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ABSTRACT

The changing pattern of quality in China's rural schools across time and province is extracted from the differential labor market earnings of rural migrant workers. Variations in rates of return to years of schooling across migrant workers working in the same urban labor market but having different sites of basic education provide for direct estimation of provincial school quality. Corroborating this approach, these school quality estimates prove to be highly correlated with provincial cognitive skill test scores for the same demographic group. Returns to quality increase with economic development level of destination cities. Importantly, quality appears higher and provincial variation appears lower for younger cohorts, indicating at least partial effectiveness of more recent policies aimed at improving rural school quality across provinces. Surprisingly, however, provincial variations in quality are uncorrelated with teacher-student ratio or per student spending.

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1. Introduction

Existing research indicates that education quality in China is an important determinant of both individual labor earnings and overall economic growth.[1] But there are major gaps in research into Chinese school quality. Most of the existing evidence reflects urban education and labor markets, even though more than a third of the Chinese population remains in rural areas.[2] Moreover, the large migration streams from rural areas that feed urban industry (Tombe and Zhu (2019)) are comprised of individuals receiving education in their home province – making Chinese industry highly dependent on the quality of rural schools. By linking the earnings of migrants to their province of education, it is possible to estimate variations in rural school quality across China and to investigate the role of school funding and policy on quality.

We estimate the variation in school quality by linking variations in the labor market rates of returns to years of schooling to the provincial school locations of migrants. A major challenge in attributing differences in rates of returns to differences in schooling quality has been removing demand side influences from individual labor market wages (Speakman and Welch (2006)). We address this challenge by taking advantage of the dispersed pattern of rural migrants across urban labor markets. Conceptually, for an individual urban labor market (where demand factors are constant), we relate observed variations of rates of returns to schooling to the province of the migrants' schooling. Empirically, we pool all migrants to estimate returns specific to each home province in models that include city-by-year fixed effects for each labor market where migrants are employed. We interpret the relative return to a year of schooling for each of the home provinces of the rural migrants as reflecting the school quality of the home province. This provides the first credible evidence on variations in quality across time and provinces for China's rural schools.

The estimation, using data from the China Migrants Dynamic Survey (CMDS), is refined by focusing on inter-provincial rural migrants who had completed only basic education (i.e., primary through high school).[3] These sampling choices are important elements of identifying

[1] Hanushek, Wang, and Zhang (2025), Hanushek and Kimko (2000), Hanushek and Woessmann (2012).
[2] According to the 2020 Chinese Census, 55% of the Chinese population has rural Hukou, of which 36% lives in rural areas and 19% in urban areas.
[3] We subsequently provide a comparison of economic outcomes for intra-province and inter-province migrants.

provincial school quality. Focusing on inter-provincial migrants allows us to separate the school quality of the home province from the demand side of the local labor markets. Focusing on basic education allows us to know quite precisely where each migrant was educated, because rural migrant workers invariably received basic education in their Hukou province (the province of their permanent residency).[4] In contrast, college-educated individuals may attend college anywhere in the country, thus obscuring where the various components of schooling were provided. Furthermore, focusing on rural migrant workers with only basic education minimizes confounding effects from variations in the family background because migrants generally come from families of similar backgrounds – their parents are farmers and poorly educated.

Some sample selection issues that potentially confound the estimation of school quality do remain, but we can control for them in the estimation with observable data. First, provinces with higher-quality schools may promote more students to college, resulting in lower-ability individuals observed with only basic education. We address this concern by controlling for the percentage of adults with a college degree or above from each Hukou province (Hanushek and Zhang (2009)), assuming that college attendance is correlated with ability through the Gaokao. Second, inter-provincial migrants may differ systematically in unobserved characteristics that may also be related to their earnings abilities in the destination labor market (Borjas (1987)). We address this issue by controlling for variables that may affect both the pattern of migration decisions and the labor market outcomes, including the distance between destination city and origin province, the difference in per capita GDP between destination city and origin province, and the social network intensity in the destination city of migrants (Martellini, Schoellman, and Sockin (2024); Lucas (1997); Matsuda and Nomura (2024; Munshi (2003)). With these selection corrections, we believe our estimated rates of returns to schooling plausibly reflect the quality of rural schools across Chinese provinces.

A startling result of the estimation is the low return to schooling in rural China. We find the Mincer returns to Hukou province basic education for inter-provincial migrants range from 1.6 to 3.1 percent for each additional year of schooling. These estimates are noticeably below those

[4] China's Hukou system registers the location of a household's permanent residency and is directly linked to a variety of social programs including schooling. Importantly, children of a migrant are generally expected to receive their schooling in the migrant's Hukou province, which does not generally change for sampled workers after migration to a different province. We use the terms Hukou province, home province, and origin province interchangeably in this paper.

previously found for China and for other countries (Zhang et al. (2005), Ding, Yang, and Ha (2013), Psacharopoulos and Patrinos (2018)). Our analytic interest in variations in school quality, however, called for a sample different from those used in virtually all other research estimating returns to schooling. Other studies commonly combine basic education with higher education and generally focus on urban workers.[5] Our new estimates, however, are readily reconciled with those from other data sets and other sample definitions. Importantly, almost all prior estimates of returns for rural non-migrants are much smaller than estimates for urban labor markets and for individuals with higher education.[6] Given the rapid expansion of the Chinese education system and the transformation of the Chinse economy since the early 2000s (Hanushek, Wang, and Zhang (2025)), it appears that the option value of basic education as a prerequisite for college attendance is very important.

The results are robust to controlling for selection in education attainment and selection in migration and are not driven by migrants of different Hukou provinces following distinct patterns of work in different occupations or industries. The returns are highly correlated (0.49) with cognitive skill test scores calculated for rural residents of the same age group from the China Family Panel Studies (CFPS) 2014, suggesting a close association between the returns and the human capital level. The returns to schooling are significantly higher when migrants work in economically more developed cities than when they work in economically less developed cities. The returns in different types of cities of migrants from the same Hukou provinces are highly correlated (greater than 0.7), suggesting fundamental differences in schooling quality by Hukou provinces.

The returns to schooling are higher for the younger cohort (born between 1986 and 2001) than for the older cohort (born between 1951 and 1985) in all but two Hukou provinces. Importantly, the cross-province variation in the returns is smaller for the younger cohort. While the returns for the two cohorts are highly correlated at 0.72, the coefficient of variation of 0.26 for the older cohort falls to 0.12 for the younger. These estimates indicate improved quality of basic education in all provinces and a convergence of basic education quality across provinces.

[5] Low participation in formal labor markets in rural areas lead to potentially severe selection effects if rural areas are sampled.

[6] De Brauw and Rozelle (2008) and Liu and Zhang (2013) provide reviews and reconciliations of prior analyses of Mincer rates of return for rural China. These reviews of labor market outcomes during earlier times identify an upward trend in returns to schooling, consistent with our more recent estimates.

Although less certain, similar patterns hold when we subdivide the younger cohort more finely, suggesting continued improvements and convergence in the overall education quality in more recent years.

Our quality estimates allow us to provide basic descriptive evidence about the relationship between school quality and school resources. Basic education is primarily financed and administered by provincial and county governments, and the large cross-province disparities in school resources and governance may contribute to the still-sizable remaining variation in school quality. We relate the provincial school quality measures to provincial inputs for rural schools during the time when the migrant workers of the younger cohort attended school.[7] Quality is not systematically correlated with teacher-student ratio, per student total spending, or per student spending on personnel, current operations, and capital. It is associated with items that perhaps characterize aspects of the province's historic support for schools – number of books per student, area of school buildings per student, and (negatively) area of unsafe school buildings per student. Overall, however, these results suggest that current school spending measures are not good proxies for what schools actually do to raise student earnings and that much of the spending is not put to effective use.

This research extends two strands of literature. First, the general research pioneered by Card and Krueger (1992) that uses returns to schooling in the labor market to infer school quality has struggled with a variety of identification and measurement issues but has established the overall perspective of how school quality relates to labor market returns.[8] Our research design effectively overcomes the historic problems of this approach by comparing individuals working in the same urban labor market but educated in different provinces and provides credible estimates of rural school quality for Chinese provinces.

Second, because virtually all prior research focuses on urban residents and employs samples

[7] The 2001 "Decision of the State Council on the Reform and Development of Basic Education" (https://www.gov.cn/gongbao/content/2001/content_60920.htm) recommended for the first time that the host city government be responsible for the education of migrant children. This was not strictly enforced until 2016 when the State Council issued "Opinions on Coordinating and Promoting the Reform and Development of Integrated Urban and rural Compulsory Education in County Areas" (http://www.gov.cn/zhengce/content/2016-07/11/content_5090298.htm), which forbade host city public schools from charging migrant children any extra fees beyond those charged to local student.

[8] Various critiques have included concerns about confounding effects of labor market institutions, of varying family background, and of assuming place of schooling to be the same as place of birth. Concerns also include linking returns to schooling for all education levels, including college education, to resources at basic education levels. See Speakman and Welch (2006), Hanushek, Rivkin, and Taylor (1996).

containing all levels of education, the picture of Chinese labor markets has been both incomplete and biased. The large number of rural migrants employed in the industrial and service sectors in urban areas implies that understanding how their education contributes to earnings is essential for a complete description of the Chinese labor market. Additionally, Chinese studies commonly link variations in returns of education to changes in the demand side factors, such as marketization reforms of the urban labor market (Zhang et al. (2005)), but seldom consider the fundamental role played by the supply side. Our investigation of the quality of schools of migrants complements this existing demand side literature.

2. Data

We estimate labor market rates of returns to schooling of migrant workers from the China Migrants Dynamic Survey (CMDS) data for 2011-2017. CMDS is a large-scale survey conducted by the National Health Commission annually since 2009 and has an average annual sample size of approximately 180,000 individuals. It employs a probability-proportionate-to-size (PPS) sampling method and covers over 1,800 counties with a large migrant population in all 31 Chinese provinces. The survey provides comprehensive information about migrants, including basic demographic characteristics such as education, gender, age, marital status, and Hukou status along with labor market details such as current city of work and residence, employment type, occupation, industry, weekly working hours, and monthly earnings. We focus on the 2011-2017 waves because information on Hukou province is not available in earlier waves and data for later waves are not yet available.

For the empirical analysis, we restrict the sample to full-time employees aged 16-59 with positive monthly wages.[9] For identification of provincial school quality, we focus on inter-provincial rural migrants who had only completed basic education (primary through high school). By looking at migrants who work in a different province from where they attended school, we can separate the school quality of the home province from the demand side of the local labor markets. For basic education, Hukou province is a very precise indicator of where

[9] Individuals with monthly wages exceeding the 99th percentile each year are excluded from the sample. Monthly wages are deflated with CPI to constant 2010 Yuan. Full-time employees are defined as those working more than 24 hours per week. Hours information is not available in CMDS 2014; however, for all other waves, 98.14% of employees with positive monthly wages, aged 16-59, and completing only basic education are full-time employed. Thus, for CMDS 2014 we classify all employees with the same characteristics as full-time employees.

they were educated, but this is not the case for college-educated individuals who may attend college anywhere in the country. Furthermore, any contamination of differential family background is minimized for the rural sample, because the migrants most often come from families where their parents are farmers and poorly educated. We discuss in detail the remaining sample selection issues that may potentially confound the estimation of school quality in the next section.

We keep migrants from the 24 Hukou provinces with at least 500 migrants meeting the above criteria. These restrictions result in a baseline sample of 233,864 inter-provincial migrants for the 2011-2017 waves. Table 1 reports summary statistics of the main variables. Columns 1, 2, and 3 show the summary statistics for all migrants, intra-provincial migrants, and inter-provincial migrants respectively. Column 4 presents the differences between inter- and intra-provincial migrants. Inter-provincial migrants account for close to 60% of all migrants. The average age of inter-provincial migrants is 32.58 years, slightly older than that of intra-provincial migrants. Inter-provincial migrants receive an average of 9.16 years of education, slightly lower than the 9.55 years attained by intra-provincial migrants.[10] More specifically, inter-provincial migrants are more likely to have only primary or middle school education, with a smaller share attaining high school education compared to intra-provincial migrants.[11] However, their average monthly wage is 2751.08 Yuan, 336.72 Yuan more than that earned by intra-provincial migrants. Additionally, inter-provincial migrants are more likely to be male and married than their intra-provincial counterparts.

In the second-stage analysis, we relate provincial school quality estimates to provincial school inputs for rural schools. School input data come from the China Education Finance Statistics Yearbook (CEFSY) for 1993-2017, which contains basic information on schools such as number of teachers and students, number of library books, size of school buildings, and school spending on personnel, current operations, and capital. We aggregate county-level input data for rural schools to the provincial level to match with estimation results from CMDS.

[10] Since CMDS only provides information on individuals' education levels, we calculate years of schooling based on the duration of each education stage in China; i.e., 6 years, 3 years, and 3 years for primary, middle and high school, respectively.
[11] Educational attainment by province is depicted in Appendix Figure A1.

3. Empirical Model

We estimate rates of returns to schooling for each Hukou province in the following generalized Mincer equation:

$$lnY_{ijct} = \beta_0 + \beta_1 \times edu_{ijct} + \sum_{j=2}^{24} \beta_j \times edu_{ijct} \times I(hkprov = j) + \Gamma X_{ijct} + \gamma_{ct} + \varepsilon_{ijct}, \quad (1)$$

where lnY_{ijct} is the natural logarithm of monthly wages for individual i, from Hukou province j, currently employed in destination city c, and surveyed in year t. edu_{ijct} denotes years of schooling. $I(hkprov = j)$ is an indicator variable equal to 1 if the Hukou province is j, with the omitted category being Hebei province. X_{ijct} represents a set of individual-level control variables, including gender (1 for male), potential experience (= age - years of schooling – 6) and its square, marital status (1 for married), and ethnicity (1 for Han). γ_{ct} is a vector of city-by-year fixed effects. ε_{ijct} is the stochastic error term.

The coefficients of interest are β_j $(j = 1, \dots, 24)$. β_1 reflects the rate of returns to years of schooling for rural migrants from Hebei, the omitted province, and β_j $(j = 2, \dots, 24)$ is the difference in rate of returns between migrants from Hebei province and those from province j. r_j, the rate of return to schooling for Hukou province j, is calculated as:

$$r_j = \begin{cases} \beta_1, j = 1 \\ \beta_1 + \beta_j, j = 2, \dots, 24 \end{cases}. \quad (2)$$

To interpret r_j as school quality of home province j, we must separate the influences of the supply and demand factors on wages. Our sample includes only inter-provincial migrants who, due to China's Hukou restrictions, receive basic education in their home province.[12] Controlling for employment location with city-by-year fixed effects essentially holds labor market demand factors constant and enables us to compare how rates of returns differ by migrants' province of schooling. We interpret the variation in these estimates as reflecting the variation in school quality of the migrants' home provinces.

Restricting the sample by education level and migration status inevitably raises the

[12] While the vast majority of individuals in our analysis sample migrate for employment purposes after completing basic education at their Hukou counties, some migrate earlier for family accompaniment, marriage, demolition-induced relocation, education opportunities, birth-related relocation, and other reasons. Nevertheless, only 2.1%, 2.6%, and 3.8% of migrants left their Hukou counties for these reasons before the age of 12, 15, and 18 respectively, the normal ages for completing primary, middle, and high school education.

possibility of bias due to sample selection. We introduce a set of added controls to address the primary selection concerns. First, provinces with higher-quality schools may promote more students to college. If the distribution of the individual innate ability is similar across provinces and individuals with higher innate abilities are more likely to go to college, individuals stopping with only basic education will have lower average ability in provinces with a high rate of college attendance, leading to underestimation of rates of returns to schooling. The opposite is true for provinces with lower-quality schools. To address this selection bias, we calculate the share of individuals from each Hukou province aged 16-59 with a rural Hukou who complete a college education or above from the 2015 Mini-Census and include it in the regression to control for the unobserved ability of the sample of individuals under study.[13]

Second, inter-provincial migrants may differ systematically in unobserved characteristics that may also be related to their earnings abilities in the destination labor market. We address this issue by controlling for variables that may affect both the migration decision and the labor market outcome including the distance between destination city and Hukou province, the difference in per capita GDP between destination city and Hukou province, and the social network intensity in the destination city of migrants from the same origin province. Migrants who travel longer distance have to overcome higher cost of migration and are likely to be more capable and earn a higher income in the destination city. Individuals migrating to places that are economically more developed than their hometown may face higher labor market risks in the destination city; for example, their skills may not be portable across locations and may be unfit for the destination economy (Martellini, Schoellman, and Sockin (2024)). Therefore, those who eventually migrate may possess larger comparative advantage in the destination city and hence command higher earnings. Finally, stronger social networks make it easier for migrants to adapt in the destination city; thus individuals that choose to migrate to these cities may have lower abilities and lower earnings. Meanwhile, stronger social networks may facilitate job search and lead to higher earnings. The total effect of social networks on wages is uncertain (Lucas (1997); Munshi (2003); Matsuda and Nomura (2024)).

In the second stage of the empirical analysis, we explore the relationship between rates of return to schooling and various measures of inputs to rural schools in the Hukou provinces. The empirical specification is:

[13] College shares for each province are reported in column 1 of Appendix Table A1.

$$r_j = \alpha_0 + bQ_j + \eta_j, \quad (3)$$

where Q_j represents the rural school inputs in province j. η_j captures all the unmeasured factors related to rates of return to schooling. Because the rates of return to schooling r_j are estimated values derived from Eq. 1 rather than true values, an additional error term is introduced in Eq. 3 due to sampling error, expressed as $\hat{r}_j = r_j + \mu_j$. Consequently, the regression becomes:

$$\hat{r}_j = \alpha_0 + bQ_j + \eta_j + \mu_j. \quad (4)$$

Because the sampling variance of the estimated rates of return to schooling differ across provinces, μ_j is heteroskedastic. To address this heteroskedasticity problem, we estimate Eq. 4 using weighted least squares, where each observation is weighted by the inverse of variance of $\hat{r}_j$, obtained from the estimation of Eq. 1.

4. Estimation of Rates of Returns to Schooling of Hukou Provinces

We begin with the baseline estimates for the entire inter-provincial migrant sample and validate the interpretation of provincial rates of return as indicators of school quality. We then show their robustness to the sample selection issues and investigate heterogeneity by cohort and by economic development level of destination cities.

4.1 Baseline estimates

The starting point is estimation of rates of return to years of basic schooling for each Hukou province. The initial estimates mimic a standard Mincer earnings function and include controls for just basic demographic differences of individuals.[14] Because of selective school attainment, however, our preferred baseline model also includes the percentage in 2015 of college graduates aged 16-59 with rural Hukou for each Hukou province.

Figure 1 shows the variation in our baseline estimates of rural rates of return to years of basic schooling. The estimated rates of returns to schooling are surprisingly low. They range from 1.6% for Guangxi and Ningxia to 3.1% for Jiangsu, with an average of 2.1%. In other words, each additional year of basic education raises earnings of these migrants by 1.6-3.1

[14] This and all subsequent regressions control for potential experience and its square and indicators for gender, being married, and being of Han ethnicity. Complete control and provincial estimates for the alternative specifications from this section are found in Appendix Table A2.

percent. These estimates are noticeably smaller than the conventionally estimated 10 percent return to a year of schooling (Zhang et al. (2005), Ding, Yang, and Ha (2013), Psacharopoulos and Patrinos (2018)). Our low estimates largely significant sample differences from those used in virtually all other research estimating returns to schooling. Other studies, both internationally and within China, commonly include individuals completing all levels of schooling including higher education. Chinese studies additionally focus on those with local urban Hukou in part because of the prevalence of nonmarket employment in rural areas. Both sampling frames work to increase rates of return to schooling.

The limited earlier research estimating returns to schooling for rural non-migrants (for example, De Brauw and Rozelle (2008)) finds much smaller estimates than those for urban labor markets and for individuals with higher education. For further validation, we present estimates of rates of return to schooling using alternative data and samples in Section 6 below. Results are fully comparable to our baseline results. Given the rapid expansion of the Chinese education system and the transformation of the Chinse economy since the early 2000s (Hanushek, Wang, and Zhang (2025)), it appears that much of the value of a rural basic education lies in opening a path to college attendance, particularly given the restricted employment opportunities of rural migrants in urban labor markets.

Because of focusing on primary and secondary schools, our baseline estimates were adjusted for college attendance in each Hukou province. If the more skilled people go on to college (as a result of the national Gaokao testing system), the estimated returns of those with just basic education would be expected to be biased downward in provinces with a large proportion of college graduates if selection is not considered. This bias is readily seen in Figure 2 that plots estimates of returns to schooling with and without the control for college attainment. Provinces with below median college completion such as Heilongjiang, Guizhou and Guangxi uniformly have uncontrolled estimates above those estimated with college completion controls, while the opposite is the case for provinces with above median college completion such as Shaanxi, Fujian, Zhejiang, and Jiangsu. The difference is larger for provinces with a larger share of college degree attainment, such as Zhejiang and Jiangsu (Appendix Table A2). Consistent with these estimates, the estimate on the college attainment control is negative and significant (column 1 of Table 2), indicating that migrants from provinces with a higher level of college attainment are on average of lower ability and hence have lower earnings.

This investigation also helps to validate our interpretation that the variations in rates of return to years of schooling represent underlying skill differences arising from differential school outcomes in each province. If moving to a different part of the skill distribution through college attendance shows up in the systematic differences between estimates with and without college selection, it provides a prima facie case for interpreting the pattern of these estimates as denoting school outcomes. This does not of course say anything about the mechanisms underlying the variations in school outcomes – be they school quality, differences in parental inputs, or fundamental ability differences. We present some information on this below, although this research design is not ideal for addressing those mechanism questions.

The rankings of estimated rates of returns to schooling are quite consistent with common perceptions of provinces' school quality, which can be seen clearly from the map in Figure 1.[15] While the two provinces on the eastern coast, Jiangsu and Zhejiang, show the highest rates of returns, several provinces in the central region, such as Hubei and Hunan, and in the western region, such as Shaanxi and Sichuan, also exhibit quite high returns. All of these provinces are traditionally identified as having high quality schools. At the other end of the spectrum, provinces showing low rates of returns, such as Guangxi, Ningxia in the west, and Heilongjiang in the northeast, are also commonly considered to have poor quality schools.[16]

Direct validation of the interpretation of these estimates as school outcomes comes from comparisons to scores on standardized assessments. The measurement of provincial averages of individual human capital with cognitive test scores is possible with the 2014 CFPS data. The CFPS provides nationally representative panel data; individuals in the sample were first surveyed in 2010 and followed up every other year. In 2014 it administered math and word tests to all individuals aged 10 or above to assess their cognitive ability.[17] Test questions are based on the national curriculum of the basic education.[18] Since curricula have changed over time and since

[15] Full regression estimates are found in Appendix Tables A2.

[16] Provinces are constantly ranked in various aspects of their school performance. For example, in the past several years, high school students from Zhejiang persistently won the largest number of gold medals in the National Olympiads, and students from Sichuan, Hunan, Hubei, and Jiangsu constantly made the top 10 or top 5, whereas Guangxi and Heilongjiang were invariably at the bottom (https://www.sohu.com/a/628454617_120927771); high-quality provinces also won the largest number of 2022 National Teaching Achievement Awards for Basic Education (http://www.moe.gov.cn/srcsite/A10/s7000/202307/t20230724_1070571.html).

[17] The tests were first administered in 2010, but scores in that year were right-censored.

[18] Math problems include addition, subtraction, multiplication, division, logarithms, trigonometric functions, sequence, permutation and combination, etc. In the word test, individuals are asked to read aloud Chinese characters presented to them. For both tests, questions are ordered from the easiest to the hardest, and the test score is assigned as the question number of the most difficult problem an individual has correctly answered.

what individuals learned in school may depreciate with age, we normalize test scores by age to obtain z-scores with a mean of zero and a standard deviation of one within each year of age.[19] We use the mean of the standardized math and word scores to proxy individual human capital level. The overall human capital level for each province is measured by the average score of rural individuals aged 16-59 with educational attainment ranging from primary to high school – restrictions that match our analytic sample definition. Individuals are matched to their province of residence at age 12 regardless of their current province of residence, assuming they receive basic education in the province of residence at age 12. The estimated rates of returns to schooling are highly correlated with test measures of the human capital level of home provinces. As illustrated in Figure 3, rates of returns to schooling are systematically related to the average cognitive test scores across home provinces; the correlation coefficient is 0.49 and is significantly different from zero.

In summary, while the magnitude of our estimated rates of returns to schooling is small, the estimates vary systematically with province test scores, lending confidence that our estimates capture meaningful school quality differences in the basic education received in home provinces.

It is useful to investigate potential mechanisms behind the estimated rates of returns. One mechanism is that higher levels of skills associated with better schooling open doors into particular well-paying occupations or industries, suggesting that estimated rates of returns potentially also capture industry or occupation premiums. When we estimate rates of returns to schooling from models controlling for a full set of industry and occupation indicators (separately and in combination) to address this sorting issue, we find the estimated returns across provinces virtually unchanged.[20] The explained variation in wages is only marginally increased (Appendix Table A2), and within-industry and within-occupation returns continue to exhibit the same pattern as in the baseline.[21] Thus, the sorting of individuals into jobs is not driving the variation

[19] Hanushek et al. (2025) show that skills tend to decline over time if not used consistently in the home or workplace. For migrants, it seems plausible that they are not using math or literacy skills frequently.

[20] Occupation and industry are identified essentially at the one-digit level. Industries include: Agriculture and mining; Electricity, gas & water; Manufacturing; Construction; Transport, storage, post and telecom & IT; Wholesale and retail trade and catering services; Finance and insurance; Real estate; Social services; Health, education, culture & research; and Party and Government organs and social organizations. Occupations include: Leading cadres; Professional and technical staff; Office workers; Service workers; Agricultural workers, and Manufacturing, transportation and construction workers. Migrants are highly concentrated in a few specific industries – 61.9% in manufacturing, transportation, and construction, 16.3% in wholesale, retail, and catering, and 11.1% in social services; similarly they are found in a few specific occupations – 53.9% as production workers in manufacturing, transportation, and construction, and 33.2% as service workers

[21] The correlation across provinces of baseline estimates with estimates conditioned on fixed effects are: industry

in rates of returns to schooling across provinces. It is, however, consistent with differential quality of schooling across provinces.

4.2 Robustness to selection in migration

One potential concern with our approach to identification of provincial school quality is that inter-provincial migrants may differ systematically in characteristics that may be related to their earnings abilities in the destination labor market. If these characteristics lead to distinct patterns of migration by underlying ability, biases could be introduced into our estimated rates of returns to schooling. We address this issue by controlling for selection factors that potentially affect both the migration decision and labor market outcomes.

We re-estimate Eq. 1 with measures of the costs and benefits to different migration streams and find that these factors do in fact interact with estimated migrant earnings (Table 2).[22] We first control for the distance between destination city and Hukou province (column 2); closer, less costly moves could induce lower-skilled migration. The estimate of the impact of distance (0.014) is significant, indicating that a 1,000-kilometer increase in distance is associated with a 1.4% increase in monthly wages; that is, migrants from farther-away provinces indeed have higher earnings abilities in order to compensate for the higher migration cost. In column 3, we control for the difference in per capita GDP between destination city and Hukou province; this is measured in the year before migration, assumed to be the time when the migration decision is made.[23] The positive and significant estimate indicates that larger GDP differences are associated with higher wages, which we interpret as reflecting that greater gaps in economic development call for more skilled migrants whose skills are better matched with the destination economy. We control for the size of social network, measured by the share of inter-provincial migrants from each Hukou province in all inter-provincial migrants in the destination city (based on the 2010 Population Census) in column 4. The negative and significant coefficient estimate suggests that, while a larger social network may help migrants adapt in the destination city and potentially lead to higher wages, it also lowers migration costs by providing migrants with greater support and

fixed effects (0.97), occupational fixed effects (0.98), and both (0.96).

[22] We present the full estimates of provincial rates of return in Appendix Table A3.

[23] For a very small number of observations (9,331, 4%), per capita GDP for the destination city is not available and is proxied by per capita GDP of the destination province. This is largely due to migrants who moved before 2000, when city-level statistics are not systematically available. The number of observations in columns 2 and 4 of Table 2 is smaller because per capita GDP data for Hainan and Tibet provinces are not available prior to 1990.

thereby attracting lower-ability individuals. The latter channel appears to dominate. Finally, in column 5, we control for all three variables simultaneously, and results remain unchanged qualitatively.

For our purposes, however, the important result is that the pattern and relative magnitude of provincial rates of return are unchanged by consideration of factors that influence the migration flows. The estimated provincial rates of return are in each instance correlated with the baseline estimates at greater than 0.99. Thus, while a variety of economic factors affect migration and the wages that are associated with migration, they do not affect our estimates to school quality in each of the rural provinces.

4.3 Heterogeneity by destination city development level

Chinese rural migrants generally are moving for better job opportunities and higher earnings. While the majority of inter-provincial migrants move to more economically developed regions, a small proportion moves to regions that are less developed. Individuals moving to less developed regions may have particular comparative advantages in the destination cities, and our estimated returns to schooling may be confounded by this unmeasured job matching quality.

We consider migrants in destination cities of different development levels separately. We divide cities into three groups based on their average per capita GDP during the 2011-2017 period. The first group consists of 212 cities with average per capita GDP below the national average; 11.36% of migrants work in these cities. For cities with average per capita GDP above the national average, we divide them roughly evenly into two group; the lower 50% consists of 62 cities with moderate per capita GDP and making up 18.09% of inter-provincial migrants, and the upper 50% includes 66 cities that have relatively high per capita GDP and are the destinations of the majority (70.56%) of inter-provincial migrant workers.[24] We estimate Eq. 1 with triple interactions of years of schooling, home province dummies, and destination city type dummies and plot the estimates of rates of returns to schooling for each destination city type in Figure 4.

Estimated rates of returns to schooling in general increase with the economic development level of the destination cities. Inter-provincial migrants from all but three home provinces receive

[24] Of the 340 destination cities, 11 lack per capita GDP information and are categorized as below-average GDP cities. These are county-level cities and destinations for only 0.82% of inter-provincial migrants in our sample.

higher rates of returns when working in moderate-income cities than in below-average income cities. Meanwhile, inter-provincial migrants from all provinces attain significantly higher rates of returns to schooling in high-income cities compared to the other two types of destination cities. We interpret this pattern as reflecting the much higher demand for less skilled workers in the high-income cities. Importantly, rates of returns in different types of destination cities of migrants from the same home provinces are highly correlated; the correlation coefficients are 0.73, 0.71, and 0.72 between low- and moderate-income cities, between moderate- and high-income cities, and between low- and high-income cities respectively. This strong correlation is reassuring and suggests fundamental differences in Hukou province schooling driving the estimates.

4.4 Heterogeneity by cohort

The Chinese central government is responsible for education policy-making, and overall education policies have undergone tremendous changes that are closely intertwined with contemporary social and economic policy changes at large. School experiences of migrants in our sample, born from 1951 to 2001, are inevitably affected by varying policies implemented across time. The oldest cohorts experienced large-scale school expansions during the Great Leap Forward in the late 1950s and school closures in the subsequent austerity in the early 1960s; subsequent cohorts suffered severe education interruptions during the Cultural Revolution of 1966-1976 and large-scale school closures in the late 1970s and early 1980s for funding shortages (Zhang (2018)). Following the promulgation of Compulsory Education Law of 1986 that mandated all children to receive 9 years of compulsory schooling, the basic education system was expanded and received more stable resources that substantially raised education attainment and human capital of younger generations (Appendix Figure A2). Rural schools, especially those in less-developed central and western regions, have been further strengthened since the early 2000s through sizable intergovernmental transfers from the central government.

Rates of return to schooling may differ not only by where but also by when individuals went to school because of secular change in school quality. To explore possible intertemporal quality variations we divide the full migrant sample into two groups. The older cohort comprises individuals born between 1951 and 1985, and the younger cohort those born between 1986 and 2001. This precise division is made to be compatible with the availability of school input data

used in the analysis of the next section. The younger cohort accounts for 38.4% of the full sample.

The estimated rates of return to schooling for the younger cohort are significantly higher than those for the older cohort for all Hukou provinces except Zhejiang and Guangdong (Figure 5); for these two provinces, intertemporal differences are insignificant. The returns to the two age cohorts are highly correlated at 0.72, but the flattened pattern across provinces indicates an equalization of school quality. The coefficient of variation falls from 0.26 for the older cohort to 0.12 for the younger cohort.

These estimates indicate improved quality of basic education in virtually all provinces and a convergence of basic education quality across provinces. Although noisily estimated, similar patterns hold when we further split the younger cohort into two groups (not shown), suggesting continued improvements and convergence in the overall education quality in more recent years.

5. School Inputs and School Quality

The prior estimates provide us with a clear picture of variations in rural school quality across provinces. Based on these, we can go deeper in describing the relationship between quality and overall school policies across the provinces. We focus on the younger cohort (1986-2001) because of availability of school input data.

5.1. Public finance of rural schools

While China's basic education policies are set by the central government, the Compulsory Education Law of 1986 established a decentralized system of financing and administration of basic education. Financial responsibility was initially delegated to village and township governments in rural areas and later to the county governments following the Rural Tax and Fee Reform in 2001.[25] Funding, however, now comes from all levels of government and varies across schools depending on various geographic and economic considerations.

[25] The 2001 Rural Tax and Fee Reform was designed to reduce the tax burden – both monetary and in-kind – of rural residents. It made adjustments to tax base and tax rate of the agricultural tax, eliminated rural slaughter tax, and abolished the compulsory labor requirements and fees on villagers for financing local public services including compulsory education and health care (State Council Notice on Launching the Pilot Program for Rural Tax and Fee Reform, URL: http://www.reformdata.org/2000/0302/6422.shtml). In conjunction with these changes, county governments became responsible for the administration and financing of rural compulsory education, and central and provincial governments significantly increased supports for rural schools through transfer payments.

To ensure a minimally adequate level of educational spending, the central government determines a benchmark level of per student spending for each schooling stage. Provinces may establish their own spending benchmarks, but they cannot be lower than the central government benchmark. Provincial benchmarks may vary across cities within a province and between rural and urban areas. Additionally, the 1995 Education Law of the People's Republic of China mandated that the educational appropriation should grow faster than regular fiscal revenue at all levels of government and per student spending should gradually increase.[26]

These requirements, however, may place a heavy burden on poor counties with limited fiscal capacities. To mitigate this problem, since the early 2000s, the central government has developed sophisticated transfer schemes favoring rural schools in the central and western regions (Ding, Lu, and Ye (2020)) and covering all three broad categories of school spending: personnel, current operations, and capital. Personnel spending, which accounts for about 70% of total spending at the basic education level in China, is primarily a shared responsibility between provincial and county governments. Provincial governments are required to subsidize less developed counties, while the central government also makes earmarked transfers to less developed provinces. Spending on both current operations and capital is a shared responsibility between the central and county governments. The central government is responsible for 80% of the current spending for counties in the western provinces and 60% in central provinces. Its share for counties in eastern provinces is contingent on the latter's fiscal capacity. The central government is responsible for 50% of the capital spending for counties in both the western and central provinces and none for counties in the eastern provinces. Once the central government's minimum spending requirements are satisfied, the benchmark per student spending level set by the provincial government and the actual spending level and growth rate determined by the county government are heavily influenced by the local economic development level and growth target and vary substantially across localities.

5.2 Rates of returns to schooling and rural school resources

We calculate school inputs for province j in two steps. First, we compute school inputs for

[26] This "two-growth" requirement was first stated in the 1985 Central Government Decision on Educational System Reform (https://edu.sh.gov.cn/jydd_zcwj_flfg/20101202/0015-jydd_264.html) and was reiterated in the 1995 Education Law of the People's Republic of China (http://www.law-lib.com/law/law_view.asp?id=11220). It was repeatedly emphasized in later national educational policies.

individuals of birth cohort c with education level e (primary, middle, and high school) in province j by taking the average of annual school inputs in province j during the years when they were at education stage e, as in the following equation:

$$inputs_{cej} = \frac{\sum_{t=start\ year\ of\ e}^{end\ year\ of\ e} inputs_{tj}}{schooling\ years\ in\ stage\ e}. \quad (5)$$

Since the estimated rates of returns to schooling reflect the returns to one additional year of schooling, we use average annual school inputs during one's highest and final stage of education as the measure of school inputs in Eq. 5.

Second, we aggregate the school inputs across cohorts and education levels into an overall measure for province j by computing a weighted average of school inputs for each cohort c with education level e, with the weight being the share of individuals in cohort c with education level e of all inter-provincial migrants of the younger cohort from Hukou province j. It is calculated as follows:

$$SI_j = \sum_c \sum_e q_{ce,j} \times inputs_{ce,j}, \quad (6)$$

where $q_{ce,j}$ is the weight, and $\sum_c \sum_e q_{ce,j} = 1$.

School input measures in the CEFSY 1993-2017 database – including number of teachers and staff, total spending, personnel spending, current spending, and capital spending – became available in 1993, the starting year of primary school for individuals born in 1986. Additional measures – including number of library books, area of school buildings, and area of unsafe school buildings – were made public in 1998, the final year of primary school of those born in 1986. We use their 1998 values for primary schools as a proxy for the period of 1993-1997, during which time the 1986-1990 cohorts were in primary school for at least one year. We use input data of rural schools for rural migrants with primary and middle school education. Since the CEFSY database does not distinguish between urban and rural high schools before 2007, we use the overall provincial inputs data of high schools for those with a high school education. This approximation is not too off the mark as the majority of high schools are located in the urban areas (cities and county seats). We calculate all school input variables on a per-student basis, and all monetary values are adjusted by CPI to constant 2010 Yuan.

With the exception of teacher-student ratio – defined as the ratio between the number of

teachers and staff and the number of students, the school input measures show reasonable variation across provinces (see Appendix Table A4). The limited variation in teacher-student ratios reflects the imposition by the Ministry of Education of strict requirements for the number of students and teachers and staff per classroom for schools at each basic education stage. The school input measures are highly correlated with the exception of teacher-student ratio and area of unsafe school buildings per student (Appendix Table A5).

Table 3 shows how school quality varies with school inputs for the 1986-2001 cohort. This exploratory analysis is, however, limited by relying on just the 24 provincial observations. Columns 1-8 considers each school input individually; column 9 includes all input measures simultaneously, where total spending per student is excluded because of multicollinearity. Spending variables are adjusted for cost of living across provinces by controlling for average monthly salary of individuals employed in government agencies and public institutions.[27]

School quality, as measured by provincial returns to schooling, is not significantly related to the various measures of current resources. Coefficient estimates on teacher-student ratio, total spending per student, and per student spending on personnel, current operations, and capital are positive but not significantly different from zero. These financial variables can be interpreted as summary measures of policy positions across provinces, but at least at the aggregate level they appear to explain little of the provincial differences in school quality.

School quality (rates of returns to schooling) is significantly positively associated with number of library books per student and area of school buildings pre student and significantly negatively correlated with area of unsafe school buildings per student. The contrast between the insignificance of current resources and the greater significance of physical surroundings and resources is striking. It is obviously difficult to think of this as identifying causal relationships. Instead, the latter elements likely indicate that the historical development and commitment to education in the province is important for quality.

In column 9, all school input measures jointly explain 18% of the variation in school quality across home provinces. With the high correlations between school input measures and the small number of observations, the general insignificance of the various individual factors is not surprising.

In summary, these results suggest that traditional measures of school inputs such as teacher-

[27] This information comes from the 2005 Mini-Census.

student ratio and per student spending are not good proxies for what schools actually do to raise student human capital levels and earnings and that spending is not generally being translated into student learning and skills.

6. Extensions and Supporting Analysis

The main estimates of rates of returns to schooling presented in the previous section are based on a sample restricted by education level, Hukou status, and migration status. This section reports additional estimation results using alternative samples and different data sets. Comparisons with these additional results put our main estimates in broader perspective.

6.1 Intra- and inter-province migrants

We first compare our main estimates for inter-provincial migrants with estimates for intra-provincial migrants using the same CMDS data. We estimate Eq. 1 with triple interactions of years of schooling, home province dummies, and migration status using the entire sample of rural migrants with only basic education (inter- or intra-province). One caveat however is that for intra-provincial migrants we are unable to separate the influences on wages of the labor market from that of Hukou province schooling quality. We do, however, expect returns for inter- and intra-province migrants from the same home provinces to be correlated since the provincial school quality applies to both groups.

The pattern of returns to schooling for intra- and inter-provincial migrants can be seen in Figure 6. For the majority of provinces, the returns to schooling are higher for intra-provincial migrants than for inter-provincial migrants. The lower returns for inter-provincial migrants appear counterintuitive, as they imply that migrants are moving longer distances to labor markets that nevertheless reward human capital less. This pattern can, however, be explained by differential selection of jobs.

Inter-provincial workers receive higher earnings but lower rewards for their education and skills; inter-provincial migrants on average earn 6.3% more per month than intra-provincial migrants. Differences in job selection between intra- and inter-provincial migrants is found in Figure 7 that provides the occupation distributions of intra- and inter- provincial migrants for the full migrant sample (Panel A) and for the separate education levels (Panels B, C, and D). At all education levels, more than 80% of all migrants are employed as either service sector workers or

production workers in manufacturing, transportation and construction. These are low-skilled jobs readily available to individuals with only basic education, but the mix differs by type of migrant. Regardless of education level, a significantly larger share of inter-provincial migrants – close to 20 percentage points – are employed as production workers, occupations that require more brawn than brains. In contrast, relatively more intra-provincial migrants are employed as workers in commercial and service industries, i.e., less brawn intensive jobs.

These estimates provide further evidence that rates of returns to schooling capture fundamental differences in the quality of rural schools of home provinces. Rates of returns for intra- and inter-provincial migrants from the same home provinces are highly correlated at 0.58. In addition, similar to inter-provincial migrants, rates of returns to schooling are also higher for the younger cohort of intra-provincial migrants than the older cohort (see Appendix Table A6).

6.2 Rates of return to schooling from alternative samples

Common estimates of rates of return to schooling from classical Mincer equations are invariably larger than those from our selected sample. We can, however, show how sampling leads to the differences by comparing the rates of return to schooling of individuals of different education levels, Hukou status, migration status, and time periods using alternative national data sets.

In addition to expanding on the CMDS data used for the main analysis, we employ three more data sets: the 2005 Mini-Census, the CFPS 2014, the Chinese Household Income Project (CHIP) 2013 and 2018. The 2005 Mini-Census is the only census that provides wage information. CHIP 2013 and CHIP 2018 are two cross-sectional data covering urban and rural residents and migrants; the surveys were conducted by the National Bureau of Statistics (NBS). All of these data are nationally representative and contain information on individuals' education, migration status, and labor market details including employment status and monthly wages. Furthermore, these data collectively span a period of more than a decade, thus providing an opportunity to look at how rates of returns to schooling evolve over time during a period of rapid expansion of the Chinese education system and transformation of the Chinese economy.

We estimate returns to years of schooling from different data sets for individuals with only basic education (Tables 4) and with all levels of education (Table 5). We separately look at individuals with urban and rural Hukou and within each by migration status.

First and foremost, nationwide estimates of rates of returns to schooling for rural inter-

provincial migrants with only basic education are comparable for CMDS 2011-2017, CFPS 2014, CHIP 2013, and CHIP 2018, ranging between 0.021 and 0.029 as reported in column 10 of Table 4 and statistically insignificantly different from each other. These plus our earlier estimates for provinces reveal clearly the low return on an additional year of schooling in the mid-2010s. Interestingly, the significantly larger estimate from the 2005 Mini-Census (0.054) suggests that the supply of low-skilled workers is outpacing its demand over this recent period of rapid Chinese development.

Rates of returns to schooling of rural migrants (both inter- and intra-provincial) estimated from all data sets are substantially higher than those of non-migrating rural residents (columns 7-10 of Table 4), suggesting serious misallocations of human capital of the rural population (Tombe and Zhu (2019)) Importantly, as late as 2018, more than half of the full-time employees of rural origin are non-migrants who have remained in the rural area. For the overall rural population and every subgroup, the rate of returns to schooling is much smaller in more recent years than in 2005.

Returns to schooling of urban residents estimated from different data sets do not exhibit systematic differences between migrants and non-migrants, consistent with the fact that substantially fewer of the urban population has migrated. Similar to the rural population, the returns decline substantially between the 2000s and the 2010s (left panel of Table 4). The urban population, regardless of migration status, has higher returns to schooling than rural migrants,[28] likely due to different quality of schooling in urban and rural areas and different occupation choices.

When we also consider individuals with a college education, we duplicate the magnitude of rates of return to schooling commonly found in the literature. The left panel of Table 5 reports estimates for the urban population, the subject of investigation in the vast majority of the literature on China. Estimates for the overall urban population (column 1) range from 0.105 in 2005 to around 0.08 in the mid-2010s, highly comparable to those in the literature. Employees with a college education account for about 40% of all urban employees in 2005, and this share increases to 53% in 2018, in line with the dramatic education expansion of the past two decades (Che and Zhang (2018)). Again, there are no systematic differences in rates of returns to education between migrants and non-migrants of urban origin.

[28] Estimates from the CFPS 2014 appear to be an exception, largely because of the small sample size.

Over time the rural population has increasingly obtained a college education, albeit at a slower pace than found for the urban population; those with a college education account for 2.3% and 15% of the total rural sample in 2005 and 2018 respectively. Therefore, while all estimated rates of returns reported for the rural population in Table 5 are higher than comparable estimates in Table 4, rural returns remain consistently below those for the urban population.

7. Conclusions

China's massive rural-to-urban migration during the past three decades has greatly improved the allocation of human capital and contributed to the overall economic development. Almost all of the rural migrant workers were educated back home in rural schools – a pattern largely repeated today, but we know very little about the quality of these schools. This paper extracts the quality of China's provincial rural schools from its influence on the labor market earnings of rural migrant workers.

We infer the quality of schooling in different Chinese provinces from the labor market rates of return to schooling of migrant workers who are schooled in different provinces but work in the same urban labor market. By restricting our sample to inter-provincial rural migrants with a basic education, we can remove demand-side influences on wages and can isolate influences of rural school quality of home provinces. We address potential sample selection issues by controlling for the college attainment rate in the home province and for various factors that may affect both individual migration decisions and labor market outcomes.

We find that the Mincer returns to home province basic education ranges from 0.016 for Guangxi and Ningxia to 0.031 for Jiangsu. While small in magnitude, the returns vary considerably across provinces and are highly correlated (0.49) with provincial cognitive skill test scores for the same demographic group. We find higher returns for migrants working in economically more developed cities, but returns for migrants from the same home province but working in different types of cities are highly correlated (greater than 0.7). These suggest that the returns to schooling capture fundamental differences in home provinces, most likely schooling quality. Our novel estimates, however, are validated by those from other data sets and other sample definitions. The small size of the estimate is likely an outcome of the rapid expansion of the Chinese education system in tandem with the slowdown of demand for unskilled workers during the recent transformation of the Chinese economy.

The returns are higher for the younger cohort (born in 1986-2001) than for the older cohort (born in 1951-1985). While the intertemporal correlation across provinces is high at 0.72, the coefficient of variation falls from 0.26 for the older cohort to 0.12 for the younger cohort. This indicates improved quality of basic education in all provinces and a convergence of quality across provinces.

We are able to link descriptively provincial school quality to school inputs for the younger cohort. Quality is not systematically associated with differences in current resources such as teacher-student ratio or per student spending. This indicates that traditional measures of school inputs are not good proxies for school quality and that much of the spending is not effectively used. Quality is significantly correlated with measures of the quantity and quality of school capital, which we interpret as proxying historic commitments to schooling. Further research is warranted to understand how to raise the efficacy of rural school inputs in improving school quality.

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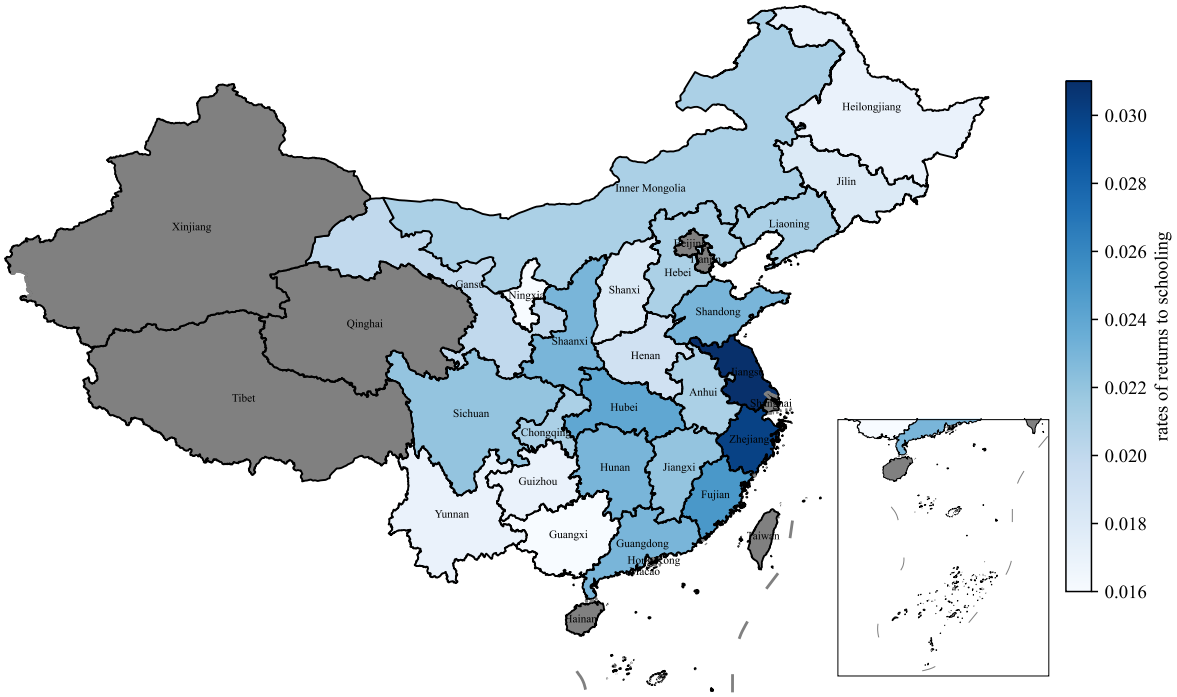
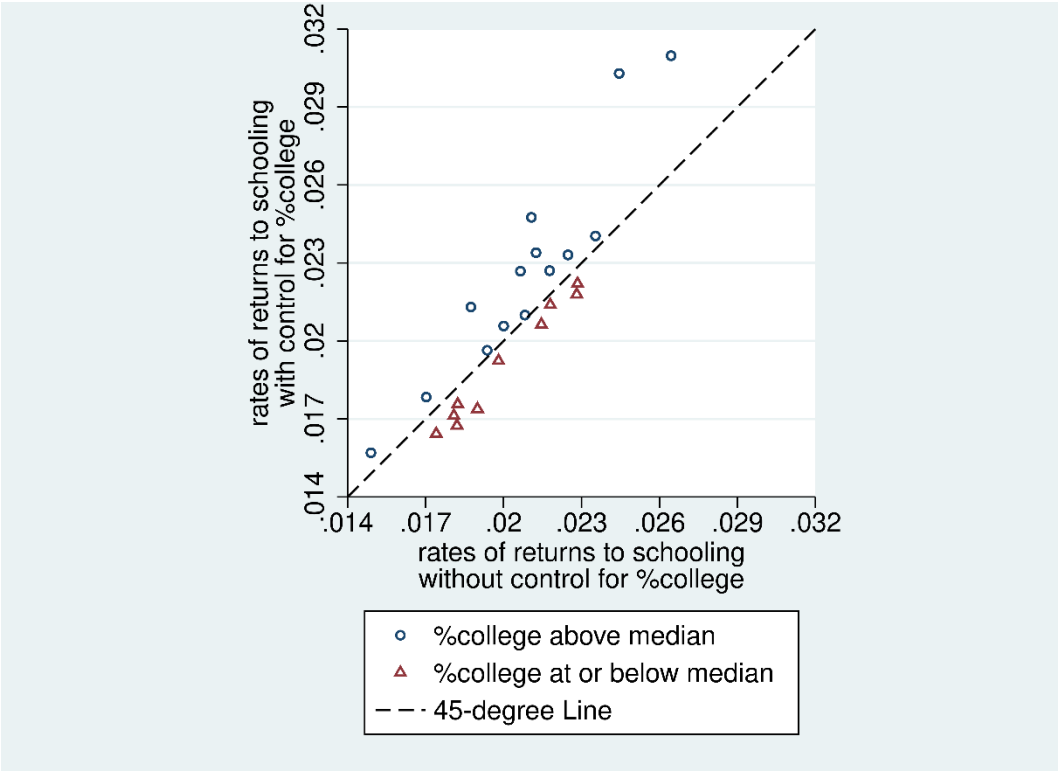
Figure 1 Rates of Returns to Schooling of 24 Major Hukou Provinces



Notes: Estimated rates of returns to schooling are based on Eq. 1, controlling for percentage of rural 16-59 population in home province with a college degree or above. Grey-shaded areas indicate provinces where data are unavailable. The base map of China complies with the national mapping standards reviewed by the Ministry of Natural Resources, China (GS (2024) 0650).

Figure 2 Rates of Returns to Schooling: Controlling vs. Not Controlling for Percentage of College Attainment

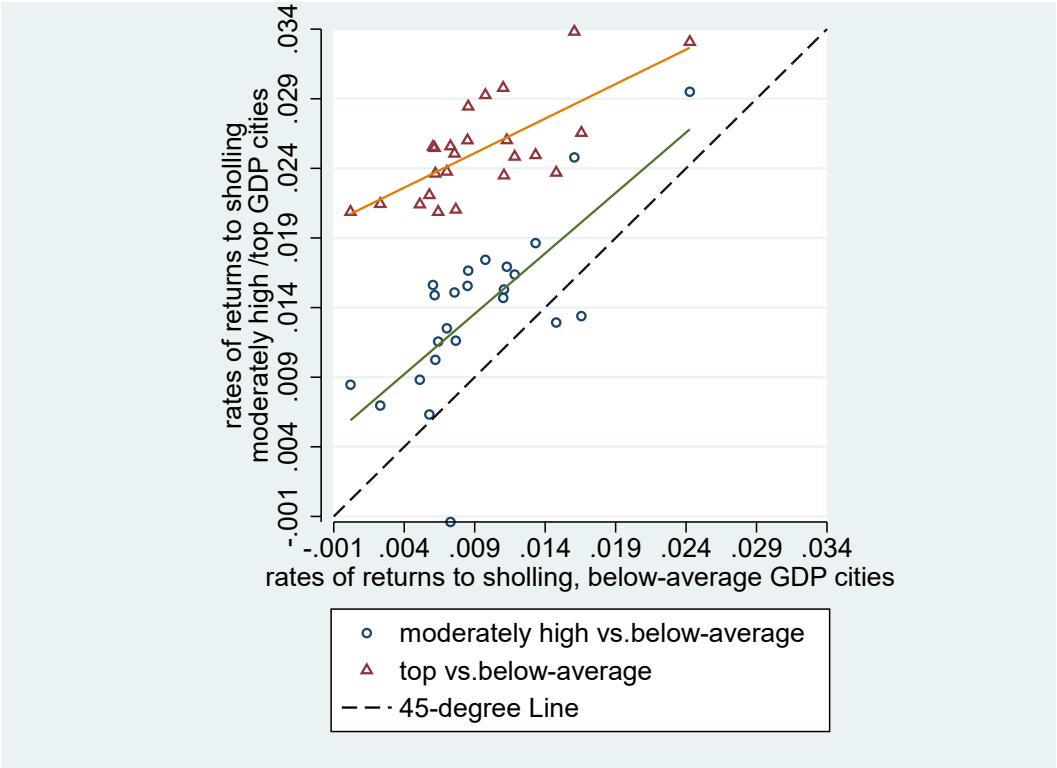


Notes: Estimated rates of returns to schooling are based on columns 1 and 2 of Appendix Table A2.

Figure 3 Rates of Returns to Schooling and Cognitive Test Scores

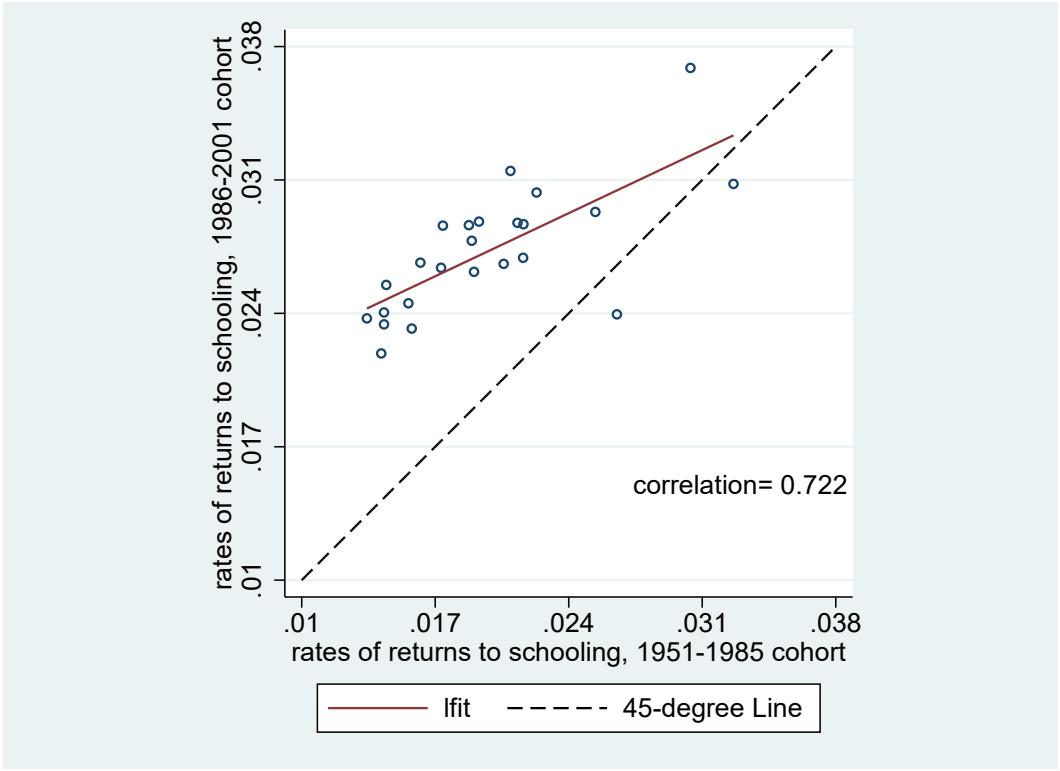
Notes: Estimated rates of returns to schooling are based on Eq. 1, controlling for percentage of rural 16-59 population in home province with a college degree or above. Test scores are from CFPS 2014. The average score of Hukou province is the average of the mean of standardized math and word test scores of rural individuals aged 16-59 with educational attainment between primary and high school, based on individuals' province of residence at age 12. Ningxia is dropped due to lack of test score information.

Figure 4 Rates of Returns to Schooling for Migrants Working in Cities of Different Development Levels



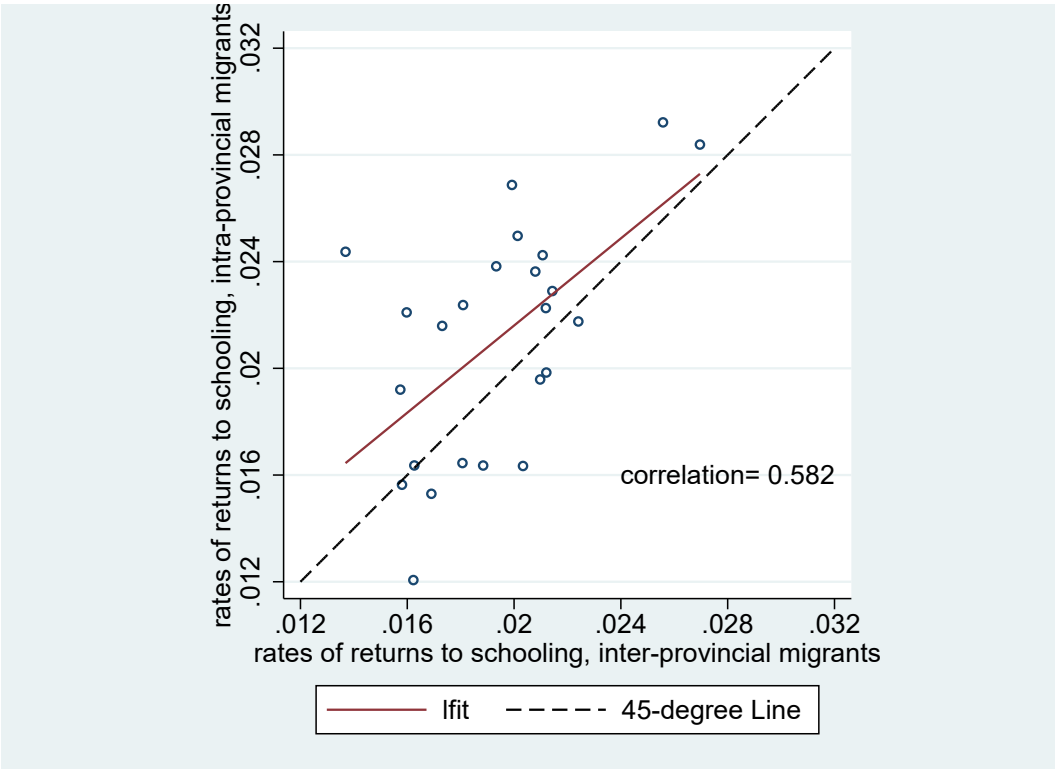
Notes: Estimated rates of returns to schooling are based on a regression with triple interactions of years of schooling, home province dummies, and destination city type dummies, controlling for percentage of rural 16-59 population in home province with a college degree or above. Correlation coefficients of estimated returns for migrants from the same home provinces are 0.73 between below-average and moderately high GDP cities, 0.71 between below-average and top GDP cities, and 0.72 between moderately high and top GDP cities.

Figure 5 Rates of Returns to Schooling for 1951-1985 and 1986-2001 Cohorts



Notes: Estimated rates of returns to schooling are based on a regression with triple interactions of years of schooling, home province dummies, and a cohort dummy, controlling for percentage of rural population aged 16-59 in home province with a college degree or above. The coefficient of variation of rates of returns to schooling is 0.26 for the 1951-1985 cohorts and 0.12 for the 1986-2001 cohorts.

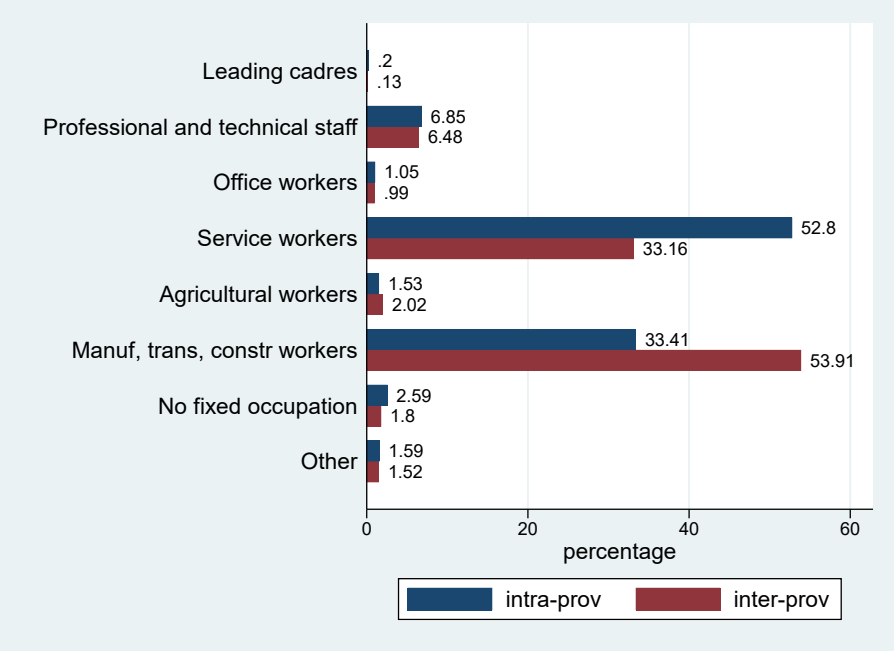
Figure 6 Rates of Returns to Schooling for Intra- and Inter-Provincial Migrants



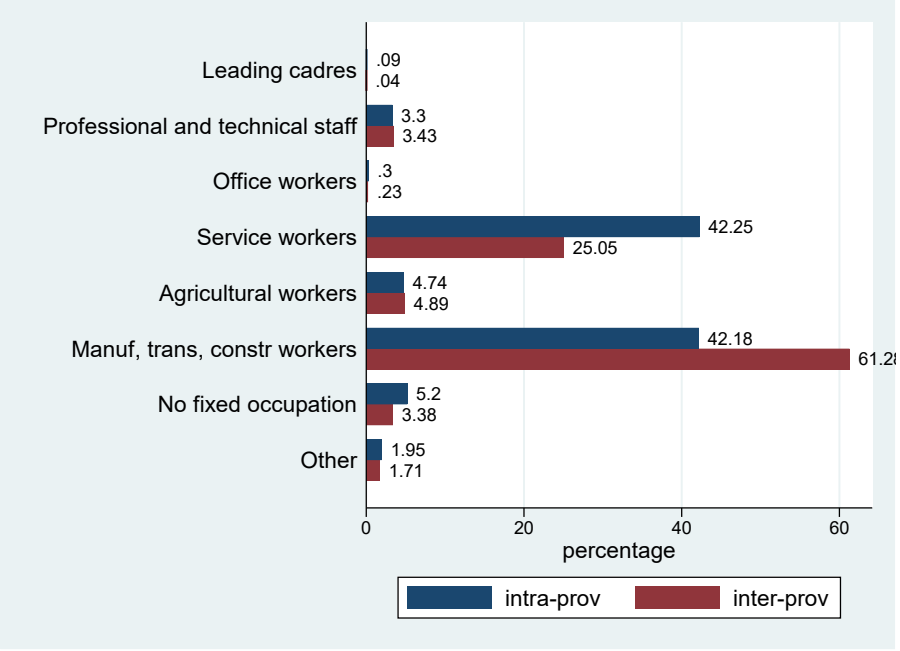
Notes: Estimated rates of returns to schooling are based on a regression with triple interactions of years of schooling, home province dummies, and a migration type dummy, controlling for percentage of rural population aged 16-59 in home province with a college degree or above. The coefficient of variation of rates of returns to schooling is 0.21 for intra-provincial migrants and 0.16 for inter-provincial migrants.

Figure 7 Occupation Distributions of Intra- and Inter-Provincial Migrants

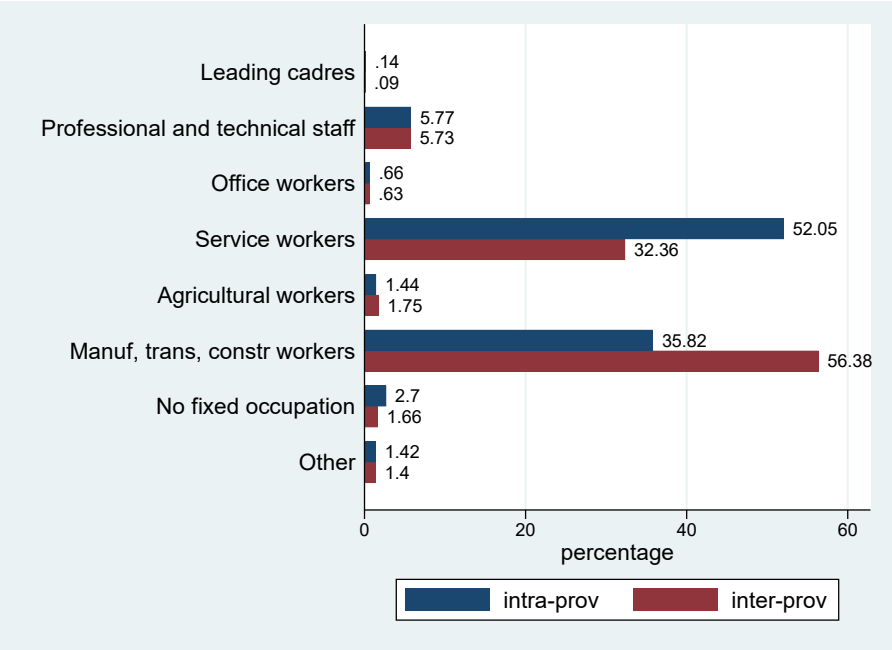
Panel A: Full-sample



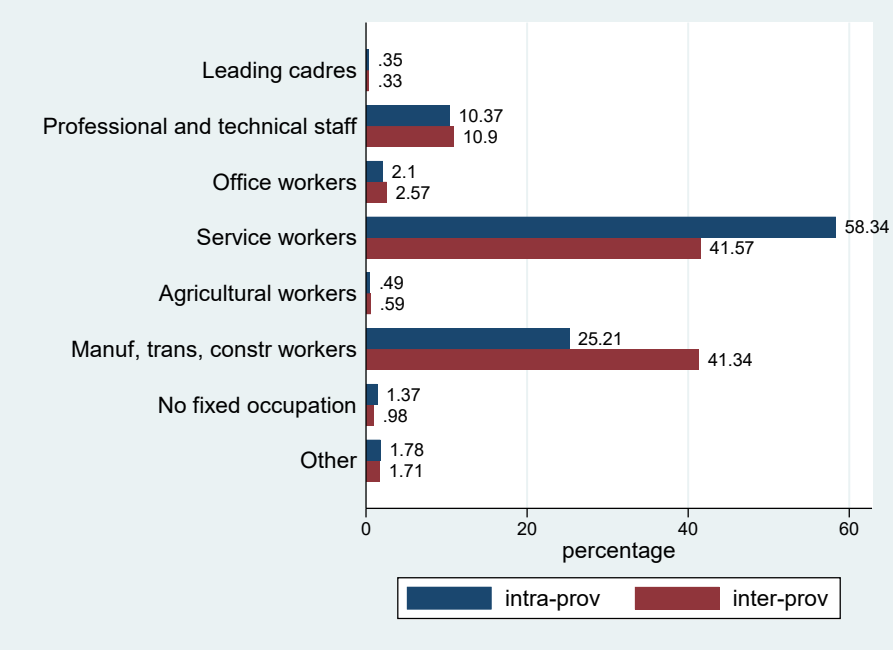
Panel B: Primary school



Panel C: Middle school



Panel D: High school



Notes: The full-sample in Panel A includes all full-time employed rural migrants aged 16–59 with educational attainment between primary and high school from the 24 major Hukou provinces. Panels B, C, and D show occupation distributions by educational attainment. The T-test statistics for Panel A indicate significant differences in the share of intra- and inter-provincial migrants across occupations (t=4.98 for leading cadres; t=4.67 for professional and technical staff; t=1.86 for office workers; t=128.41 for service workers; t=-11.50 for agricultural workers; t=-132.97 for manufacturing, transportation and construction workers; t=17.39 for no fixed occupation; t=1.74 for other).

.

Table 1 Summary Statistics

	Full migrant sample (1)	Intra-prov migrants (2)	Inter-prov migrants (3)	(3)-(2) Diff. (4)
Age	32.478	32.339	32.581	0.242***
	(9.653)	(9.560)	(9.720)	[7.924]
Potential experience	17.159	16.800	17.427	0.627***
	(10.409)	(10.323)	(10.466)	[19.051]
Years of schooling	9.325	9.547	9.159	-0.388***
	(1.856)	(1.840)	(1.850)	[-66.382]
Primary school	0.143	0.114	0.165	0.052***
	(0.350)	(0.317)	(0.371)	[46.619]
Middle school	0.606	0.591	0.617	0.026***
	(0.489)	(0.492)	(0.486)	[16.953]
High school	0.251	0.296	0.218	-0.078***
	(0.434)	(0.456)	(0.413)	[-56.850]
Monthly wage (Yuan)	2607.31	2414.36	2751.08	336.72***
	(1115.5)	(1090.8)	(1112.0)	[96.47]
Male	0.588	0.580	0.595	0.015***
	(0.492)	(0.494)	(0.491)	[9.747]
Rural Hukou	1.000	1.000	1.000	0.000
	(0.000)	(0.000)	(0.000)	\
Han	0.934	0.931	0.936	0.005***
	(0.249)	(0.254)	(0.245)	[6.538]
Married	0.700	0.687	0.709	0.022***
	(0.458)	(0.464)	(0.454)	[15.184]
Obs.	408,116	174,252	233,864	\

Notes: The full migrant sample in column 1 includes all full-time employed rural migrants aged 16–59 with educational attainment between primary and high school from the 24 Hukou provinces. Intra-provincial migrants in column 2 are individuals who migrate across counties but remain within the home province. Column 3 includes inter-provincial migrants. Monthly wages are deflated by CPI to constant 2010 Yuan. Potential experience=age-years of schooling-6. Primary school, middle school, high school, male, rural Hukou, Han, and married are dummy variables, each taking the value of 1 if the individual has primary, middle, or high school education, is male, holds rural Hukou, belongs to the Han ethnicity, and is married. Standard deviations are in parentheses. T-values are in brackets. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 2 Estimates on Variables Addressing Sample Selection

Dep var: ln(montly wage)	(1)	(2)	(3)	(4)	(5)
Share of college degree or above in 2015	-0.009***	-0.008***	-0.008***	-0.010***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Distance (1,000 km)		0.014***			0.007**
		(0.002)			(0.003)
Differences in GDP (10,000 Yuan)			0.003***		0.003***
			(0.001)		(0.001)
Share of home prov migrants in all migrants in destination city /10				-0.006***	-0.004***
				(0.001)	(0.001)
Destination city-year FE	YES	YES	YES	YES	YES
Obs.	233711	233711	233702	233711	233702
Adjusted R^2	0.256	0.257	0.256	0.257	0.257

Notes: The results in column 1 are drawn from column 2 of Appendix Table A2. The results in columns 2 to 5 are drawn from columns 1 to 4 of Appendix Table A3. All regressions control for gender, potential experience and its square, an indicator for being married, and an indicator for belonging to the Han ethnicity. Robust standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 3 School Inputs and Rates of Returns to Schooling, 1986-2001 Cohorts

	Dep. Var: rates of returns to schooling for the 1986-2001 cohorts								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total spending	0.013								
	(0.008)								
Personnel spending		0.021							0.017
		(0.013)							(0.028)
Current spending			0.029						-0.075
			(0.021)						(0.047)
Capital spending				0.174					0.153
				(0.116)					(0.155)
Number of teachers and staff					0.067				0.063
					(0.058)				(0.086)
Number of library books (÷100)						0.035**			0.016
						(0.013)			(0.019)
School buildings (÷10, m^2)							0.007**		0.006
							(0.003)		(0.005)
Unsafe school buildings (÷10, m^2)								-0.027*	-0.031*
								(0.013)	(0.015)
Cost of living	-0.023	-0.022	-0.006	-0.035					-0.019
	(0.044)	(0.045)	(0.040)	(0.052)					(0.060)
Constant	0.025***	0.025***	0.024***	0.029***	0.023***	0.022***	0.021***	0.028***	0.023**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.002)	(0.003)	(0.001)	(0.008)
Obs.	24	24	24	24	24	24	24	24	24
Adjusted R^2	0.056	0.050	0.029	0.040	0.015	0.204	0.163	0.122	0.179

Notes: All school input variables are defined and measured on a per-student basis. All monetary values are in 10,000 constant 2010 Yuan. The cost of living is measured by the average monthly salary of individuals employed in government agencies and public institutions, calculated from 2005 Mini-Census. Standard errors in parentheses are weighted by the inverse of the variance derived from the regression that generates the estimated rates of returns to schooling for each Hukou province (column 2 of Appendix Table A2).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 Rates of Returns to Schooling for Individuals with Basic Education, Various Databases

	Urban					Rural				
β_1	All	Non-mig	All mig	Intra-prov mig	Inter-prov mig	All	Non-mig	All mig	Intra-prov mig	Inter-prov mig
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mini-Census 2005	0.077***	0.078***	0.074***	0.081***	0.076***	0.036***	0.026***	0.055***	0.064***	0.054***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Obs.	151562	134753	16809	9298	7511	184820	103833	80987	18027	62960
CMDS 2011-2017			0.026***	0.025***	0.030***			0.021***	0.028***	0.024***
			(0.001)	(0.002)	(0.002)			(0.000)	(0.001)	(0.001)
Obs.			48458	26158	22300			419713	184663	235050
CFPS 2014	0.033***	0.030***	0.057**	0.068**	0.036	0.011	0.004	0.042***	0.050***	0.029
	(0.010)	(0.011)	(0.026)	(0.028)	(0.059)	(0.007)	(0.009)	(0.013)	(0.017)	(0.020)
Obs.	1704	1486	218	161	57	3302	2209	1093	623	470
CHIP 2013	0.045***	0.047***	0.040***	0.054***	0.027	0.007**	0.005	0.024***	0.028***	0.029***
	(0.005)	(0.006)	(0.008)	(0.009)	(0.023)	(0.003)	(0.004)	(0.004)	(0.006)	(0.006)
Obs.	4339	3204	1135	951	184	11836	6512	5324	2846	2478
CHIP 2018	0.026***	0.033***	0.012	0.017	0.011	0.001	0.004	0.011***	0.009**	0.021***
	(0.006)	(0.007)	(0.011)	(0.012)	(0.022)	(0.003)	(0.004)	(0.004)	(0.005)	(0.006)
Obs.	3635	2552	1083	864	219	12979	6559	6420	3541	2879

Notes: All samples consist of full-time employees aged 16 to 59, with educational attainment ranging from primary to high school. Table reports estimates of β_1 from the Mincer equation: $lnY_i = \beta_0 + \beta_1 edu_i + \Gamma X_i + \varepsilon_i$, where lnY_i is the natural logarithm of monthly wages for individual i, X_i includes gender (=1 if male), potential experience and its square, married status (=1 if married), and ethnicity (=1 if Han). Robust standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

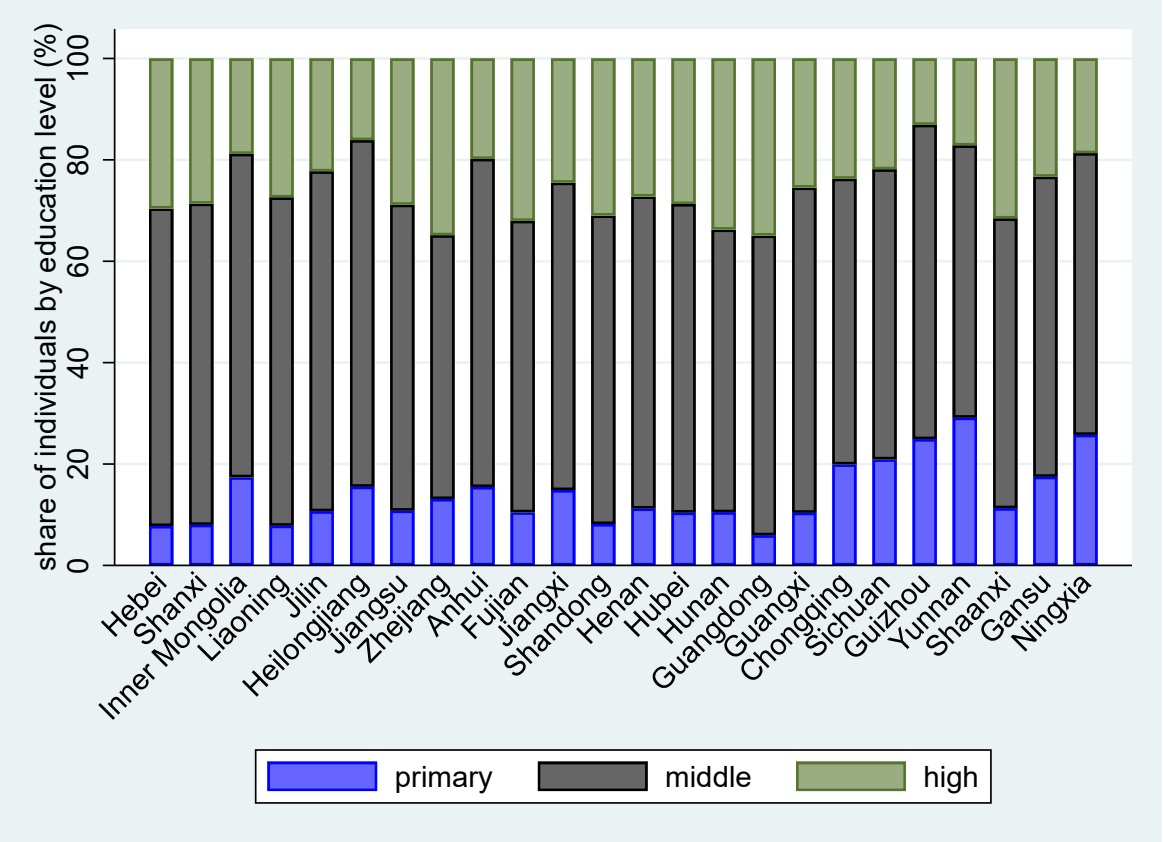
Table 5 Rates of Returns to Education for Individuals with All Levels of Education, Various Databases

	Urban					Rural				
β_1	All	Non-mig	All mig	Intra-prov mig	Inter-prov mig	All	Non-mig	All mig	Intra-prov mig	Inter-prov mig
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mini-Census 2005	0.105***	0.105***	0.115***	0.117***	0.125***	0.044***	0.034***	0.066***	0.073***	0.066***
	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Obs.	244223	214671	29552	17234	12318	189255	106189	83066	18682	64384
CMDS 2011-2017			0.069***	0.052***	0.078***			0.036***	0.042***	0.040***
			(0.001)	(0.001)	(0.001)			(0.000)	(0.000)	(0.000)
Obs.			99334	50460	48874			470238	214236	256002
CFPS 2014	0.073***	0.068***	0.093***	0.100***	0.081***	0.038***	0.032***	0.056***	0.047***	0.075***
	(0.005)	(0.006)	(0.014)	(0.017)	(0.028)	(0.006)	(0.007)	(0.009)	(0.012)	(0.015)
Obs.	2805	2342	463	350	113	3714	2457	1257	739	518
CHIP 2013	0.080***	0.081***	0.078***	0.089***	0.050***	0.020***	0.014***	0.037***	0.042***	0.039***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.011)	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)
Obs.	7635	5389	2246	1905	341	12912	7008	5904	3226	2678
CHIP 2018	0.084***	0.089***	0.078***	0.084***	0.070***	0.027***	0.026***	0.037***	0.032***	0.051***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.014)	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)
Obs.	7711	5112	2599	2123	476	15337	7447	7890	4487	3403

Notes: All samples consist of full-time employees aged 16 to 59, with educational attainment ranging from primary school to a college degree or above. Table reports estimates of β_1 from the Mincer equation: $lnY_i = \beta_0 + \beta_1 edu_i + \Gamma X_i + \varepsilon_i$, where lnY_i is the natural logarithm of monthly wages for individual i, X_i includes gender (=1 if male), potential experience and its square, married status (=1 if married), and ethnicity (=1 if Han). Robust standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Appendix

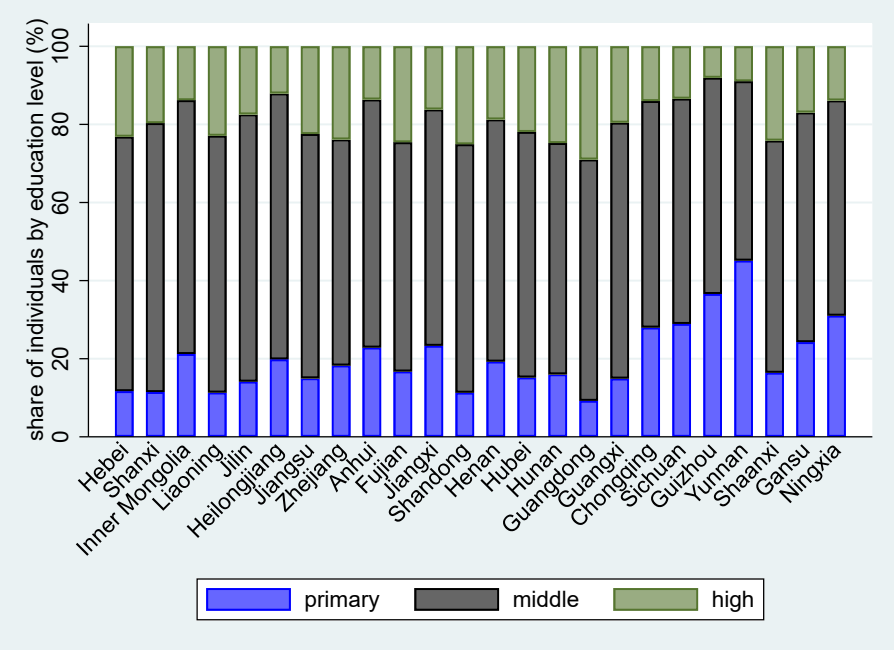
Appendix Figure A1 Distribution of Educational Attainment by Hukou Province



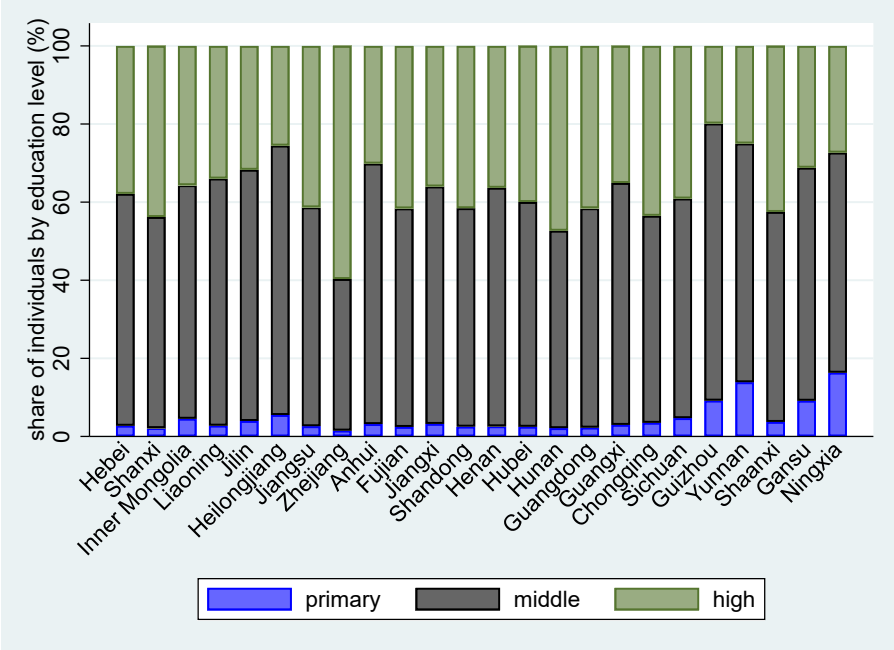
Notes: The sample consists of full-time employed inter-provincial rural migrants from the 24 Hukou provinces aged 16–59 with educational attainment between primary and high school. For the 24 Hukou provinces, the average share of individuals with high school education is 25.6%, with a standard deviation of 6.17% and a coefficient of variation of 0.242.

Appendix Figure A2 Distribution of Educational Attainment by Hukou Province and Cohort

Panel A: 1951-1985 cohorts



Panel B: 1986-2001 cohorts



Notes: The samples are full-time employed inter-provincial rural migrants from the 24 Hukou provinces aged 16–59 with educational attainment between primary school and high school. Panel A and Panel B present the educational attainment distribution for the 1951-1985 cohort and the 1986-2001 cohort, respectively. For the 1951-1985 cohort, the average share of individuals with a high school education is 18.7%, with a standard deviation of 5.61% and a coefficient of variation of 0.301; for the 1986-2001 cohort, the average is 37.0%, with a standard deviation of 8.40% and a coefficient of variation of 0.227.

Appendix Table A1 College Degree Share and Cognitive Scores by Hukou Province

	2015 Min-Census	CFPS 2014			
	Share of college degree or above	Math Scores	Word Scores	Avg. (math, word)	Obs.
	(1)	(2)	(3)	(4)	(5)
Hebei	5.583	0.059	0.284	0.172	916
Shanxi	5.864	-0.028	0.121	0.047	731
Inner Mongolia	7.665	0.013	0.111	0.062	32
Liaoning	5.139	0.131	0.212	0.171	1055
Jilin	4.225	-0.009	0.198	0.094	176
Heilongjiang	3.404	-0.172	-0.077	-0.125	203
Jiangsu	9.906	-0.035	0.138	0.051	270
Zhejiang	11.476	0.110	0.350	0.230	237
Anhui	4.480	-0.129	0.011	-0.059	355
Fujian	9.066	-0.150	-0.185	-0.168	171
Jiangxi	4.207	0.061	-0.053	0.004	232
Shandong	7.306	-0.028	0.125	0.048	671
Henan	4.306	-0.208	-0.143	-0.175	1686
Hubei	5.457	0.099	0.365	0.232	147
Hunan	5.927	0.121	0.226	0.174	330
Guangdong	5.849	-0.103	-0.126	-0.114	991
Guangxi	3.836	-0.158	-0.393	-0.276	411
Chongqing	4.043	-0.159	0.084	-0.037	69
Sichuan	3.834	0.005	0.033	0.019	586
Guizhou	3.272	-0.189	-0.202	-0.196	356
Yunnan	3.924	-0.192	-0.157	-0.175	465
Shaanxi	7.178	-0.059	0.136	0.038	309
Gansu	5.215	-0.094	0.073	-0.011	1445
Ningxia	5.721	\	\	\	\

Notes: The share of individuals with a college degree or above in column 1 is calculated for individuals aged 16-59 with rural Hukou in the home province who hold a college degree or above from the 2015 Mini-Census. The scores in columns 2-4 for each Hukou province are calculated using CFPS 2014 data. They are the average standardized math scores, average standardized word scores, and the mean of the two averages for rural individuals aged 16-59 with educational attainment between primary and high school, based on Hukou province at age 12. Test score data for Ningxia are unavailable.

Appendix Table A2 Estimates of Rates of Returns to Schooling by Hukou Province

	(1)	(2)	(3)	(4)	(5)
Edu	0.020***	0.021***	0.021***	0.019***	0.019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Shanxi*Edu	-0.003***	-0.003***	-0.002**	-0.002***	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inner Mongolia*Edu	-0.001	0.001	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Liaoning*Edu	0.001	0.000	0.002**	0.002*	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Jilin*Edu	-0.002**	-0.003***	-0.001	-0.002*	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Heilongjiang*Edu	-0.002***	-0.004***	-0.001	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Jiangsu*Edu	0.006***	0.010***	0.008***	0.009***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Zhejiang*Edu	0.004***	0.010***	0.009***	0.009***	0.008***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Anhui*Edu	0.002***	0.001	0.002***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fujian*Edu	0.001	0.004***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Jiangxi*Edu	0.003***	0.002**	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Shandong*Edu	0.001**	0.003***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Henan*Edu	-0.000	-0.001**	-0.000	0.000	0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Hubei*Edu	0.004***	0.003***	0.003***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hunan*Edu	0.002***	0.002***	0.002***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Guangdong*Edu	0.002**	0.003**	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Guangxi*Edu	-0.003***	-0.004***	-0.003***	-0.003***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Chongqing*Edu	0.001**	0.000	0.000	0.001*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Sichuan*Edu	0.003***	0.001*	0.001	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Guizhou*Edu	-0.001*	-0.003***	-0.003***	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Yunnan*Edu	-0.002***	-0.003***	-0.003***	-0.003***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Shaanxi*Edu	0.001	0.002***	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gansu*Edu	-0.001	-0.001	0.000	-0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ningxia*Edu	-0.005***	-0.005***	-0.003*	-0.003	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Share of college degree or above in 2015		-0.009***	-0.004*	-0.004	-0.002
		(0.003)	(0.003)	(0.003)	(0.002)
Male	0.244***	0.244***	0.207***	0.227***	0.201***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Pexp	0.017***	0.017***	0.016***	0.016***	0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Pexp2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.073***	0.073***	0.058***	0.063***	0.056***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Han	0.024***	0.024***	0.022***	0.026***	0.021***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	7.314***	7.358***	7.371***	7.358***	7.383***
	(0.006)	(0.014)	(0.014)	(0.014)	(0.014)
Destination city-year FE	YES	YES	YES	YES	YES
Industry FE	NO	NO	YES	NO	YES
Occupation FE	NO	NO	NO	YES	YES
Obs.	233711	233711	233711	233711	233711
Adjusted R^2	0.256	0.256	0.289	0.278	0.297

Notes: Samples are full-time inter-provincial rural migrants from the 24 Hukou provinces aged 16–59 with educational attainment between primary and high school. The share of college degree or above in 2015 is calculated for individuals aged 16-59 with rural Hukou in the home province who hold a college degree or above from the 2015 Mini-Census. Hebei province is the benchmark province. Coefficient estimates on interactions (including the coefficient on years of schooling) in column 2 are statistically significantly different from those in column 1 at the 1% level (Wald Statistic=51.02, p-value=0.001). Coefficient estimates on interactions in columns 3 and 4 are not statistically significantly different from those in column 2 (Wald Statistic=19.91, p-value =0.702 between columns 3 and 2; Wald Statistic=28.35, p-value =0.246 between columns 4 and 2). Coefficient estimates on interactions in column 5 are statistically different from those in column 2 at the 5% level (Wald Statistic=39.75, p-value =0.023), but the differences are economically insignificant. Robust standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Appendix Table A3 Controlling for Migration-Related Factors: Estimates of Rates of Returns to Schooling by Hukou Province

	(1)	(2)	(3)	(4)
Edu	0.021***	0.021***	0.021***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)
Shanxi*Edu	-0.003***	-0.003***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Inner Mongolia*Edu	0.000	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Liaoning*Edu	-0.000	0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Jilin*Edu	-0.003***	-0.003***	-0.004***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Heilongjiang*Edu	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Jiangsu*Edu	0.010***	0.011***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
Zhejiang*Edu	0.008***	0.010***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Anhui*Edu	0.001*	0.001	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Fujian*Edu	0.003**	0.004***	0.003***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Jiangxi*Edu	0.002**	0.002**	0.001	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Shandong*Edu	0.002***	0.003***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Henan*Edu	-0.002***	-0.001**	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Hubei*Edu	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Hunan*Edu	0.002***	0.002***	0.002***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)
Guangdong*Edu	0.002**	0.003***	0.002*	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Guangxi*Edu	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Chongqing*Edu	-0.001	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Sichuan*Edu	0.000	0.001*	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Guizhou*Edu	-0.004***	-0.003***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Yunnan*Edu	-0.005***	-0.004***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Shaanxi*Edu	0.001	0.002**	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Gansu*Edu	-0.001**	-0.001*	-0.001**	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Ningxia*Edu	-0.005***	-0.005***	-0.006***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Share of college degree or above in 2015	-0.008***	-0.008***	-0.010***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
Distance (1,000 km)	0.014***			0.007**
	(0.002)			(0.003)
Differences in GDP (10,000 Yuan)		0.003***		0.003***

		(0.001)		(0.001)
Share of home prov migrants in all migrants in destination city /10			-0.006***	-0.004***
			(0.001)	(0.001)
Male	0.244***	0.244***	0.244***	0.244***
	(0.002)	(0.002)	(0.002)	(0.002)
Pexp	0.017***	0.017***	0.017***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
Pexp2	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.073***	0.073***	0.073***	0.074***
	(0.002)	(0.002)	(0.002)	(0.002)
Han	0.024***	0.024***	0.024***	0.024***
	(0.003)	(0.003)	(0.003)	(0.003)
Constant	7.339***	7.340***	7.373***	7.343***
	(0.014)	(0.014)	(0.014)	(0.016)
Destination city-year FE	YES	YES	YES	YES
Obs.	233711	233702	233711	233702
Adjusted R^2	0.257	0.256	0.257	0.257

Notes: Samples are full-time employed inter-provincial rural migrants from the 24 Hukou provinces aged 16–59 with educational attainment between primary and high school. The share of college degree or above in 2015 is calculated for individuals aged 16-59 with rural Hukou in the home province who hold a college degree or above from the 2015 Mini-Census. Hebei province is the benchmark province. Columns 2 and 4 have smaller number of observations because per capita GDP data for Hainan and Tibet are not available prior to 1990. Coefficient estimates on interactions (including the coefficient on years of schooling) in columns 1-4 are not significantly different from those in column 2 of Appendix Table A2 (Wald Statistic=7.00, p-value=1.000 for column 1; Wald Statistic=0.64, p-value=1.000 for column 2; Wald Statistic=8.64, p-value=0.998 for column 3; Wald Statistic=12.97, p-value=0.967 for column 4). Robust standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Appendix Table A4 Summary Statistics of School Inputs, 1986-2001 Cohort

	Mean (1)	Sd. (2)	CV (3)
Total spending	0.391	0.140	0.359
Personnel spending	0.236	0.085	0.361
Current spending	0.137	0.047	0.342
Capital spending	0.018	0.012	0.673
Number of teachers and staff	0.069	0.011	0.154
Number of library books (÷100)	0.163	0.046	0.285
School buildings (÷10, m^2)	0.819	0.199	0.243
Unsafe school buildings (÷10, m^2)	0.046	0.040	0.875
Obs.	24	24	24

Notes: All variables are measured on a per-student basis. All monetary values are in 10,000 constant 2010 Yuan. Data are from China Education Finance Statistics Yearbook 1993-2017.

Appendix Table A5 Correlations Between School Inputs, 1986-2001 Cohorts

	Total spending	Personnel spending	Current spending	Capital spending	Number of teachers and staff	Number of library books (÷100)	School buildings (÷10, m^2)	Unsafe school buildings (÷10, m^2)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total spending	1.000							
Personnel spending	0.988	1.000						
Current spending	0.970	0.927	1.000					
Capital spending	0.875	0.829	0.853	1.000				
Number of teachers and staff	0.445	0.471	0.447	0.112	1.000			
Number of library books (÷10)	0.726	0.704	0.729	0.641	0.262	1.000		
School buildings (÷10, m^2)	0.785	0.777	0.755	0.704	0.237	0.772	1.000	
Unsafe school buildings (÷10, m^2)	-0.334	-0.281	-0.411	-0.308	-0.151	-0.416	-0.164	1.000

Notes: All variables are measured on a per-student basis. All monetary values are in 10,000 constant 2010 Yuan. Data are from China Education Finance Statistics Yearbook 1993-2017.

Appendix Table A6 Estimates of Rates of Returns to Schooling by Cohort, Intra-Provincial Migrants

	1951-1985 cohorts	1986-2001 cohorts
	(1)	(2)
Hebei	0.001	0.013***
	(0.003)	(0.003)
Shanxi	0.016***	0.020***
	(0.004)	(0.004)
Inner Mongolia	0.022***	0.034***
	(0.003)	(0.003)
Liaoning	0.011***	0.025***
	(0.003)	(0.003)
Jilin	0.009***	0.027***
	(0.004)	(0.003)
Heilongjiang	0.011***	0.024***
	(0.003)	(0.003)
Jiangsu	0.014***	0.029***
	(0.002)	(0.002)
Zhejiang	0.021***	0.030***
	(0.004)	(0.004)
Anhui	0.023***	0.035***
	(0.003)	(0.003)
Fujian	0.018***	0.032***
	(0.003)	(0.003)
Jiangxi	0.010***	0.022***
	(0.003)	(0.003)
Shandong	0.020***	0.037***
	(0.002)	(0.002)
Henan	0.022***	0.033***
	(0.002)	(0.002)
Hubei	0.012***	0.025***
	(0.003)	(0.003)
Hunan	0.011***	0.025***
	(0.002)	(0.002)
Guangdong	0.022***	0.038***
	(0.002)	(0.002)
Guangxi	0.018***	0.033***
	(0.002)	(0.002)
Chongqing	0.014***	0.027***
	(0.002)	(0.002)
Sichuan	0.014***	0.028***
	(0.002)	(0.002)
Guizhou	0.016***	0.026***
	(0.004)	(0.003)
Yunnan	0.027***	0.039***
	(0.003)	(0.003)
Shaanxi	0.016***	0.027***
	(0.003)	(0.003)
Gansu	0.010***	0.023***
	(0.003)	(0.003)
Ningxia	0.020***	0.030***
	(0.004)	(0.004)
Obs.	105,582	68,629

Notes: Estimates are based on regression with triple interactions of years of schooling, home province dummies, and a cohort dummy, alongside a separate cohort dummy, controlling for percentage of rural population aged 16-59 in home province with a college degree or above. Coefficient of variation is 0.37 in column 1 and 0.216 in column 2. Correlation coefficient between estimates in columns 1 and 2 is 0.89. Robust standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.