6-11-2015

Education, Health and Inequality: Schooling infrastructure and educational outcomes in Nepal

Vinish Shrestha
Towson University

Schooling Infrastructure and Educational Outcomes in Nepal

June 11, 2015

Abstract

We estimate the impact of an increase in the number of schools on educational outcomes in Nepal. We combine the between-district differences in number of new schools with variation in exposure to these schools created by the virtue of individuals being of school-age. Our results and back-of-the-envelope calculations suggest that on average the increase in the number of schools can explain about a third of the total differences in the reading and writing abilities for the treated and control groups of women. These results underscore the continued importance of increasing access to schooling in developing countries like Nepal.

Keywords: access to education, female literacy
JEL classification: I2, O1, H52

Introduction

Given that well-educated children are more likely to grow up to be better parents, make informed choices, adopt new technologies, and have generally higher standards of living, policy interventions designed to encourage and retain school enrollment are a central focus in developing countries (World Bank, 2011). Such interventions may be broadly categorized into demand and supply-side policies. Supply-side policies may include establishing new schools and/or increasing the number of teachers. But do more schools necessarily mean better educational outcomes?

Based on existing research, evidence on the effectiveness—or lack thereof— of supply-side policies in improving educational outcomes has been far from conclusive. There is evidence that policy-driven construction of new schools in Indonesia and Peru have led to improved educational outcomes in these countries (Duflo, 2001; and Paxson and Schady, 2002). Additionally, a large body of literature has established that the presence of a schooling infrastructure is positively correlated with educational attainment (Bridsall, 1985; DeTray, 1988; Lee and Willis, 1994; Lavy, 1996; and Case and Deaton, 1996). There are, however, also examples of countries where the low quality of education has delinked schooling and improved educational outcomes (Prichett, 2001). In this paper, we investigate the effectiveness of supply-side policies in Nepal, where education remains constrained to women in general and minorities from lower castes.

Not surprisingly, the School Sector Reform Program in Nepal, a multi-billion dollar World Bank project aiming to increase access to and quality of schooling in the country, began as recently as 2009. According to the World Bank website, over 70 percent of the budget focuses on basic education (grades 1-8). Increased access to basic education includes the establishment

of schooling infrastructure, which may lead to higher enrollment by reducing the distance to the nearest school. This can be especially relevant for female students in developing countries where parents may be more reluctant to send their daughters to schools located at a distance.

The relationship between the availability of schools and improved educational outcomes may not be as straightforward as one may think. This may be due to a number of reasons beyond just the aforementioned lower quality of education. This is particularly noticeable in rural Nepal, where traditional norms and/or financial needs may necessitate children's labor participation. Even at zero-price, there can be considerable opportunity costs for households to invest in children's education. Data used for the current analysis shows that 14 percent of those not attending school stayed home to help their parents. Cultural norms that discourage education for women and minority castes can also further complicate the relationship between the availability of schools and transfer of knowledge. Estimating the causal effect of an increased number of schools on educational outcomes, therefore, is an involved and important endeavor.

With an average per capita income of just $400 per year, Nepal is one of the least developed countries in the world. The adult literacy rate in Nepal was 40 percent in 1991, 54 percent in 2001, and 66 percent in 2011 (Nepal Census Report). Data used in the present study suggest that in rural areas the number of individuals able to read rose modestly from 36 percent in 1995 to 48 percent in 2004. Among females, the statistics are even grimmer. Between 1995 to 2004, the number of females able to read rose from just 23 percent to 36 percent. This persistence of low national educational levels emphasizes both the need for sound future policies and evaluations of current and past education-related policies.

The fall of the Panchayat system and reemergence of democracy in Nepal in 1990

provided a much needed impetus towards improved educational standards.[1] The new Nepali government joined the World Conference on Education for All (WCEFA) in 1990 with aspirations of providing greater access to basic and primary education (Caddel, 2007). This pact, along with the Nepali government increasing its capital expenditure in the education sector, led to an increase in the number of schools established in the early nineties. In this paper, we evaluate this increase in the establishment of schools and its impact on education outcomes in the rural communities of Nepal. We use cross-sectional data from the 2003-2004 Nepal Living Standards Survey (NLSS), a detailed survey conducted at the household and community-level by the Nepal Census Bureau of Statistics (CBS) and the World Bank. Data on school construction is obtained from the community-level files of NLSS and are linked with the individual files. The trend in the establishment of schools in the communities of focus in this study is depicted in Figure 1.

The results of this paper are based on two specific identification strategies. First, we use the between-district variation in school establishments over time to evaluate the effect of the establishment of schools on educational outcomes. We supplement our first identification strategy by exploiting the variation in exposure to the rapid increase in the number of schools in 1990 created by the virtue of some individuals being of school-going age during this period of school construction. In the spirit of Duflo (2001), we use a difference-in-difference methodology to leverage the idea that the establishment of schools are likely to affect those who are of school-going age in 1990 more so than older individuals. Furthermore, all else being equal, any effect of school construction should be higher in the districts where more schools were constructed.

[1]Panchayat refers to a form of local government historically found in the Indian subcontinent.

Our results indicate that the establishment of an additional school in a 1,000 square kilometer area increased the probability to read and write by 1.95 and 1.93 percentage points, respectively. Stratifying our sample by gender, we find that our results are driven predominantly by educational improvements for females. An additional school in a 1,000 square kilometer area increased the probability to read and write among females by 2.3 percentage points. Since the majority of the female population living in rural areas did not know how to read or write before 1990, we argue that the marginal benefit of the establishment of a school is likely higher for females compared to males.

Furthermore, because we focus our analysis on the rural parts of Nepal, it is very likely that those individuals—especially males—who may have desired a higher quality and level of education migrated to urban areas. In fact, Savada (1991) asserts that this period of school construction also coincides with the mass exodus of the educated from rural to urban parts of the country. In addition to explaining the muted effect for males, this also means that the reported effects for females may be a lower bound estimate. Nonetheless, our findings suggest that women in the rural parts of Nepal may have disproportionately benefited from the herculean school-building efforts of the early 1990s. Our findings underscore the continued importance of increasing broad access to primary education among socially-overlooked population groups through programs such as the School Sector Reform Program in Nepal.

In the sections that follow, we motivate our topic with a brief history on the development of education in Nepal, followed by a discussion of our data and empirical framework. The remainder of the paper includes our findings and conclusion.

1. Brief History of Education in Nepal

Major social and economic developments in Nepal, including those involving education,

can be traced back to the changing landscape of the political systems in the country. The oligarchy of Rana prime ministers began in 1846 and was entrenched for over a century. During this period, the Ranas thrived by maintaining absolute power while leaving the king as a mere religious and ceremonial figurehead. Although the oligarchy was aware of the importance of Western-style education through its dealings and negotiations with other countries, they were concerned that providing any type of education to the masses would make their citizens conscious of their rights or lack thereof (Shakya, 1977). Not surprisingly, educational opportunities were extremely restricted and severe penalties were placed on those attempting to spread education in Nepal. Estimates from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) point to a literacy rate of a mere 1 percent prior to 1950.

With the overhaul of the Rana regime and the establishment of a democracy in 1950, the new government took important steps towards modernity by opening up to the outside world. The establishment of formal educational practices in the country began only after 1950 (UNESCO). Promoting schooling became a symbol of modernity and an outlet for the new government to distinguish itself from the older regime. Caplan (1970) points to the highly visible change in the number of schools during this time period. For Nepal, the decade of the 1950s has been heralded as one of emerging from darkness (Caddell, 2007). The First Five Year Plan for Education was enacted in 1956 with the aim of increasing literacy rates in Nepal (Caddell, 2007). During this period, the country saw its first spurt of school constructions, which is depicted in Figure 1 by the spike in the late 1950s. Although this early effort had a monumental in increasing the number of schools, Savada (1991) points to limited impacts on overall education levels in the country. The author reasons that because children were still needed in the fields and for household work, many of them did not begin schooling until they were nine or ten years old.

Furthermore, among those who went to school, as many as half quit after just one year. Also during the period, female education was considered largely unnecessary.

The fledgling democracy of 1950 eventually succumbed to the tensions between the Nepali Congress (the then ruling party) and the monarch. Citing ineffective governance and problems of chronic violence, the king dissolved the democratic system in December 1960 and replaced it with a system of local governance, known as the Panchayat system (Vir, 1988). One of the main objectives of the Panchayat regime was to create a unified nation. This is exemplified in the popularized motto of the time, ek bhasa, ek bhesh, ek desh (one language, one dress, one nation). Under the Panchayat government, education was viewed as a mechanism that could lead to unification among the diverse communities of Nepal. Consequently, after 1975, primary education was made available at zero cost (Savada, 1991). During the 1980s, the importance and availability of education in Nepal was heavily promulgated by international donors like the World Bank and United Nations. Two specific projects are worth mentioning. First, the Education for Rural Development Project, termed as the Seti Project, was funded by UNICEF, UNESCO, and UNDP (Benette, 1979). The objective of this project was to provide improved educational opportunities among six districts in the far western region of Nepal. Second, the Primary Education Project (PEP) was supported by UNICEF and the World Bank. This project was designed to improve the standards of primary education in 20 of the total 75 districts across the country.

The end of the Panchayat system and re-emergence of democracy in 1990 redefined the nation. The new government emerged with aspirations of developing the nation with processes linked to the international community (De Chene, 1996). In 1990, the World Conference on Education for All (WCEFA, 1990) instigated a declaration that called for a greater focus on basic

and primary education (Cadell, 2007). The new Nepali government signed the WCEFA Declaration as the first international treaty in the country. Such an act signaled a desire for development and attracted financial support for development efforts (Cadell, 2007). During the post-Panchayat period, there was a general consensus that education would play a key role in bringing forth the necessary developments needed in Nepalese society. There was a call for better opportunities for education among women, children, orphans, disabled, and the poor (Cadell, 2007). According to UNESCO, the total number of schools in the country increased from 11,332 to 24,818 from 1981 to 1991. This rapid rise in school construction in the early 1990s is evident in Figure 1 and clearly resembles a break from the previous trend. In this paper, we attempt to exploit this massive school-building effort to estimate the impact of the increase in the number of schools on educational outcomes.

2. Data

We use cross-sectional data from the 2003-2004 Nepal Living Standard Survey, which was conducted by the Nepal Central Bureau of Statistics in collaboration with the World Bank. The survey is a product of the development efforts aimed at reducing poverty in the country, and as such, includes data on education, health, employment, migration, and access to facilities. For our analysis, we utilize the individual, household, and community-level data from the survey. Table 1 provides a summary of the variables used in the present analysis.

Figure 2A shows a map of Nepal divided into five developmental regions: 1) East; 2) Central; 3) West, 4) Midwest; and 5) Far West (from right to left). There are three geographic belts in the country: 1) Mountain; 2) Hills; and 3) Terai (plains), which are depicted from top to bottom on Figure 2B. Finally, as depicted in Figure 2C, the country is made up of 75 districts, which are further divided into wards (not shown in the map but analogous to counties in the

United States). Household weights are included in all the models in order to account for the unequal probability of household selection across wards. Our variable measuring the intensity of school-building efforts is calculated at the district level and is detailed below.

A. Education

In the NLSS survey, questions pertaining to education are given to individuals aged five and older. We focus on four educational outcomes: 1) Ability to read; 2) Ability to write; 3) Highest level of education; and 4) Completion of fifth grade. While test scores for reading and writing would have served as ideal measures for the first two outcomes, we are constrained by available data and thus must rely on self-reported dichotomous responses for the ability to read and write. For the latter two outcomes, we use a subset of older respondents who are above ten years old and their reported highest level of completed education.

We use the number of schools constructed from 1985 to 1995 in a specific district as a measure of school-building intensity. A community-level file provides information regarding the list of schools available in wards where the interviews were conducted. First, the school name is provided, which is then followed by the year the school was founded. To obtain an overall measure of the school infrastructure in a district, we use data from the 2004-2005 survey to calculate the total number of schools available in a district per 1,000 square kilometers.[2] The measure of schooling intensity is merged with the individual level file by the district of birth. The summary statistics in Table 1 indicate that there were on average about six schools per thousand square kilometers. The relatively high standard deviation further suggests a high degree

[2]To account for differences in the size of districts, we use number of schools in a given time period per 1,000 square kilometers

of variation in the number of schools even when the analysis is limited to only rural parts of the country.

B. Other Control Variables

Other individual specific variables accounted for in the model specifications include religious status; ethnicity, represented by categorical variables for Brahmins, Chettris, and others; gender; and parental education status, a binary variable that takes the value of 1 if a parent is literate and "0" otherwise. To account for any heterogeneity across wards, we control for ward-specific variables: 1) As a measure that accounts for ease of accessibility of facilities, the model accounts for the distance to the closest school from the household in minutes; 2) A binary variable indicating whether a ward has a health post; and 3) The population of the ward. Although the survey includes several ward-specific variables, such as percentage of households with electricity, percentage involved in agriculture, and land ownership, these variables are not included in the main specifications as they may be endogenous.

3. Empirical Methods

A. Identification Strategy

We use a combination of two different variations to estimate the causal impact that school-building has on educational outcomes. Given our priors that the impacts differ systematically across genders, the specification below is analyzed separately for males and females. First, we exploit the spurt in school construction in the early 1990s to create a treated group of school-age children. In Nepal, children normally attend primary school between the ages of five and ten. Thus an individual's exposure and benefit from the school construction program would have depended on the age of the individual in 1990. Children aged fifteen years or older in 1990 are less likely to have benefited from the establishment of school as they would

have completed their primary education by 1990. As such, we treat children between the ages of zero to ten in 1990 as the cohort affected by the school construction and use those individuals aged fifteen to twenty-five in 1990 as the comparison group. The effect of school construction should be a decreasing function of one's age in 1990. This is a testable hypothesis and we discuss the findings in the results section.

The second source of variation follows from the rigor of the school-building efforts across districts. Districts receiving more schools per 1,000 square kilometers are more likely to have been affected. This assumption requires that respondents attend schools in the district of birth; traveling across districts in search of better schools will overestimate the effect of the establishment of a school. To avoid such issues, we focus on the rural communities of Nepal, where traveling is difficult due to the undulating landscape and almost all travel by foot. After controlling for the district and year of birth, the assignment of school construction is arguably exogenous. Combining the two identification sources, our basic empirical model is of a difference-in-differences specification. We estimate the effect of school establishment on education by estimating the following equation:

$$E_{idl} = \alpha + \beta_j(S_d * T_{ij}) + \mu X_{idl} + \tau_d + \rho_b + \omega_w + Trend_c + e_{idl} \qquad (1)$$

Where E_{idl} represents the educational outcome of an individual i born in district d in year l, $S_d$is the number of schools constructed per 1,000 square kilometers in district d between 1985 to 1995, T_i indicates the treated age group (0-10 in 1990), X_{idl} is a vector of individual specific characteristics, τ_d is district of birth dummies, ρ_b is a vector of birth year dummy variables, and ω_w is a vector of ward specific characteristics.[3] $Trend_c$ represents a district-specific linear cohort trend which is obtained by interacting the district of birth dummies with the birth cohort

[3] Ward is a primary sampling unit of Nepal Living Standard Survey (NLSS).

dummies. The oldest age of respondents in the sample is twenty-five years old in 1990, (born in 1965). Hence, those born between 1965 and 1970 are considered as cohort 1; those born between 1971 and 1980 are cohort 2; those born between 1981 and 1990 are cohort 3 (also the treated group); and those born after 1990 are cohort 4. Interactions of birth cohort with the district of birth dummies allows for the capture of any time-varying linear changes occurring between cohorts across districts. The coefficient of interest in equation eqn1 is β_j which reflects the effect of a 1 unit increase in school construction per 1,000 square kilometers on the educational outcomes of the affected group. Equation (1) is estimated by OLS and standard errors are clustered at the household level to account for the correlation within the households.[4]

B. Identifying Assumptions

The identification of equation (1) relies upon the assumption that in the absence of school construction, the educational outcomes of individuals born in districts with a higher number of schools would be no different than the educational outcomes of individuals born in districts having a low number of schools. This identification assumption cannot be taken for granted. For example, the establishment of schools can be a function of the literacy rate— districts with a high demand for education may have constructed a high number of schools; similarly, it is also possible that districts with a low demand for education may have received a low number of schools. We identify four indirect ways to test the underlying assumption of the identification strategy of this study. These tests are briefly mentioned below.

1) As a first test, we evaluate the effect of school construction on parental educational outcomes. If school establishments were not demand driven or need driven, the status of

[4]Our results are robust to the level at which errors are clustered. In results not included here, we have clustered at ward and district levels as well. These results are available upon request.

parental education should be unaffected by the school-building craze of the early 1990s. If the estimated effect is not zero, then it indicates that school construction is correlated with literacy status of respective districts.

2) Second, we compare the educational outcomes between two control groups that should not have been affected by the establishment of schools across the two district types (those with a high number of schools and those with a low number of schools). These groups include individuals who are 15-25 and 26-35 years old in 1990. In this case, the effect of school construction on educational outcomes should be close to zero, as school construction would not affect the individuals in these older cohorts. The assumption used by this study posits that the difference in educational outcomes for the two groups, conditional on the covariates, is not statistically different from zero. A rejection of the above hypothesis would raise doubts about the validity of the underlying assumption.
3) Finally, we directly test whether the school construction in the early 1990s had zero effect for individuals who were older than fifteen in 1990. This test provides suggestive evidence regarding whether or not there may have been other district-specific changes, excluding school construction that may have affected educational outcomes. Also, it provides empirical evidence regarding the implicit assumption that 0-10 year olds are affected and 15-25 year olds are unaffected by the school construction.

4. Results

A. The Effect of School Establishment on Educational Outcomes

Table 2 shows the effect of a one unit increase in school establishment per 1,000 square kilometers on the ability to read, and write, the highest level of education achieved, and the rate of completion of fifth grade. The coefficient on the interaction term suggests that a one unit

increase in school per 1,000 square kilometers increases the probability that an individual can read and write by 1.95 and 1.93 percentage points, respectively. These coefficients are significant at a 5 percent level. Although positive, the effect of school infrastructure on the highest level of education achieved is imprecisely estimated and is not statistically significant at the conventional levels.

To interpret the results as a causal relationship between school construction and educational outcomes, the trend in educational outcomes of districts receiving more schools should not be systematically different from the districts receiving low number of schools. It is plausible that school construction across districts may not be random; for instance, school establishments can be a function of literacy rates (i.e, districts with low literacy rates may obtain more schools and vice versa). To account for the measure of literacy rate, we control for the parents' years of education while estimating the results of Table 2. Parental education status is crucial in the specification as it also partially accounts for the spillover effects of schooling. Those individuals who decided to attend school might have done so specifically because of their parents. If parental education is systematically correlated to school construction, the estimated effect of school construction is likely to be biased upwards.

A way of examining whether school construction systematically depends on the literacy rate of the district is to use parental educational status as the dependent variable in equation (1). This is a more direct test that provides evidence regarding whether or not schools built is a function of literacy rates (for those individuals used as control and treatment groups while estimating the results for Table 2). Table 3 shows the results when parental education status is used as the dependent variable. The coefficient on the interaction term when using the mother's education level as the dependent variable is small, statistically insignificant, and close to zero.

Although statistically insignificant at the conventional levels, the coefficient on the interaction term when using the father's education level as the dependent variable is positive and sizeable in magnitude. Hence, the possibility that school construction could be demand driven cannot be fully ruled out. This further validates the necessity of parental educational status as a control variable in specifications of this study.

To ensure that the results presented in Table 2 are not driven by other unobserved factors correlated to school construction and the literacy rate of a district, we perform a falsification test by comparing individuals aged 15 - 25 in 1990 with 26 - 35 year olds. In this falsification exercise, 15 - 25 year olds are treated as a hypothetical treatment group and 26 - 35 year olds are the comparison group. If the coefficient on the interaction term is significant, then we cannot rule out the possibility that the results in Table 2 may be spurious. In other words, the effect may have been prominent even in the absence of schools. The findings from such a falsification exercise are presented in Table 4. The coefficient on the interaction term is small, close to zero, and statistically insignificant at any conventional levels. This provides further suggestive evidence that the obtained estimates in Table 2 are not driven by unobserved factors not accounted for in the specification.

B. Validity of the Treatment and Control Groups

Until now, we have implicitly assumed that zero to ten year olds in 1990 are affected by the burst of school construction in the late 1980s and early 1990s; whereas, 15 to 25 year olds are unaffected. This assumption in not necessarily a given. The implicit assumption that younger cohorts are affected more by the establishment of schools, following Duflo (2002), is a testable hypothesis and can be estimated by the following regression:

$$E_{idl} = \alpha + \sum_{j=0}^{25} \beta_j (S_d * T_{ij}) + \mu X_{idl} + \tau_d + \omega_w + Trend_c + e_{idl} \qquad equ(2)$$

All the variables in equation (2) are similar to those of equation (1) with the exception that T_{ij} is a dummy variable indicating whether individual i is of age j in 1990 and is interacted with S_d, schools available per 1,000 square kilometers in district d. We use those individuals who are 25 years old in 1990 as the omitted (comparison) group. In equation (2), β_j indicates the effect of a 1 unit increase in schools per 1,000 square kilometers on individuals aged j and how it alters their years of education, as compared to those aged 25 years in 1990. If the analysis satisfies an implicit assumption that younger cohort is more affected by the establishments of schools, β_j should be a decreasing function of age.

Figure 3 plots the estimates of β_j obtained from equation (2) along with the 90 percent confidence intervals. The coefficients are positive and statistically significant in most cases before the age of ten. However, coefficients pertaining to those age groups greater than ten years old are noisy, statistically insignificant at any conventional levels, and fluctuate around zero. Figure 3 empirically advocates for the assumption undertaken by this study. Furthermore, the results presented in Figure 3 indicate that other district-specific unobserved factors, which are correlated to both the educational outcomes and intensity of schooling measure, are not driving the results presented in Table 2. In summary, the results from our battery of tests collectively support the underlying assumption used in this study.

C. Effects of the Establishment of Schools by Gender

School-building after the first democracy was established in the 1950s affected males; however, the educational attainments of females remained largely unaffected as females were discouraged from attending schools. It was only in late 1980s onwards that females were

encouraged to attend schools; hence, this allows us to speculate that the effect of school construction may vary systematically according to gender.

Table 5 presents results from estimating equation (1) after stratifying the sample by gender. Panel A of Table 5 pertains to males; whereas, Panel B represents results for females. The coefficient on the interaction term for the males (Panel A) is not statistically different from zero at any conventional levels, thereby indicating that school construction may not have affected educational outcomes for males. However, the coefficients on the interaction term for females (Panel B) reveals that school construction increased the females' ability to read and write, as well as their highest level of education. For instance, on average, an increase in 1 unit of schools per 1,000 square kilometers led to a rise in the ability to read and write by 2.37 and 2.29 percentage points, respectively. These coefficients in Table 5 are statistically significant at 5 and 1 percent levels.

The question that arises from the results in Table 5 is why did the establishment of schools affect the educational outcomes of females, but had no effect on the educational outcomes among males? Two main reasons can explain this questions. First, the literacy rate of males was relatively higher than the literacy rate of females. For instance, females who were born between 1965 and 1975 reported having a literacy rate of 21 percent; whereas, the rate for the males was 52 percent. Figure 4 further demonstrates the mean ability to write as a function of age. Although the younger age group is more likely to be able to write, the drop is sharp and prominent for females when compared to males. Only 20 percent of females who were twenty-five years old in the 2003-2004 survey were able to write compared to over 70 percent of twenty-five years old males. Figure 4 points out a huge disparity between the male and female population in their ability to write. Since the majority of the female population living in rural

areas did not know how to write before 1990, the marginal benefit of new schools is likely to be higher for the females compared to males. Second, it is likely that relatively highly educated males migrated to urban areas and, hence, did not enter the sample. If educated individuals are likely to migrate to urban parts of the country for better jobs and a higher standard of living, the effect of school construction will be underestimated.

D. Which Grade Levels Were Affected?

Thus far, we have demonstrated that school construction affected the educational outcomes of females. To investigate what grade levels were most affected by the establishment of schools, we estimate the following regression by OLS:

$$L_{idlk} = \alpha + \beta_k S_d * T_i + \mu X_{idl} + \tau_d + \rho_b + \omega_w + Trend_c + \varepsilon_{idl} \qquad (3)$$

where all of the variables are similar to equation (1) with the exception of L_{idlk}, which represents whether an individual completed at least k years of education (k ranges from 2 to 10). The coefficient on β_k will indicate the effect of school construction on the completion of k^{th} level of education. The estimates of parameters β_k are plotted in Figure 5 along with the grade level and the 95 percent confidence intervals. As the results from the previous sections are largely driven by the experiences of females, the above equation is estimated using only the female sample.

Figure 5 shows that the effect of school construction decreases with grade level in the female population. The effect of a 1 unit increase in schools per 1,000 square kilometers is positive and statistically significant at a 5 percent level until the 4th grade, after which, though positive, the coefficients are imprecisely estimated. Hence, Figure 5 indicates that school construction increased the completion rate in the lower grades among females, but had no impact

on the completion of higher grade levels.[5] This is consistent with the fact that the majority of schools built in the late 1980s and early 1990s were primary schools, as shown in Figure 6.

5. Mechanism and Confounding Factors

One possible mechanism through which the increase in school construction can lead to better educational outcomes is by reducing the distance to the nearest school. School distance can play a vital role in determining educational outcomes in rural households in developing countries. The availability of nearby schools can reduce travel costs and boarding fees (Lavy, 1996). The potential impact of distance to a school is itself confounded by the possibility that families who value education highly may consider the presence of schools and location when deciding where to live. Children in these families have greater opportunities to obtain an education, which could lead to better educational outcomes.[6] It is important therefore to control for family characteristics like parental education when estimating the potential impact of the distance to school on educational outcomes. Inclusion for parental characteristics in the specification lowers the degree of endogeneity of school proximity.

The results in Table 6 show that the coefficient on distance to school interacted with the treatment variable is insignificant at the conventional levels for males. In contrast, the results pertaining to females in Panel B indicate that more distance is associated with a reduction in the ability to read. Distance to school has a negative effect on the educational outcomes for females,

[5]It has to be noted that migration may explain why we are seeing no effect on higher grade levels. If more educated people move to urban areas for a better life or in search of a higher education, then such individuals will not be in the survey.

[6]Individual ability may not play a large role as we are concerned with basic educational outcomes, such as ability to write and read.

but has no effect for males. This fact provides evidence that school proximity may not be endogenous. If families with better educational outcomes are likely to live close to schools, then school proximity should have a negative effect on the educational outcomes of the male group as well. Furthermore, although distance to school seems to matter, especially for females, its inclusion in the model fails to explain the substantial educational gains from the increase in schools.

Variation in the quality of the new schools is a mechanism that may potentially help explain the impact on educational gains. School quality may also confound the impact of an increase in the number of schools. If schools are demand or needs driven, the quality of the schools may be correlated with the quantity of schools being established. It is possible that areas with a higher number of schools also attracts a higher quality of schools. This would mean that our estimated impacts of the establishments of schools are biased upwards. Alternatively, there may exist a quality-quantity trade-off in the establishment of schools. Areas with a higher number of schools may potentially suffer from lower quality due to greater division of limited resources. This would, in turn, bias our estimates downwards. The effect of quality on educational outcomes is unclear *a priori*.

To test whether our results are driven and/ or confounded by the quality of schools, we re-estimate equation (1) including measures of school quality. We analyze multiple variables proxying for school quality at the district level, including the ratio of boys to girls in schools, the highest grade level offered, the proportion of public schools constructed, student-teach ratio, and proportion of schools with toilets. We argue that boys-to-girls ratio is positively correlated to the quality of schools due to the social preference of valuing sons' education over those of daughters. Schools offering a higher level of education, with lower student-teacher ratios, and those

equipped with toilets, are arguably better funded and, hence, also of greater quality. Finally, in all generality, private schools are also more likely to be of a higher quality than their public counterparts. Tables 7A and 7B report related results from the estimations for males and females, respectively. Across both gender types, we find that the impact of school establishments is unaffected by the inclusion of measures of school quality. Based on these results, it seems unlikely that our estimate for the impact of school establishments is driven by school quality.

6. Discussion and Conclusion

The rapid building of schools in the early 1990s increased the ability to read and write, as well as the highest level of education achieved among females in rural Nepal. Our findings indicate that a 1 unit increase in schools per 1,000 square kilometers led to a rise in the females' ability to read and write by 2.37 and 2.29 percentage points, respectively. To place these effects in some perspective, the raw difference in mean ability to read and write between females who were 15 - 25 years of age in 1990 (control group) and the females who were 0-10 years of age in 1990 (treatment group) was about 37 percentage points. There were on average about 5.5 schools built during the period per 1,000 square kilometers. A simple back-of-the-envelope calculation then suggests that, on average, the establishments of schools can account for 13 percentage points or over a third of the total difference between the control and treatment groups.[7]

Additionally, the construction of new schools improved the completion rate of lower grades among females; whereas, their higher level education was unaffected. The results also suggest that school-building did not affect educational outcomes among males. One possible

[7]The calculation simply entails the product of the average number of schools per 1,000 square kilometers and the effect per school.

explanation regarding this finding is that the marginal benefit of the presence of schools for females may have been higher than that for males, as the literacy rate of females in the 1990s was severely lower than the literacy rate of males.

Our findings in this paper resonate with those of Duflo (2001) and Paxson and Schady (2002). Unlike these findings, however, our results feature the added caveat of the difference in impact for male and female children. This difference in findings likely stems from our focus on only rural parts of the country. With respect to the debate on the quality/quantity trade-off for schooling infrastructures in developing countries like Nepal, our results are relevant and illuminating. While we certainly do not wish to underemphasize the importance of a quality education, our present findings indicate that the pursuit of quality education also should not occur at the expense of broader access to education. When existing levels of education are low to begin with and there is considerable potential for gain—as was the case with female education prior to the mid-1980s—we cannot discount the importance of increasing the sheer quantity of schools.

There is existing evidence that returns to primary education are considerably larger than those for higher levels of education and these differences are larger yet in developing countries (Psacharopoulos, 1994). Providing broader access to primary education, especially in rural areas, is also likely to be cheaper than providing higher education. Given the larger gains and relatively lower costs, our findings underscore the importance of increasing broader access to primary education among the masses; more specifically, providing broader access to primary education to certain socially-overlooked subpopulation groups.

References

Bennett, N. (1979), "New Education for Old Problems: Can Education Be Made a Force for Rural Development in Nepal?" *CERID, Education for Rural Development: National Seminar Kathmandu, Tribhuvan University*: 20-38.

Caddell, Martha. (2007), "Education and Change: A Historical Perspective on Schooling, Development and the Nepali Nation-state", *Education and Social Change in South Asia*. New Delhi: Orient Longman, 251-284.

Caplan, L. (1970), "Education Policy in Nepal," *Venture* 22(11): 8-11.

Central Bureau of Statistics (2012), National Population and Housing Census 2011

De Chene, M. (1996), "In the Name of Bikas," *Studies in Nepali History and Society*, 1(2): 259-270.

Duflo, Esther (2001), "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment," *American Economic Review*, 91(4): 795-813.

Hanushek, Eric A. (1995), Interpreting Recent Research on Schooling in Developing Countries, *World Bank Research Observer* 10(2): 227-246.

Heckman, James J., and Richard Robb Jr. (1985), "Alternative Methods for Evaluating the Impact of Interventions: An Overview," *Journal of Econometrics* 30(1): 239-267.

Kremer, Michael R. (1995), "Research on Schooling: What We Know and What We Don't: A Comment," *World Bank Research Observer* 10(2): 247-54.

Lechner, Michael. (1999), "Earnings and Employment Effects of Continuous Off-the-job Training in East Germany after Unification," *Journal of Business & Economic Statistics* 17(1): 74-90.

Lechner, Michael. (2002), "Program Heterogeneity and Propensity Score Matching: An Application to the Evaluation of Active Labor Market Policies," *Review of Economics and Statistics* 84(2): 205-220.

Paxson, Christina, and Norbert R. Schady. (2002), The Allocation and Impact of Social Funds: Spending on School Infrastructure in Peru, *The World Bank Economic Review* 16(2): 297-319.

Pritchett, Lant. (2001), "Where Has All the Education Gone?" *World Bank Econ Rev* 15(3): 367-391.

Psacharopoulos, George (1994), Returns to Investment in Education: A Global Update, *World Development* 22(9): 1325-1343.

Savada, Andrea Matles. (1991), Nepal: A Country Study, Washington: GPO for the Library of Congress.

Shakya, T. M. (1977), "National Education System Plan: An Analysis," *Nepal Digest: Nepal Education Special*: 17-25.

Strauss, John, and Duncan Thomas (1995), "Human Resources: Empirical Modeling of Household and Family Decisions." *Handbook of Development Economics* 3: 1883-2023.

Vir, Dharam (1988). *Education and Polity in Nepal: An Asian Experiment*. Northern Book Center.

World Bank Group (2011), Learning for All: Investing in People's Knowledge and Skills to Promote Development, *Education Strategy 2020*.

Figure 1

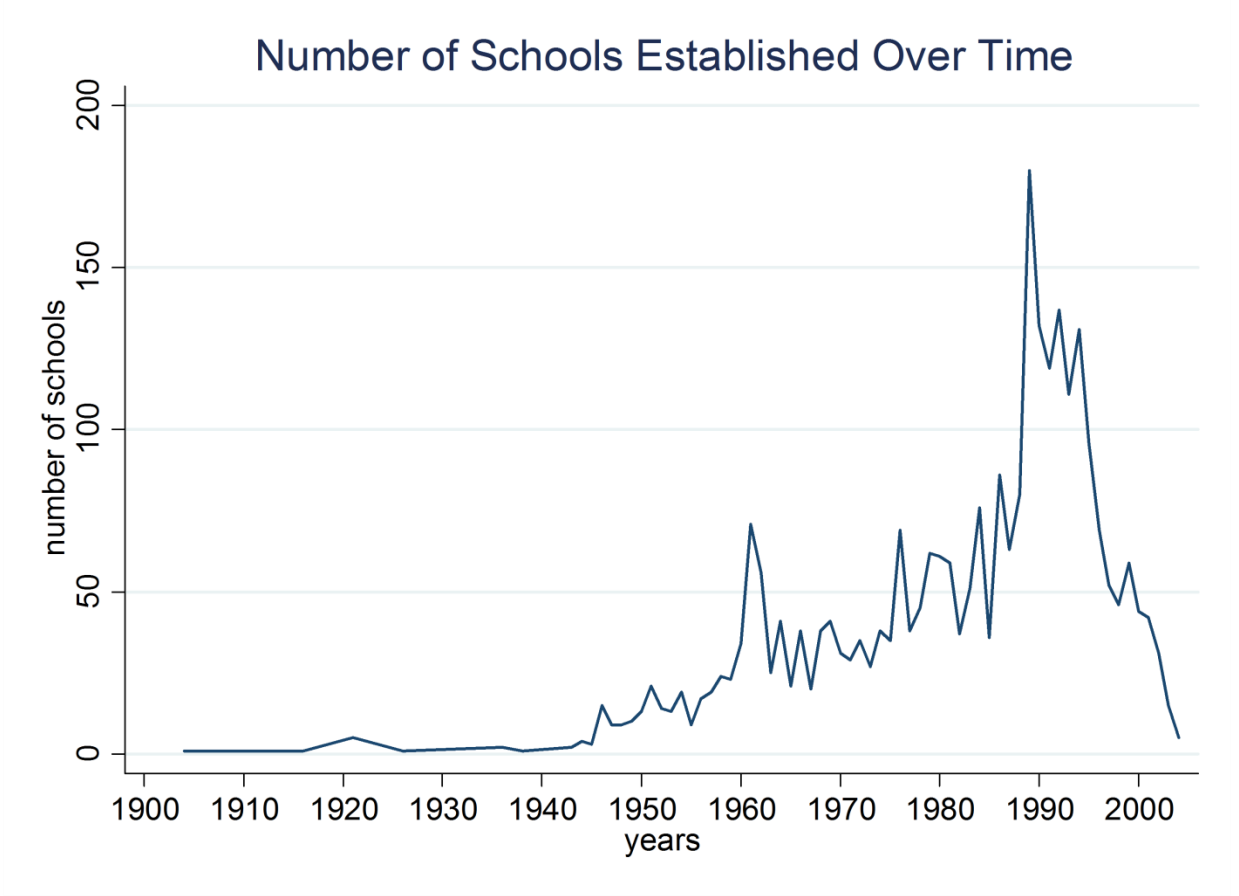
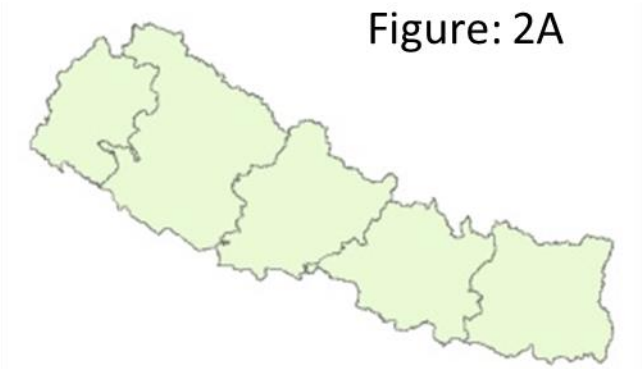
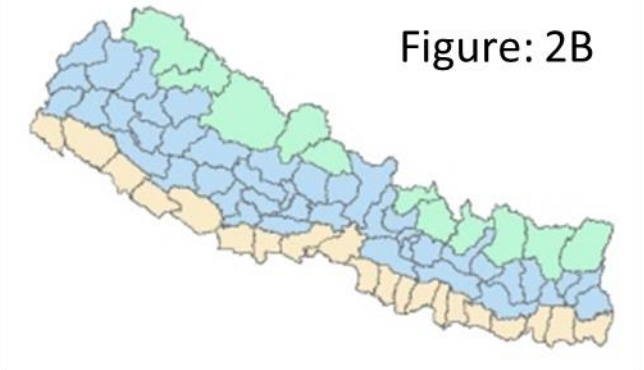

Number of Schools Established Over Time
number of schools
0
50
100
150
200
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
years

Figure 2





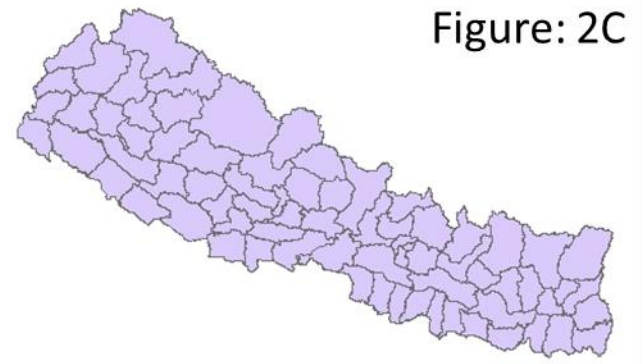


Figure 3A

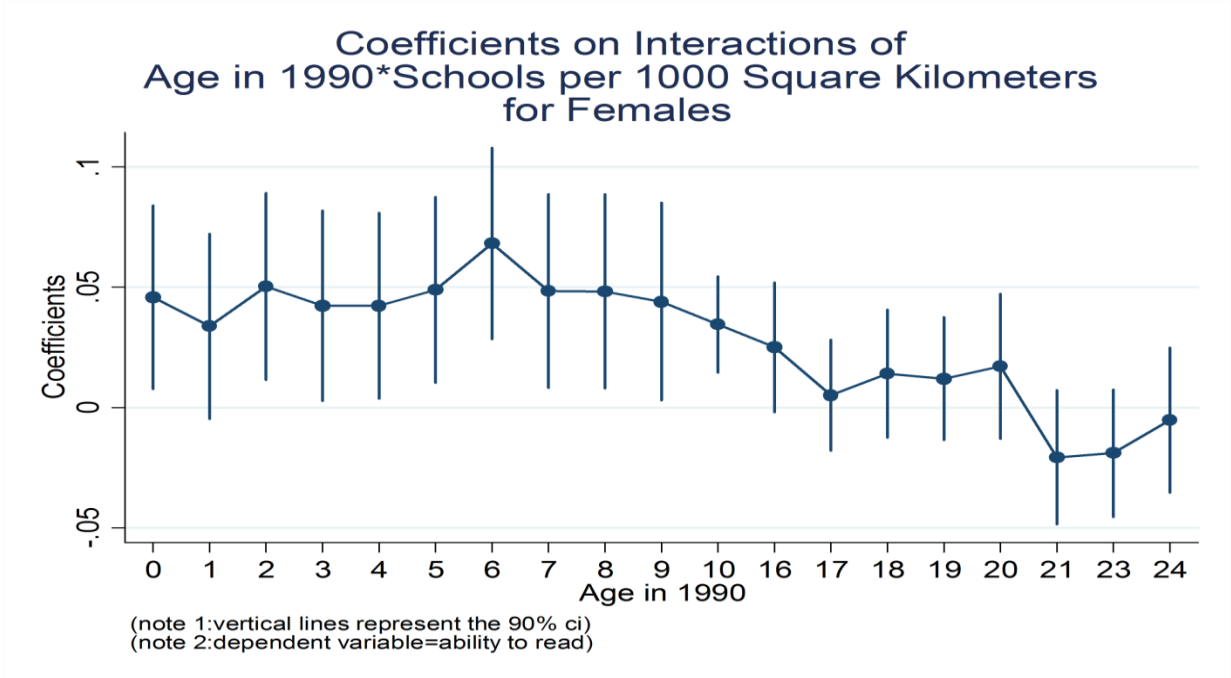


Figure 3B

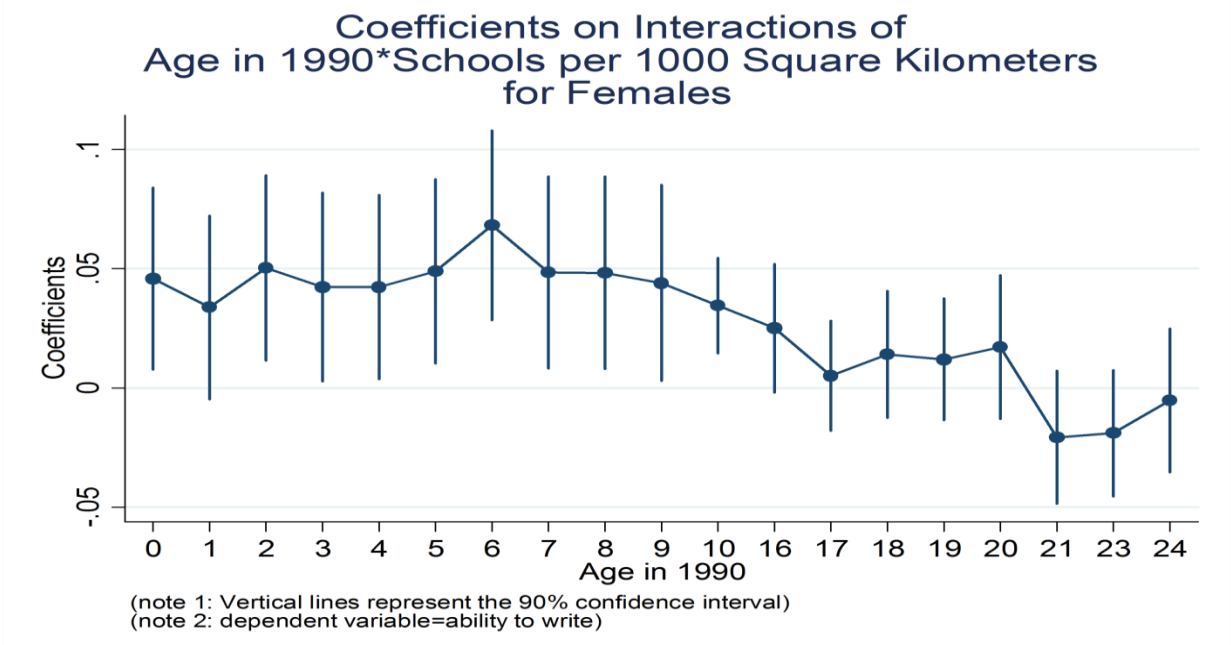


Figure 4

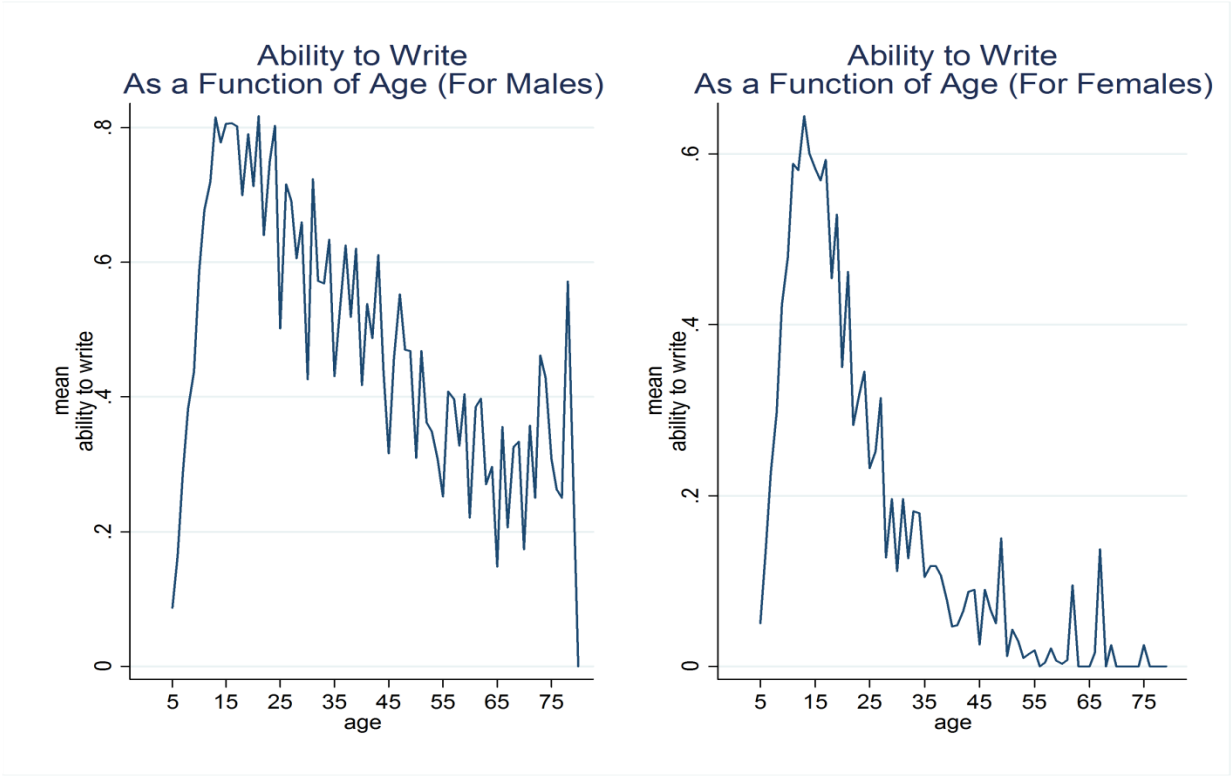


Figure 5

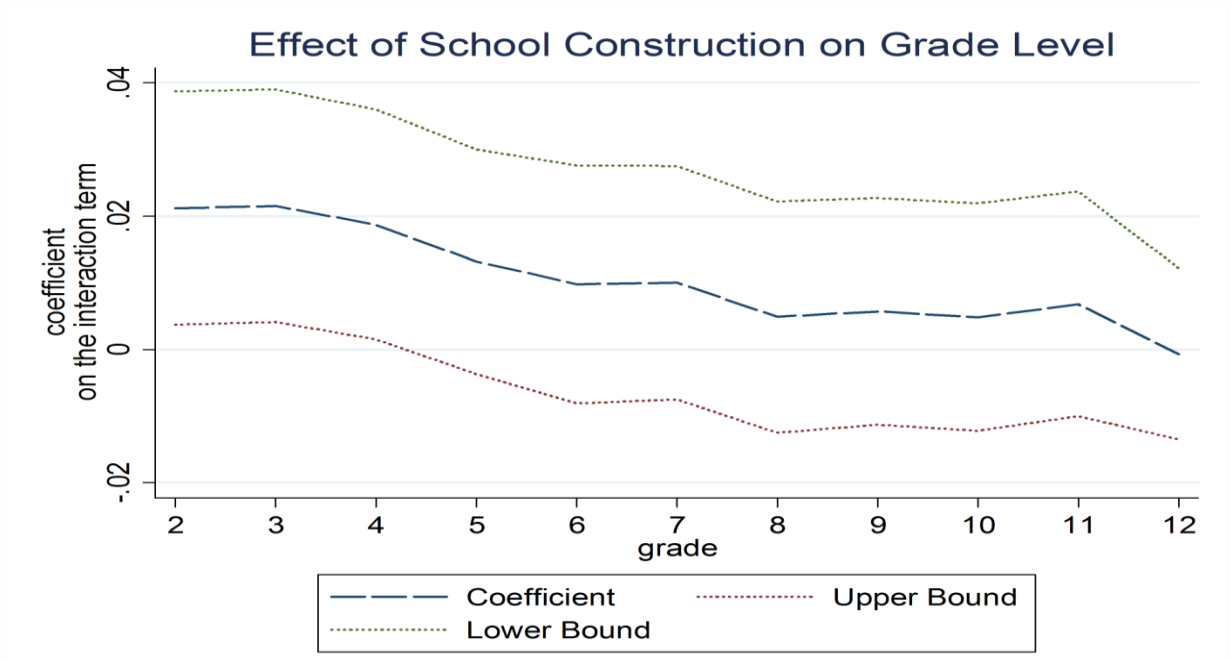


Figure 6

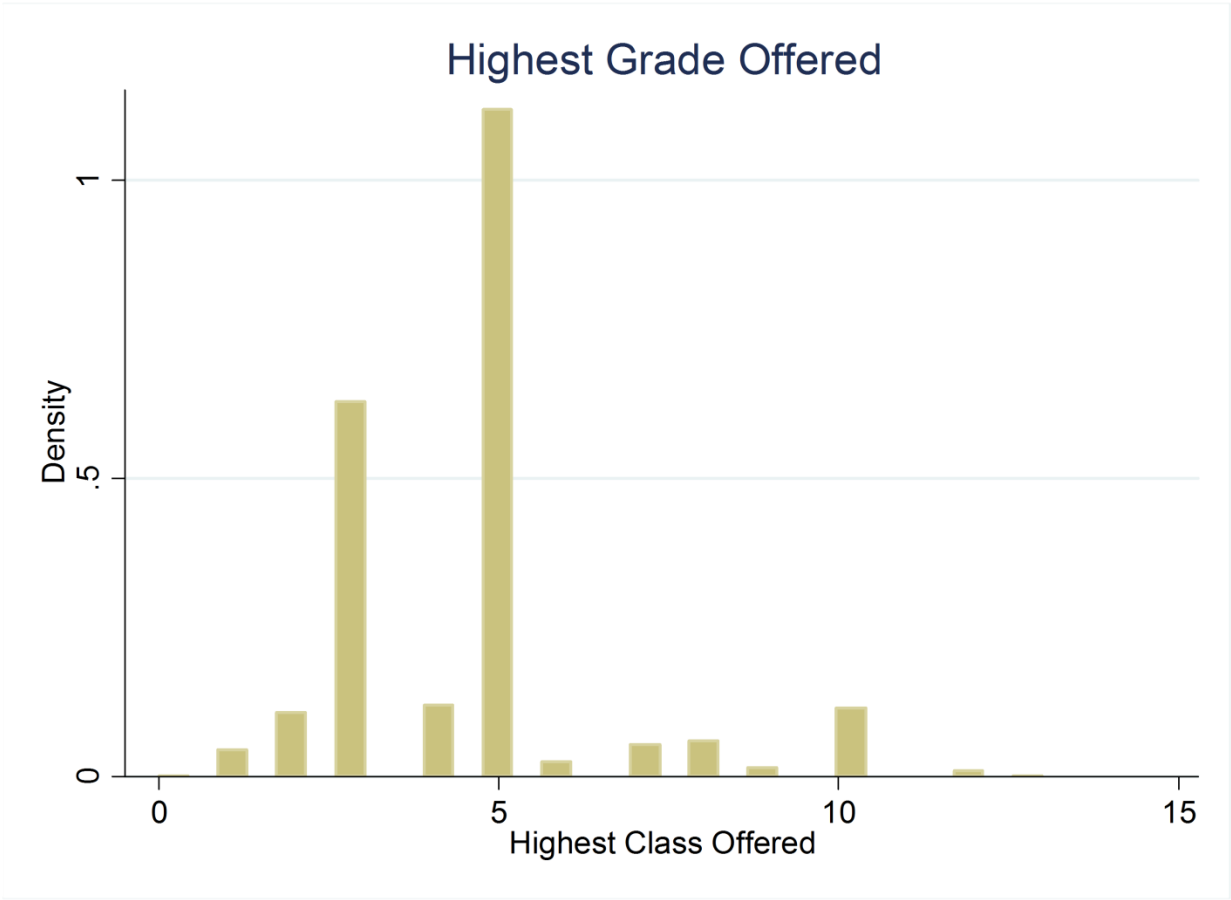

Highest Grade Offered
Density
0
.5
1
0
5
10
15
Highest Class Offered

Table 1. Summary Statistics

Variables	N	Mean	Std. Dev.
Able to read	5,382	0.553	0.497
Able to write	5,382	0.534	0.499
Number of schools per 1,000 km^2	5,382	5.691	3.912
Ward population	5,382	1096.591	941.796
Gender (male=1)	5,382	0.504	0.500
Total distance to school (in minutes)	5,362	19.997	26.325
Total school Distance missing	5,382	0.035	0.184
Health post present	5,360	0.298	0.457
Health post missing	5,382	0.004	0.064
Years of education (father)	2,669	2.251	1.746
Father's education missing	5,382	0.504	0.500
Years of education (mother)	2,313	1.211	0.866
Mother's education missing	5,382	0.570	0.495

Table 2. Effect of School Construction on Educational Outcomes

	Read	Write	Highest Education	Fifth Grade
Interaction between the treatment dummy and schools per capita	0.0195**	0.0193**	0.0566	-0.0015
	(0.0077)	(0.0077)	(0.0606)	(0.0074)
Distance to closest school	-0.0008**	-0.0007*	-0.0069*	-0.0010**
	(0.0004)	(0.0003)	(0.0036)	(0.0004)
Gender (female=1)	-0.1907***	-0.1862***	-2.2076***	-0.1931***
	(0.0141)	(0.0141)	(0.1314)	(0.0158)
Father's education level	0.0692***	0.0668***	0.5272***	0.0482***
	(0.0054)	(0.0055)	(0.0463)	(0.0058)
Mother's education level	0.0487***	0.0500***	0.5653***	0.0516***
	(0.0091)	(0.0093)	(0.0985)	(0.0123)
N	5,382	5,382	3,457	3,457
r2	0.3026	0.3051	0.4062	0.3164
F	17.4685	17.3676	16.7109	11.3710

Note: Additionally, the models include a dummy variable indicating whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, and ward population. Standard errors are clustered at the household level. *** represent significance at a 1% level, ** at a 5% level, and *** at a 10% level.

Table 3. School Construction and Parental Education Status

	Paternal schooling	Maternal schooling
Interaction between the treatment dummy and schools per 1,000 square kilometers	0.0130	0.0031
	(0.0096)	(0.0132)
Distance to closest school	-0.0013	0.0001
	(0.0008)	(0.0011)
Gender (female=1)	0.7331***	-2.1417***
	(0.0427)	(0.0659)
N	5,382	5,382
r2	0.1856	0.4444

Note: Additionally, the models include a dummy variable indicating whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, and ward population. Standard errors are clustered at the household level. *** represent significance at a 1% level, ** at a 5% level, and *** at a 10% level.

Table 4. Effect of School Construction on Educational Outcomes (Falsification Test)

	Read	Write	Highest Education	Fifth grade
Interaction between the treatment dummy and schools per capita	-0.0027	-0.0008	-0.0081	-0.0001
	(0.0050)	(0.0049)	(0.0455)	(0.0056)
Distance to closest school	-0.0005	-0.0004	-0.0029	-0.0005
	(0.0003)	(0.0003)	(0.0025)	(0.0003)
Gender (female=1)	-0.4049***	-0.3969***	-2.8706***	-0.2434***
	(0.0162)	(0.0158)	(0.1252)	(0.0146)
Father's education level	0.0785***	0.0785***	0.5693***	0.0537***
	(0.0056)	(0.0056)	(0.0452)	(0.0055)
Mother's education level	0.0373***	0.0340***	0.4771***	0.0434***
	(0.0119)	(0.0128)	(0.1150)	(0.0139)
N	3,278	3,278	2,869	2,869
r2	0.3462	0.3507	0.4398	0.3326
F	21.2722	21.5603	16.8872	9.3288

Note: Additionally, the models include a dummy variable indicating whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, and ward population. Standard errors are clustered at the household level. *** represents significance at a 1% level, ** at a 5% level, and *** at a 10% level.

Table 5. Effect of School Construction on Educational Outcomes by Gender

Panel A (males)	Read	Write	Highest education	Fifth grade
Interaction between the treatment dummy and schools per capita	0.0131	0.0139	-0.0422	-0.0166
	(0.0108)	(0.0108)	(0.1096)	(0.0138)
Distance to closest school	-0.0003	-0.0003	-0.0041	-0.0008**
	(0.0003)	(0.0003)	(0.0032)	(0.0004)
Father's education level	0.0581***	0.0605***	0.6608***	0.0685***
	(0.0084)	(0.0087)	(0.0905)	(0.0120)
Mother's education level	0.0465***	0.0465***	0.7022***	0.0665***
	(0.0174)	(0.0177)	(0.2070)	(0.0242)
N	2671	2671	1445	1445
r2	0.2432	0.2451	0.3783	0.3262
F	5.3752	5.5779	3.386e+07	7.1640

Panel B (females)	Read	Write	Highest education	Fifth grade
Interaction between the treatment dummy and schools per capita	0.0237***	0.0229**	0.1345*	0.0094
	(0.0091)	(0.0092)	(0.0715)	(0.0086)
Distance to closest school	-0.0016***	-0.0015***	-0.0139***	-0.0015***
	(0.0005)	(0.0005)	(0.0037)	(0.0004)
Father's education level	0.0729***	0.0687***	0.4791***	0.0421***
	(0.0066)	(0.0067)	(0.0513)	(0.0062)
Mother's education level	0.0472***	0.0494***	0.5227***	0.0475***
	(0.0109)	(0.0115)	(0.1120)	(0.0138)
N	2711	2711	2012	2012
r2	0.4236	0.4261	0.4335	0.3454
F	19.8917	18.2573	9.5714	5.8811

Note: Additionally, the models include a dummy variable indicating whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, and ward population. Standard errors are clustered at the household level. *** represents significance at a 1% level, ** at a 5% level, and *** at a 10% level.

Table 6. Effect of School Construction on Educational Outcomes (By Gender)

(Males)	(1)	(2)	(3)
Interaction between year of birth and schools per 1,000 square km	0.0133	0.0133	0.0132
	(0.0108)	(0.0108)	(0.0108)
Interaction between year of birth and distance to closest school	×	-0.0001	×
		(0.0003)	
Birth order	×	×	0.3730***
			(0.1223)
Distance to closest school	×	×	-0.0003
			(0.0003)
N	2,671	2,671	2,671
r2	0.2429	0.2429	0.2438
F	5.4166	5.3629	5.4255
(Females)	(1)	(2)	(3)
Interaction between year of birth and schools per 1,000 square km	0.0236***	0.0239***	0.0239***
	(0.0091)	(0.0091)	(0.0091)
Interaction between year of birth and distance to closest school	×	-0.0020***	×
		(0.0006)	
Birth order	×	×	-0.0094
			(0.0095)
Distance to closest school	×	×	-0.0017***
			(0.0005)
N	2,711	2,711	2,711
r2	0.4204	0.4236	0.4238
F	19.7006	19.8838	19.6401

Note: Dependent variable is ability to read. Model 1 excludes distance to closest school from one's household, Model 2 includes an interaction between the treatment dummy and distance to closest school, Model 3 includes birth order and distance to closest school. Additionally, the models include a dummy variable including whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, father's education level, mother's education level, and ward population. Standard errors are clustered at the household level. Standard errors are clustered at the household level. *** represents significance at a 1 % level, ** at a 5 % level, and *** at a 10% level.

Table 7A. Effect of Schooling on Educational Outcomes by Gender (Including Quality Measures)

(Males)	(1)	(2)	(3)	(4)	(5)	(6)
interaction between year of birth and schools per 1,000	0.0140	0.0132	0.0139	0.0134	0.0158	0.0149
square kilometers	(0.0114)	(0.0108)	(0.0108)	(0.0108)	(0.0111)	(0.0116)
interaction between year of birth and ratio of boys to girls in class	0.0009					-0.0065
	(0.0364)					(0.0373)
interaction between year of birth and highest grade level offered		-0.0884				
		(0.0540)				
interaction between year of birth and proportion of public schools constructed			0.0892			
			(0.1935)			
interaction between year of birth and student teacher ratio				-0.0022		-0.0025
				(0.0029)		(0.0029)
interaction between year of birth and proportion of schools with toilet for students					-0.2285	-0.2451
					(0.1781)	(0.1809)
Distance to closest school	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
N	2671	2671	2671	2671	2671	2671
r2	0.2451	0.2458	0.2452	0.2453	0.2457	0.2459
F	5.5255	5.5733	5.5325	5.5259	5.5595	5.4684

Note: Dependent variable is ability to read. Additionally, the models include a dummy variable including whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, father's education level, mother's education level, and ward population. Standard errors are clustered at the household level. Standard errors are clustered at the household level. *** represents significance at a 1 % level, ** at a 5 % level, and *** at a 10% level.

Table 7B. Effect of Schooling on Educational Outcomes by Gender (Including Quality Measures)

(Females)	(1)	(2)	(3)	(4)	(5)	(6)
interaction between year of birth and schools per capita	0.0247**	0.0226**	0.0228**	0.0230**	0.0216**	0.0236**
	(0.0097)	(0.0093)	(0.0092)	(0.0092)	(0.0094)	(0.0098)
interaction between year of birth and ratio of boys to girls in class	0.0233					0.0288
	(0.0234)					(0.0231)
interaction between year of birth and highest grade level		-0.0110				
		(0.0511)				
interaction between year of birth and proportion of public schools constructed			0.0903			
			(0.1710)			
interaction between year of birth and student teacher ratio				0.0006		0.0005
				(0.0022)		(0.0021)
interaction between year of birth and proportion of schools with toilet for students					0.1096	0.1391
					(0.1470)	(0.1471)
Distance to closest school	-0.0015***	-0.0015***	-0.0015***	-0.0015***	-0.0016***	-0.0016***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
N	2711	2711	2711	2711	2711	2711
r2	0.4262	0.4261	0.4261	0.4261	0.4262	0.4264
F	18.3059	18.0916	18.1362	18.1215	18.0713	17.9948

Note: Dependent variable is ability to read. Additionally, the models include a dummy variable including whether a health post is available in the ward, year of birth dummies, district dummies, the district-specific linear time trend, father's education level, mother's education level, and ward population. Standard errors are clustered at the household level. Standard errors are clustered at the household level. *** represents significance at a 1 % level, ** at a 5 % level, and *** at a 10% level.