Note: Table 3 presents results from equation 2 but split by gender. Columns 2, 3, 4 present results from alternative IV specifications discussed in the text. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard errors clustered at the province level are in parentheses. Regressions all contain survey wave fixed effects.

Next, I examine whether the policy had any heterogeneous effects across different age groups. Instead of using age as a continuous covariate, age is discretized and turned into indicators to estimate the magnitude of the effects for different age groups. This additional analysis is motivated by the nature of the policy change: high school enrollments being opened up to non-local residents likely have a greater effect on older children who will soon enroll in high school rather than

younger children. The first stage for this specification interacts age dummies with the year-since-policy instrument, and the coefficients of the interaction terms are plotted in Figure 5.

The coefficients of interests are significantly positive for age groups 7-12 and 17-18 at the five percent level. The effects are mainly driven by the migration of primary school-aged children and children who have just begun middle school or graduated from primary school.[24] The results are not entirely aligned with my hypothesis of the policy driving more older children to migrate rather than younger children. This may be a result of a few provinces requiring enrollment in local middle schools as a prerequisite for enrollment in high school.[25] The pattern of children migrating right before enrollment into middle school matches this policy restriction. At the same time, coefficients for ages 13-16 are insignificant, suggesting that students who are near the end of middle school or at the beginning of high school are not induced to migrate. This may be a result of rules regarding the timing of the transfer. For instance, Tianjin province prohibits students from transferring in their last one and a half years of middle school or their first year of high school.[26] The positive and

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[24] The level of schooling marked on the left-hand-side of the figure are legal enrollment age, but it is very common for children to enroll one year later if their birth date is after August or September.

[25] For instance, Gansu province requires enrollment in middle school at migration destination for at least two years consecutively; Guangxi province requires enrollment in middle schools at migration destination for all three years of middle school in additional to parents having stable housing (including renting) for at least a year; Hunan province allows transfer between high schools but also requires completion of middle schools at migration destination; Sichuan province requires one year of studying in local middle school.

[26] It is unclear how prevalent this type of restriction is in other provinces, but Tianjin province's rules seem suggestive of the reasons behind the observed pattern.

significant coefficients for age 17 and 18 seem consistent with the restrictions on transfer at the beginning of high school and the loosening of transfer near the end of high school.
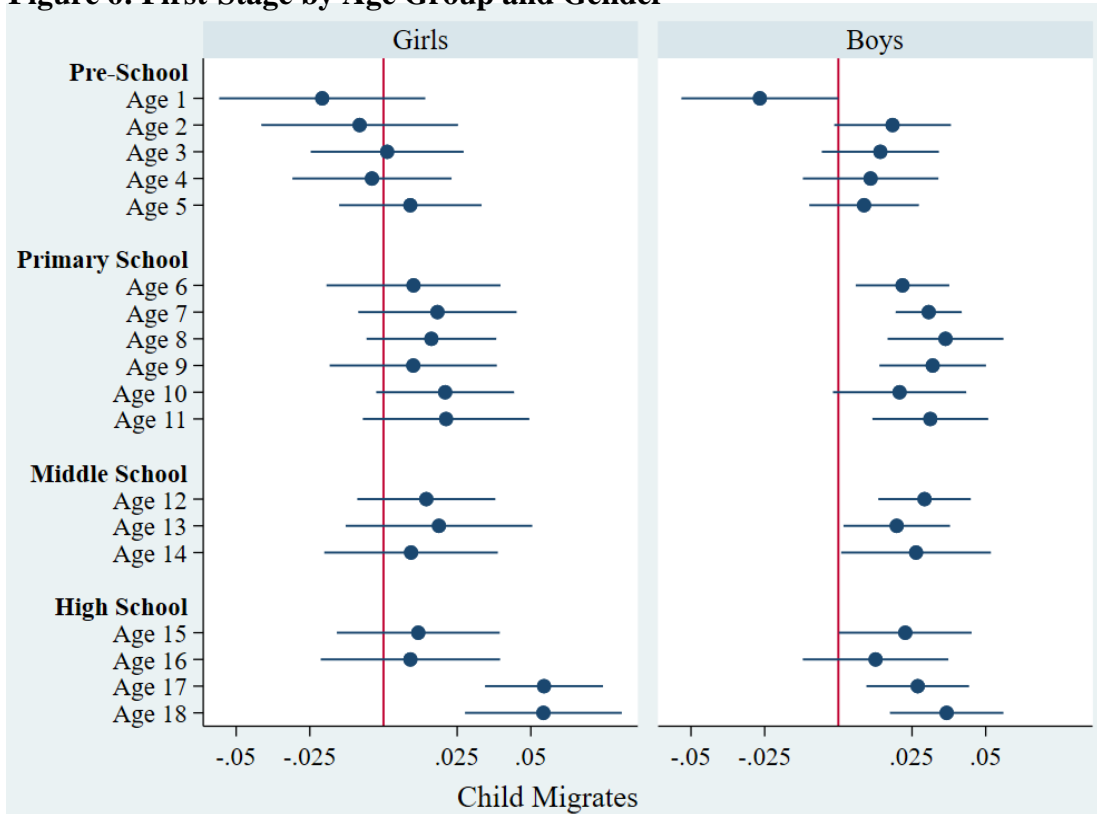
Figure 5: First-Stage by Age Group
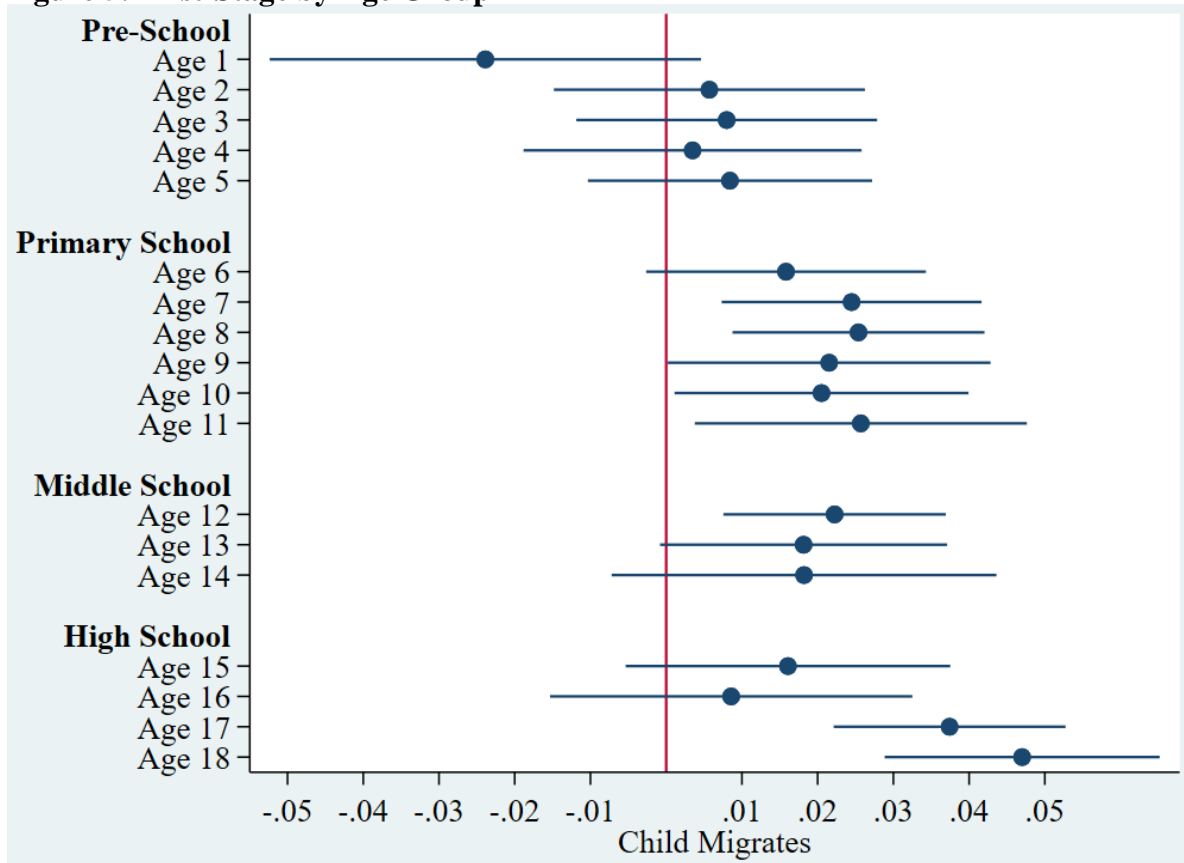
Note: This graph plots the coefficients of the age dummy interacting with year-since-policy instrument. Author adds stages of school label on the left-hand side based on the legal age of enrollment in different stages of schooling.

I then split the sample by gender to examine whether gender impacts children's response to policy changes across the different age groups. Figure 6 plots the coefficients of the interaction terms. The divergent impact as a result of gender becomes more obvious in this graph. Most of the first stage effects are driven by the migration of primary school and middle school-aged boys. In

contrast, girls during the same age range are hardly impacted until the last year of high school.

This is likely a result of rural migrant worker parents' preference for their sons' educations.

Figure 6: First-Stage by Age Group and Gender

Note: This graph plots the coefficients of the age dummy interacting with year-since-policy instrument.

Lastly, children's schooling performance prior to the policy reform may be a factor that leads

to heterogeneous parental responses to the policy reform. Due to the selective nature of academic

high schools, it is plausible that only the top-performing children are brought to the cities because

these children are more likely to perform well in high school and obtain college degrees. Thus,

parents may perceive the return to education of already high-performing children to be higher than

that of previously underperforming children. However, given that the majority of the vocational-

technical high schools are not selective, this positive selection should theoretically not be an issue.

To test whether families respond to education policy reform differently based on their children's

academic performance, I use the baseline year test score prior to policy reform to stratify children

into four scoring quantiles. Indicator variables that specify children's testing quantile are interacted with year-since-policy in the first stage specification to test whether children's schooling performance influences their parents' decision regarding children's migration status. Running the first stage with this new specification, I find that prior testing score strata are not major determinants of children's migration status. Therefore, positive selection into migration does not seem to be a significant driving force of children's migration for either gender. I do note that the magnitude of the estimates is larger than that of boys, suggesting that schooling performance may be a larger factor in determining girls' migration status.

Figure 7: Heterogeneity by Prior Academic Performance
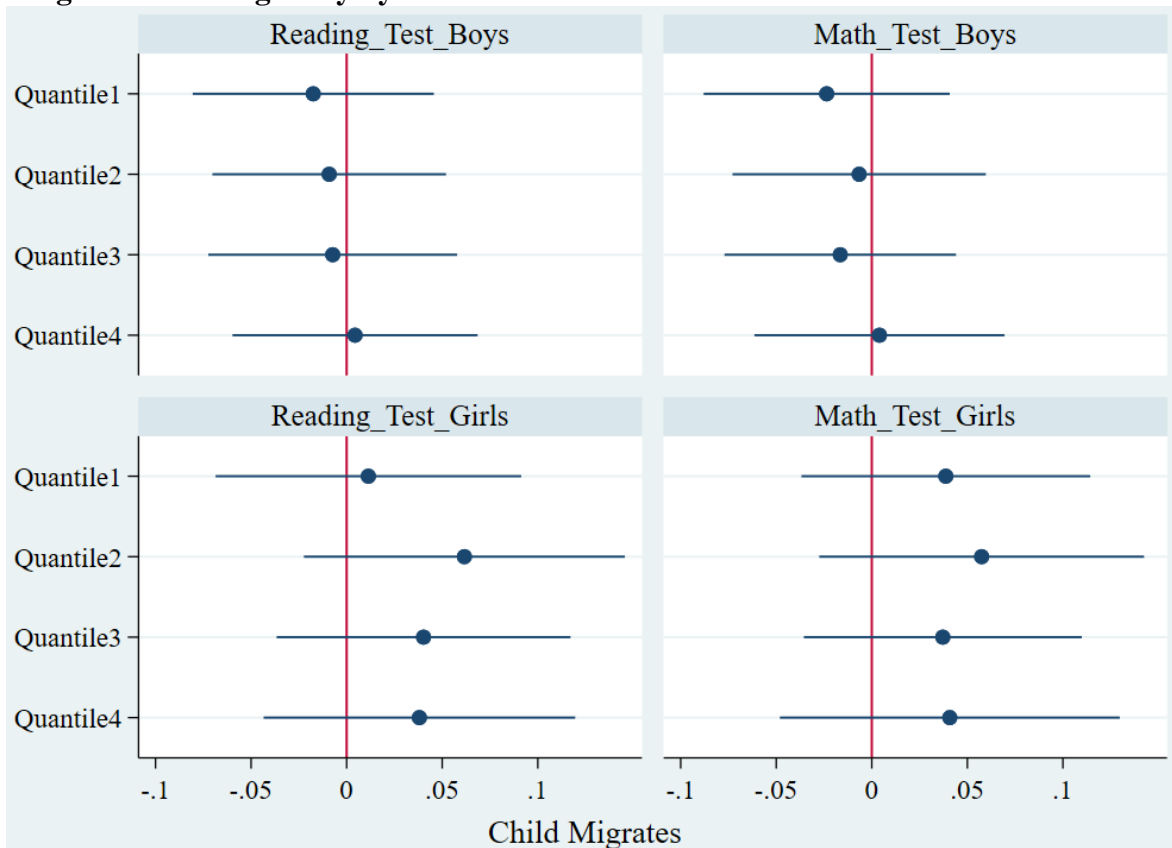
Note: This figure plots the coefficients of the test score quantile dummies interacting with year-since-policy instrument in the first stage specification.

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6.2. Children's Migration Status and Education Outcomes

In this section, I explore the causal linkage between children's migration status and children's educational outcomes. Table 4 below presents the second stage results on outcome variables that measure persistence in schooling, including years of schooling attended, enrollment in high school, and drop out from 9-year compulsory education estimated using year-since-policy as the IV. Across all three outcome variables, the coefficients of interest are insignificant, indicating that children's migration status does not have a significant impact on these schooling outcomes. Consistent with prior literature, having more siblings significantly decreases a child's years of schooling, with each additional sibling reducing 1.5 years of schooling on average. Higher parental education increases children's years of schooling significantly. Boys have a higher probability of dropping out and attaining fewer years of education.

Table 4: Effect of Children's Migration on Persistence in Schooling

Dependent Variable:	Years of Schooling† (1)	High School Attendance (2)	Drop Out (3)
Child Migrates	0.138	0.356	0.0201
	(0.390)	(0.243)	(0.0514)
Gender	-0.112***	-0.0649***	0.0124**
(1=Male, 0=Female)	(0.0310)	(0.0216)	(0.00593)
Age	0.874***	0.179***	0.00781***
	(0.0150)	(0.00862)	(0.000911)
Number of Siblings	-0.146***	-0.0473***	0.00964
	(0.0379)	(0.0101)	(0.00893)
Father's Years	0.0332***	0.0165***	-0.00424***
of Schooling	(0.00566)	(0.00328)	(0.000689)
Mother's Years	0.0232***	0.0130***	-0.00266***
of Schooling	(0.00683)	(0.00417)	(0.000793)
Constant	-5.396***	-2.852***	-0.0359
	(0.171)	(0.104)	(0.0248)
Observations	9,047	2,759	8,242
F statistic	19.26	14.92	20.19

Note: Table 4 presents the results of equation 3. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard errors clustered at the *hukou* province level are shown in

parentheses. Regressions all contain survey wave fixed effects. †Years of schooling refers to the highest level of schooling that a child has attended. The variable only includes those above age 6.

Table 5 below presents the second stage results on outcome variables that measure academic performance, including performance in math and reading tests administrated by CFPS. The results show that children's migration has a significant positive impact on math test scores but not on reading test scores. In particular, when the sample is split by gender, children's migration with parents shows a greater impact on girls' math test scores (1.164 standard deviations) than boys' (1.018 standard deviations), although both are significant. Interestingly, girls' reading test scores are also positively impacted although the estimate is not statistically significant. I note that the survey math and reading test scores have missing data issues which are unlikely to be random, and Manski bounding exercise will be performed in the robustness section to provide the range of estimations.

Table 5: Effect of Children's Migration on Academic Performance

			Male		Female	
	Math	Reading	Math	Reading	Math	Reading
Dependent Variable:	Test Scores	Test Scores	Test Scores	Test Scores	Test Scores	Test Scores
	(1)	(2)	(3)	(4)	(5)	(6)
Child Migrates	1.068**	0.159	1.018*	-0.166	1.164*	0.593
	(0.453)	(0.534)	(0.609)	(0.523)	(0.635)	(0.621)
Gender	6.56e-05	-0.166***	—	—	—	—
(1=Male, 0=Female)	(0.0373)	(0.0241)	—	—	—	—
Age	-0.0137*	0.00164	-0.0161	0.00157	-0.0110	9.28e-05
	(0.00697)	(0.00663)	(0.0103)	(0.00803)	(0.00897)	(0.00702)
Number of Siblings	-0.0405	-0.0709**	-0.0174	-0.0699*	-0.0610**	-0.0702**
	(0.0292)	(0.0300)	(0.0330)	(0.0421)	(0.0284)	(0.0281)
Father's Years	0.0298***	0.0193***	0.0346***	0.0191***	0.0232***	0.0182***
of Schooling	(0.00550)	(0.00480)	(0.00660)	(0.00655)	(0.00816)	(0.00501)
Mother's Years	0.0135	0.0145**	0.00842	0.0196***	0.0193*	0.00826
of Schooling	(0.00835)	(0.00652)	(0.00982)	(0.00660)	(0.0116)	(0.00933)
Constant	-0.375**	0.0923	-0.427**	0.0140	-0.323	0.0205
	(0.182)	(0.184)	(0.196)	(0.187)	(0.230)	(0.190)
Observations	7,179	7,224	3,846	3,873	3,333	3,351
F statistic	13.89	14.22	11.52	11.96	13.45	13.60

Note: Table 5 presents the results of equation 3. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard errors clustered at the *hukou* province level are shown in parentheses.

It is unclear why migration affects math test scores but not reading test scores. One potential mechanism is that children's migration leads to increased parental guidance in schoolwork. Recall from the data section migrant children are much more likely to live with their fathers and mothers[27] and as a result, receive more hours of tutoring from their parents than do left-behind children. The additional amount of tutoring from parents is not easily made up for by other family members in the case of left-behind children. Given that migrant fathers on average have about one more year of education than mothers do, one plausible channel for this increase in math test performance is through the increased study time with parents, particularly with fathers.

To test whether this is one of the causal mechanisms, I run the 2SLS specification with different measures of weekly hours of tutoring that children receive as the second stage outcome variables. Table 6 presents the estimation results. The estimates are not statistically significant, indicating that children's migration does not significantly increase how much hour parents spent on helping out with schoolwork. This suggests that increased parents' supervision may not be the causal channel of children's improved math performance. However, I note that all measures of hours of tutoring are only recorded for children below age 16 in the children's survey. Therefore, it is plausible that for older children, the effects are a result of parents' increased tutoring. Given the limited data available to me, it is unclear whether this improvement of math scores should be credited to parents or better quality of schooling.

Table 6: Hours of Tutoring as A Result of Migration

Dependent Variable:	Hours of Tutoring (1)	Fathers' Tutoring Hours (2)	Mothers' Tutoring Hours (3)
Child Migrates	0.618	0.703	0.225

[27] 73% of migrant children co-reside with their fathers while only 19% of left-behind children do; 85% of migrant children co-reside with their mothers while only 62% of left-behind children do in the sample.

	(1.371)	(0.865)	(1.032)
Gender	0.312***	0.0672**	0.0234
(1=Male, 0=Female)	(0.0917)	(0.0276)	(0.0681)
Age	0.0878***	0.0205**	0.0613***
	(0.0256)	(0.0102)	(0.0180)
Number of Siblings	-0.160*	-0.0645	-0.0660
of Siblings	(0.0825)	(0.0396)	(0.0568)
Father's Years	-0.00388	0.0140	-0.0174
of Schooling	(0.0215)	(0.00905)	(0.0159)
Mother's Years	0.111***	-0.0156	0.100***
of Schooling	(0.0250)	(0.0138)	(0.0182)
Constant	-0.371	-0.153	-0.252
	(0.368)	(0.233)	(0.281)
Observations	10,460	10,460	10,460
F statistic	11.46	11.46	11.46

Note: Table 6 reports the second stage results of hours of tutoring received by children. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard errors clustered at the *hukou* province level are shown in parentheses. Regressions all contain survey wave fixed effects.

7. Robustness Checks

7.1. Manski Bound for Nonrandom Nonresponse

As discussed above, another source of endogeneity comes from the nonrandom missing pattern in survey test scores. Table 7 compares observations with missing test scores and observations with no missing test scores. Observations with missing test scores are more likely to be male and older migrant children and to have fewer years of education and less educated parents. These comparison results suggest that we cannot simply remove observations with missing responses. Although hypotheses can be made regarding the reasons behind the non-response such as underperformance at school, the exact underlying factors that drive the non-response cannot be pinpointed. Thus, bounding is utilized to capture the true effects in a reasonable range.

Table 7: Comparison Between Observations With and Without Nonresponse

	Math Test			Reading Test		
	Response	Non-Response	Difference	Response	Non-Response	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
Child Migrates	0.32	0.42	-0.100***	0.32	0.42	-0.102***
	(0.465)	(0.493)	(0.022)	(0.465)	(0.494)	(0.023)
Age	14.09	12.83	1.262***	14.10	12.56	1.547***

	(2.558)	(2.677)	(0.121)	(2.556)	(2.595)	(0.123)
Male	0.53	0.58	-0.048*	0.53	0.58	-0.044
	(0.499)	(0.494)	(0.022)	(0.499)	(0.495)	(0.024)
Number	1.24	1.31	-0.075	1.24	1.32	-0.086
of Siblings	(0.910)	(1.116)	(0.051)	(0.909)	(1.139)	(0.054)
Years	6.95	5.46	1.491***	6.96	5.19	1.771***
of Education	(2.540)	(2.543)	(0.115)	(2.538)	(2.434)	(0.116)
Drop out	0.05	0.09	-0.039**	0.05	0.09	-0.040**
	(0.226)	(0.290)	(0.013)	(0.226)	(0.292)	(0.014)
High School	0.47	0.44	0.028	0.47	0.45	0.019
Enrollment	(0.499)	(0.498)	(0.042)	(0.499)	(0.500)	(0.048)
Reading Test	0.08	-0.59	0.675***	0.06	-3.03	3.088***
/Math Test†	(0.953)	(1.221)	(0.164)	(0.983)	(0.443)	(0.199)
Father's Years	6.90	7.47	-0.565***	6.90	7.51	-0.608***
of Education	(3.680)	(3.519)	(0.161)	(3.670)	(3.619)	(0.173)
Mother's Years	5.04	6.24	-1.199***	5.05	6.32	-1.271***
of Education	(4.072)	(4.189)	(0.191)	(4.073)	(4.179)	(0.200)
Family Income	44264.12	58365.10	-1.4e+04***	44233.82	60180.45	-1.6e+04***
	(3.9e+04)	(4.5e+04)	(2044.041)	(3.9e+04)	(4.6e+04)	(2171.682)
N	5793	529	6322	5844	478	6322

Note: Table 6 compares observations with and without missing responses in math and reading test scores. †This row reports the other test score if the other test score is not missing. *** p<0.01, ** p<0.05, * p<0.1

Following Manski, sharp bounds are derived for the treatment effects under minimal assumptions. The first bound is derived assuming the worst-case scenario for treatment (migration), replacing missing values of migrant children with the lowest score observed in the migrant children group and replacing missing values of left-behind children with the highest scores observed in the left-behind children group. The second bound is derived assuming the best scenario for treatment, replacing missing values of migrant children with the highest scores achieved in the group and replacing missing values of left-behind children with the lowest scores achieved in the group. For the math test, the best-case and worst-case scenario estimates are [0.308, 4.319]; for the reading test, the best-case and worst-case scenario estimates are [-2.795, 1.249]. The fact that the math test scores bound is above zero indicates that even in the worst-case scenario where missing responses are replaced by the lowest scores obtained, there is still a non-zero positive effect on math test scores.

8. Discussion

What are the potential reasons behind the insignificant impact of migration on children's educational attainment despite the positive impact on children's academic performance? Given that the policy aims to improve the high school enrollment of migrant children and that it did positively impact children's migration with parents, it seems reasonable to expect that these migrant children would subsequently enroll in high schools at migration destinations. One possible explanation consistent with the results observed is that although children's migration to the cities does lead to them receive better compulsory education, in addition to the legislative or formally defined barriers to high school, other implicit constraints are still present and continue to prevent them from enrolling in high schools. For instance, the number of high schools in the cities may not have changed much after the policy announcement and high schools in urban regions may have capacity constraints in the number of students who can be admitted.[28] As a result, children may have migrated with the hope of attending urban high schools, but in the end, found themselves unable to compete with local students in getting into academic high schools. At the same time, migrant children may regard the option of attending nonselective vocational-technical schools as unappealing[29] and subsequently join the workforce early.

In addition, existing literature suggests that it is very challenging for many migrant children to get into quality public schools at migration destinations due to severe discrimination against migrant children in the enrollment process. There is a huge quality gap between public schools which few migrant children can get into and lower-quality private schools which many migrant

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[28] Based on annual data published by the Ministry of Education, the number of high schools and the number of students admitted to high school across the nation have declined overtime from 2008 to 2018. See figure 8 in the appendix.
[29] Existing literature suggests that the returns to education is the highest for college education in China (Churchill et al., 2018). Given that attendance of vocational high school means lower level of preparation for college admission tests (*gaokao*), the investment in vocational high school education may not be worthwhile given that vocational high school graduates are unlikely to perform well in *gaokao* and attend universities.

children end up attending (Chen and Feng, 2013). Therefore, it is plausible that the urban education available to migrant children during the 9-year compulsory education does not significantly reduce the performance gap between migrant children and local children, rendering competition with local children for academic high schools impossible.

Lastly, the coefficients for high school enrollment are positive in magnitude but given that I only have 2,759 observations above age 14 to examine high school enrollment, it is also possible that I simply do not have enough power to detect the effects that children's migration has on high school attendance. However, even if there is a lack of power for the high school enrollment outcome, years of education capture all observations' highest level of school attended and the null effects of migration on years of schooling makes it more plausible that children's migration does not have any significant impact on schooling attainment.

8.1. Limitations

There are several limitations in my study. Given that the instrument captures within-province policy exposure, removing observations with parents who migrate across provinces may have led to more precisely estimated results. However, CFPS lacks information on migrant parents' destinations. The survey also does not inquire about children's migration history so only migration that happened during the survey wave is recorded. Therefore, a child's current schooling outcomes could be impacted by their prior migration history, but the effects are mistakenly credited to contemporary migration status. If a substantial portion of the left-behind children had migration history and migration positively impacted their academic performance, then the current estimations of the impact of migration are underestimates.

When compiling the database of policy changes, I found that within-province policy variation is very common. Different counties and districts often have different requirements for migrant children's enrollment into local high schools. However, given the data available, I am unable to

exploit the within-province variation further, as the county information is not observed in the dataset due to confidentiality.

9. Conclusion

Over the past two decades, China's central government and regional governments have announced policies that aim to ameliorate the family separation issue experienced by many migrant families by opening up schooling access and making it easier for migrant workers to migrate with their children. Opening up urban high school enrollment is a major step in equalizing educational resources available to urban versus rural children. Compared to policies such as the implementation of free compulsory education or allowing college entrance exams to be taken outside of *hukou* registration, lifting restrictions high school enrollment restrictions attracts far less attention from the public and scholars. However, this policy reform is crucial in linking migrant children's completion of compulsory education to their aspirations for higher education. Before the reform, many migrant children chose to return to their hometown at around the age of attending middle school because they were unable to attend high schools at parents' migration destinations. The lack of quality high schools in rural areas means that it is more challenging for children of migrant workers to perform well in college entrance exams and attend highly regarded universities.

This thesis asks whether these policy reforms had an impact on children's migration status. Using a household-level panel dataset, this thesis uses an instrumental variables approach to identify the effect of children's migration status on their schooling outcomes. The first stage results show that provincial-level policy reforms are positively associated with an increase in children's migration rates. One additional year of reform increases children's likelihood of migration by 3.7 percentage points. Migrant families with primary school and middle school-aged boys are most likely to respond to the policy change and migrate with their children, reflecting the importance of sons' education to rural migrant families. Furthermore, I find that children's migration has a

statistically significant and positive impact on children's performance in math tests. However, migration does not have a significant impact on other schooling outcomes including high school enrollment, years of schooling obtained, dropout rate, and reading test scores. This result seems inconsistent with the explicit goal of the policy reform.

The lack of significant impacts on migrant children's duration of education signals that the policy reform itself is insufficient in addressing barriers to secondary education. Policymakers should pay attention to other obstacles that continue to impede migrant children's educational attainment and whether the current compulsory education provided to migrant children adequately prepares them for high school admission. The existing literature suggests that the returns to education in China are non-linear, with college education having the highest level of return (Churchill et al., 2018) and high school education mainly serving as a selection mechanism to college education (Li et al., 2012). Rural migrants' children's continued inability to access quality high school education greatly limits their ability to reap benefits from higher levels of education. Improving access to high school education for migrant workers' children would also mitigate the growing regional inequality in educational resources.

This thesis contributes to the current literature on child migration and human capital in China by examining a policy that is currently understudied and comparing educational outcomes as a result of migrant families' choices of migrating with or without their children. I conclude that the current policy that claims to tackle migrant children's lack of access to secondary education has largely failed to achieve its goal. Despite benefiting from academic improvement caused by migration with parents, children of migrant workers still face overbearing challenges in realizing higher education attainment beyond the compulsory education in urban regions of China.

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11. Appendix

Figure 8: Number of High Schools & Number of Admitted High School Students
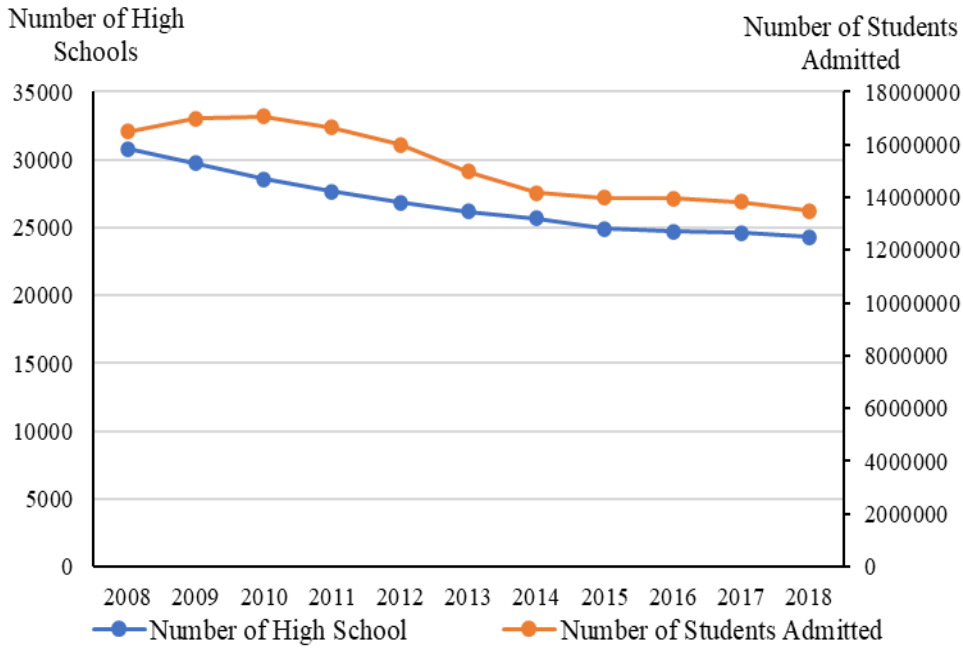
Note: This figure plots the number of high schools and number of students admitted to high schools (academic and vocational) at the national level. Data comes from Ministry of Education.

Table 9: Effect of Children's Migration on Education Outcomes Using Years-Since-Policy-Implementation

Dependent Variable:	Years of Schooling (1)	Math Test Scores (2)	Reading Test Scores (3)	High School Attendance (4)	Drop Out (5)
Child Migrates	0.425	1.266**	0.407	0.296	0.000292
	(0.481)	(0.495)	(0.597)	(0.238)	(0.0578)
Gender	-0.0897***	0.00162	-0.164***	-0.0670***	0.0122**
(1=Male, 0=Female)	(0.0274)	(0.0379)	(0.0233)	(0.0225)	(0.00586)
Age	0.741***	-0.0161**	-0.00140	0.181***	0.00791***
	(0.00852)	(0.00746)	(0.00753)	(0.00859)	(0.000943)
Number of Siblings	-0.110***	-0.0364	-0.0656**	-0.0483***	0.00901
	(0.0318)	(0.0345)	(0.0314)	(0.00981)	(0.00864)
Father's Years	0.0290***	0.0293***	0.0186***	0.0167***	-0.00414***
of Schooling	(0.00649)	(0.00551)	(0.00474)	(0.00308)	(0.000665)
Mother's Years	0.0166**	0.0112	0.0116	0.0135***	-0.00241***
of Schooling	(0.00815)	(0.00847)	(0.00781)	(0.00405)	(0.000922)
Constant	-3.378***	-0.410**	0.0466	-2.858***	-0.0306
	(0.167)	(0.200)	(0.196)	(0.103)	(0.0252)
Observations	12,621	7,179	7,224	2,759	8,242
F statistic	11.024	10.94	11.34	16.56	17.22

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Notes: Table 9 presents the second stage results using year-since-policy implementation as the instrument. ***
p<0.01, ** p<0.05, * p<0.1 Kleibergen-Paap rk Wald F statistics are reported in the last row. Robust standard
errors clustered at the *hukou* province level are shown in parentheses. Regressions all contain survey wave fixed
effects.

Table 10: Policy Reform Used in the Analysis

Province	Date	Document Title
Anhui	2008	"Notice of Anhui Province on Issues Concerning the 2008 Junior High School Graduation Examination and High School Enrollment Work"
Beijing	2012.12.29	"Notice of the General Office of the Beijing Municipal People's Government on forwarding the "Work Plan for the Children of Migrant Workers to Take the Entrance Examination in Beijing after Compulsory Education" formulated by the Municipal Education Commission and other four departments"
Chongqing	2016	"Notice of the Chongqing Municipal Education Commission on Printing and Distributing the Implementation Measures for the Enrollment Work of National Ordinary Colleges and Universities in Chongqing in 2016"
Fujian	2008	"Measures for the Administration of Student Status in Regular Junior High Schools in Fujian Province (Trial Implementation)"
Gansu	2012.12.31	"The Gansu Provincial Department of Education, the Gansu Provincial Development and Reform Commission, the Gansu Provincial Department of Public Security, and the Gansu Provincial Department of Human Resources and Social Security on Plans for Entrance Examinations for Children of Migrant Workers Post-Compulsory Education (Trial)"
Guangdong	2012.04.17	"Notice of the General Office of the People's Government of Guangdong Province on Issuing the Work Plan for Deepening the Comprehensive Reform of Equalization of Basic Public Services (2012-2014)"
Guangxi Zhuang Autonomous	2012.12.30	"Notice of the General Office of the People's Government of the Guangxi Zhuang Autonomous Region to forward the opinions of the Education Department of the Autonomous Region on the Opinions of the Children of Migrant Workers and Those Who Have Registered in Other Provinces to Take the Entrance Examination Post-Compulsory Education in Guangxi"
Guizhou	2014	"Notice of the Guizhou Provincial Department of Education on the 2014 Provincial Junior High School Graduates' Academic Examination and General High School Enrollment"
Hebei	2012.12.17	"The General Office of the People's Government of Hebei Province Forwards the notice of the Provincial Department of Education On the Implementation Plan for the Children of Migrant Workers in the City to Participate in the Entrance Examination Post-Compulsory Education"
Heilongjiang	2013.01.22	"Notice of the General Office of the Heilongjiang Provincial People's Government to forward the opinions of the Provincial Department of Education On the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education"
Henan	2012.12.31	"Notice of the General Office of the People's Government of Henan Province to Forward the Opinions of the Provincial Department of Education On the Implementation Plan for the Children of Migrant

		Workers in the City to Take in the Entrance Examination Post-Compulsory Education"
Hubei	2013.01.18	"Hubei Provincial Department of Education Implementation Measures for the Children of Migrant Workers in the City to Take the Entrance Examination in Our Province after Compulsory Education (Trial)"
Hunan	2012.12.24	"The General Office of the People's Government of Hunan Province Forwards the notice of the Provincial Department of Education On the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education"
Inner Mongolia	2015.09.08	"Opinions of the People's Government of Inner Mongolia Autonomous Region on Further Promoting the Reform of the Household Registration System"
Jiangsu	2010.08.26	"Notice of the Jiangsu Provincial Committee of the Communist Party of China and the People's Government of Jiangsu Province on Issuing the Outline of the Medium and Long-term Education Reform and Development Plan of Jiangsu Province (2010-2020)"
Jiangxi	2012.11.28	"The General Office of the People's Government of Jiangxi Province Forwards the Notice of the Provincial Department of Education On the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education"
Jilin	2010.10.28	"Notice of the General Office of the People's Government of Jilin Province to Forward the Opinions of the Provincial Department of Education on Furthering the Compulsory Education For Children of Migrant Workers in Cities"
Liaoning	2012.12.27	"The General Office of the People's Government of Liaoning Province Forwarded the Notice of the Provincial Department of Education On the Implementation plan (trial) for Children of Migrant Workers to Participate in the High school Entrance Examination and College Entrance Examination in Liaoning Province"
Shaanxi	2011.11.22	"Notice of the Shaanxi Provincial Department of Education on Distributing the Measures for Migrant Workers' Children to Take the Junior High School Graduation Examination and General High School Enrollment Examination after Compulsory Education (Trial)"
Shandong	2012.12.05	"Opinions of Shandong Provincial Department of Education, Shandong Provincial Development and Reform Commission, Shandong Provincial Department of Public Security, Shandong Provincial Department of Human Resources and Social Security On the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education"
Shanghai	2010	"2010 Plan for Vocational Schools in Shanghai to Recruit Children of Migrant Workers"
Shanxi	2012.11.17	"Notice of the General Office of the People's Government of Shanxi Province on Issuing the Twelfth Five-Year Plan for the Basic Public Service System of Shanxi Province"
Sichuan	2012.12.31	"Notice of the General Office of the People's Government of Sichuan Province on Forwarding the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education "

Tianjin	2005	"2005 Tianjin High School Admissions Guide"
Xinjiang	2013.01.26	"Notice of the Xinjiang Uygur Autonomous Region Education Department on Printing and Distributing the 2012 Work Summary of the Autonomous Region Education Working Committee and the Education Department and the Main Focus of Work in 2013"
Yunnan	2015.05.29	"Opinions of the People's Government of Yunnan Province on Further Promoting the Reform of the Household Registration System"
Zhejiang	2012.12.28	"Notice of the General Office of the People's Government of Zhejiang Province to Forward the Opinions of the Provincial Department of Education and Other Four Departments On the Implementation Plan for the Children of Migrant Workers in the City to Take in the Entrance Examination Post-Compulsory Education"

Notes: Table 10 presents the province-level policy reform regarding migrant children's high school enrollment. This table is constructed using information collected from China Law Info and cross-validated using partial information collected by prior literature. Due to space constraints, policy details and policy implementation dates are not included in this table. If needed, additional information can be provided upon request.