WORKING PAPER NO. 80

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An International Study of Childhood Poverty

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Funded by

UKaid from the British people

Ministry of Foreign Affairs of the Netherlands

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First published by Young Lives in September 2012

ISBN: 978-1-904427-91-9

A catalogue record for this publication is available from the British Library.

Available from:
Young Lives
Oxford Department of International Development (ODID)
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Queen Elizabeth House
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Oxford OX1 3TB, UK
Tel: +44 (0)1865 281751
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Web: www.younglives.org.uk

Printed on FSC-certified paper from traceable and sustainable sources.

Contents

Abstract

Ethnic minority children in Vietnam score much lower on mathematics and reading tests than do ethnic Vietnamese (Kinh) children. This paper examines the acquisition of mathematics and reading skills in Vietnam, using the Young Lives household survey data that were collected in 2002 and 2006. While further research is needed, the analysis in this paper leads to three important conclusions. First, these disparities are already very large by age 5, i.e. even before children start primary school. Second, language appears to be an important factor, as ethnic minority children whose mother tongue was Vietnamese had much higher scores than those whose mother tongue was an ethnic minority language. Note that all tests were administered in whatever language the children wanted to take them in, so the poor performance of ethnic minority children on these tests is not simply due to being forced to take the test in Vietnamese. Third, Blinder-Oaxaca decompositions offer some explanation of the Kinh–ethnic minority gap in test scores, especially for the Older Cohort children (who were 12 years old when tested in 2006). The higher per capita expenditure of Kinh households explains about 0.2 to 0.3 standard deviations of their gap in test scores, out of a total gap of 1.3 to 1.5 standard deviations. Higher parental education among Kinh children generally explains about 0.3 standard deviations of the gap for both the Younger Cohort (who were age 5 when tested) and the Older Cohort. Among the Older Cohort, more time spent in school, less time spent working, and higher levels of nutrition each explain about 0.1 standard deviations of the gap in the mathematics score, and more years of schooling among Kinh children explains about 0.3 standard deviations of the gap for the PPVT score.

Acknowledgements

We would like to thank Laura Camfield, Stefan Dercon, Helen Pinnock, Caitlin Porter and Chi Truong for comments on earlier drafts of this paper.

Note

The analysis in this paper is based on data from Rounds 1 and 2 of the Young Lives survey, carried out in 2002 and 2006 when the Older Cohort of children were aged 8 and 12 respectively. Further data have now been collected in a 2009 household survey and a school-based component that follows Young Lives children in their school environment. Further research, which is intended to extend the analysis covered in this Working Paper, is underway on these new data.

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About Young Lives

Young Lives is an international study of childhood poverty, following the lives of 12,000 children in 4 countries (Ethiopia, India, Peru and Vietnam) over 15 years. **www.younglives.org.uk**

Young Lives is core-funded from 2001 to 2017 by UK aid from the Department for International Development (DFID), and co-funded by the Netherlands Ministry of Foreign Affairs from 2010 to 2014.

1. Introduction

Vietnam is one of the poorest countries in south-east Asia, but since the late 1980s it has enjoyed a high rate of economic growth, which is almost certainly due to its Doi Moi policies, which in effect replaced Vietnam's planned economy with a market economy. Like many formerly socialist countries, Vietnam has long had relatively high levels of education when compared to other low-income countries. Its primary school gross enrolment rate has been close to 100 per cent since the early 1990s, and perhaps since the early 1980s, and its secondary school gross enrolment rate increased from about 32 per cent in the early 1990s to 57 per cent in the late 1990s and about 85 per cent in 2006 (see Glewwe 2004, and General Statistics Office 2007).

While education is often measured in terms of years of schooling, or highest level of schooling completed, the benefits of education are ultimately determined by the skills individuals acquire during their years in school. Thus it is important to understand what individual, family and school characteristics lead to the acquisition of academic skills. Unfortunately, thorough studies of the determinants of academic skills in developing countries are somewhat rare owing to lack of data on both academic skills and the variables that determine them.

This paper examines the acquisition of mathematics and reading skills in Vietnam, using the Young Lives household survey data that were collected in 2002 and 2006. While Vietnam has long had unusually good performance in education as measured by years of education completed, the relatively short school day in Vietnam may limit the skills acquired by students during the years they are in school. Another problem with educational outcomes in Vietnam is that ethnic minority students have much lower outcomes, in terms of both years of schooling and test scores, than ethnic Vietnamese (i.e. the Kinh ethnic group). Thus the focus of this paper is on explaining the gap in learning, as measured by scores in achievement tests, between Kinh and ethnic minority students in Vietnam.

The rest of this paper is organised as follows. Section 2 briefly describes Vietnam's system of education, and reviews the few recent studies of the determinants of school enrolment and student learning in Vietnam. The following section describes the data used in this analysis. The basic methodological framework underlying the analysis is presented in Section 4. The results for the Younger Cohort, who were 5 years old in 2006, are given in Section 5, and the results for the Older Cohort, who were 12 years old in 2006, are given in Section 6. Section 7 discusses the impact of school characteristics, and a final section draws conclusions and presents some suggestions for future research.

2. Literature review

Vietnam's system of education has three levels: primary, secondary, and tertiary (post-secondary). Primary education consists of Grade 1 to Grade 5, and is for children who are 6 to 10 years old. Secondary education is divided into lower secondary education, which consists of Grades 6 to 9 (for children 11 to 14 years old), and upper secondary education, which consists of Grades 10 to 12 (for children 15 to 17 years old). Various types of tertiary education, ranging from university degree programmes to a wide variety of technical training, are available for the population aged 18 years and older. Note that the Younger Cohort of children in the Young Lives sample were 5 years old in 2006, and thus almost all (1,956 out of 1,970 children) had not yet started Grade 1. In contrast, the Older Cohort children were 12 years old in 2006, so most (896 out of 990) had finished their primary education and were enrolled in lower secondary school.

Relative to its low income level, Vietnam has achieved remarkable success in terms of its basic education outcomes. While its GDP per capita in 2004 was US$502, less than one half the average of East Asian and Pacific countries and a quarter of the average of middle-income countries, it has similar literacy rates to those two groups of countries (see Dang 2007, for details). The primary school completion rate for Vietnam is 92 per cent, even slightly higher than those for the above-mentioned groups of countries; gross enrolment rates in Vietnam were 90 per cent, 76 per cent and 16 per cent at the primary, secondary and tertiary levels, respectively, in 2006 (World Bank 2008). The vast majority of Vietnam's schools are public (government-operated) schools. Indeed, none of the 34 primary schools in the Young Lives community data collected in Round 2 are private schools, and only one of the 1,000 Older Cohort children reported going to a private school in Round 1 of the survey (2002), and only three reported going to a private school in Round 2 (2006).

Several papers and reports have been written in the last few years that examine the educational performance of ethnic minority children in Vietnam.[1] The first such paper is that of Dang (2003), which does not examine performance on academic tests but instead estimates the determinants of years of schooling, in rural areas only, which is closely related. Using data from the 1997–8 Vietnam Living Standards Survey (VLSS), he finds that rural children with more educated parents, and children from wealthier households, tend to complete more years of schooling. He also finds that boys complete more years of schooling than girls. Finally, higher male agricultural wage rates and longer distances to the nearest town have negative impacts on years of schooling, while the proportion of teachers with formal qualifications increases years of schooling.

While Dang did not estimate separate regressions for ethnic majority (Kinh) and ethnic minority children, he did include separate ethnic minority dummy variables for the Northern Uplands, Central Highlands and Mekong Delta regions, as well as a general ethnic minority dummy variable for all other regions in Vietnam (most ethnic minority children in Vietnam live in the Northern Uplands, Central Highlands and Mekong Delta). He did not find that ethnic minority children in the Northern Uplands had fewer years of schooling; indeed, there is a tendency for them to have more years of schooling, but this effect is significant only at the 10 per cent level. In contrast, ethnic minority children in the Central Highlands and the Mekong Delta, as well as in all other areas of Vietnam, had one to two fewer years of schooling than Kinh children, after controlling for the variables mentioned in the previous paragraph. These negative impacts are especially strong in the Central Highlands and 'other areas' of Vietnam (other than the three regions just mentioned). Note also that since many ethnic minority children live in remote areas, the distance to the nearest town effect will have an additional negative impact on their years of schooling. Similarly, the qualifications of teachers in schools attended by ethnic minority children are likely to be lower, further reducing their years of schooling.

Two recent papers have made use of the Young Lives data to examine mathematics and reading (vocabulary) skills using the Round 2 data for the Older Cohort children. These children

1 A related point is that there are also several general papers on student performance in Vietnam in recent years that do not emphasise differences between Kinh and ethnic minority students. To avoid making this paper overly long, and to focus on issues pertaining to ethnic minorities, we do not review those papers here.

were 12 years old, and most were enrolled in lower secondary school, at the time they were tested in Round 2. Himaz (2009) regressed the mathematics and vocabulary (PPVT)[2] test scores on variables for gender (male dummy variable), child age, mother's and father's education, height-for-age z-score, a wealth index, an urban dummy variable, household size and a dummy variable indicating that the mother belongs to an ethnic minority.[3] She found no gender effects on either test score, but mothers' and fathers' education had strong positive effects for both tests, as did the height-for-age z-score. The wealth index had a weak positive impact on the mathematics score but not on the PPVT score. Finally, household size and having an ethnic minority mother had significantly strong negative effects on both test scores. (Himaz also presented estimates that add the Raven's test, which was administered in Round 1, as an explanatory variable, but only about 17 per cent of the children had data for that variable, so the results are based on a much smaller sample.) In general, virtually all of Himaz's results are plausible and consistent with many other studies of the determinants of test scores in developing countries (see Glewwe and Kremer 2006 for a recent review). As such, they confirm the importance of parental education and child nutritional status (as measured by height-for-age), as well as negative outcomes for ethnic minority children even after controlling for parental education and child nutritional status.[4]

A more qualitative study of education among ethnic minorities in Vietnam, based in part on the Young Lives data, is the study by Truong (2009). While this paper does not attempt to estimate the factors that influence test scores, it documents the large gaps in school enrolment and drop-out rates, and in test scores, between Kinh and ethnic minority children. The focus of this paper is on Bao Ly commune in Lao Cai province, which has a high H'mong population, and on Ea Mua commune in Phu Yen province, which has a sizeable Cham population. (More precisely, this population is Cham H'Roi, which is a sub-group of the Cham ethnic group.) The H'mong children in Bao Ly commune are much more likely to drop out of school (by age 12), and score far lower on reading, writing and mathematics tests, compared to Kinh children in that commune. The drop-out rate of Cham children in Ea Mua commune is also high, but not as high as that of the H'mong children in Bao Ly commune, and test scores are also relatively better (except for the mathematics test).

Finally, the World Bank has conducted two reading and mathematics studies, working with Vietnam's Ministry of Education and Training. The first was conducted in 2001, and the main results are provided in World Bank (2004). The second was conducted in 2007, and the main results were published in World Bank (2011). Both studies focus on children in the last year of primary school (Grade 5). The general findings are as one would expect; for example, children with better-educated parents and from wealthier households have higher scores on the reading and mathematics assessment tests. The studies also find that ethnic minority children tend to have lower scores, but neither study provides a detailed analysis of the reasons for this.

Overall, only Himaz has used the Young Lives data to examine the determinants of test scores in Vietnam, and since her paper analysed the data for all four Young Lives countries

2 Peabody Picture Vocabulary Test.

3 The child and mother ethnic minority status variables are extremely highly correlated; of the 989 observations that have both variables, there are only 26 cases where the child was from an ethnic minority while the mother was not, or the mother was from an ethnic minority but the child was not.

4 The negative effect of family size probably reflects the fact that the household wealth variable is not in per capita terms; as discussed below, once household consumption is expressed in per capita terms there is no additional explanatory power of family size.

(the others being Ethiopia, India and Peru) she did not go into much detail for Vietnam. In addition, the focus of her paper was not on ethnic minority children. The World Bank reports used other data to assess the factors associated with Grade 5 students' competencies in reading and mathematics, but those reports also do not focus on ethnic minority students. Thus this paper is the first to examine the determinants of test scores in detail using the Round 2 Young Lives data from Vietnam, and the first to use those data to focus on the differences between ethnic majority (Kinh) and ethnic minority children.

3. Data

The analysis in this paper uses the first two rounds of the Young Lives data from Vietnam, which were collected in 2002 (Round 1) and 2006 (Round 2). The Round 1 sample consists of 2,000 children who were between the ages of 6 and 17 months in 2002, and 1,000 children who were between 7.5 and 8.5 years old in that year. Strictly speaking, this sample is not representative of Vietnam as a whole. Instead, five of Vietnam's 63 provinces were selected to be 'representative' of most of Vietnam's regions. However, comparisons with the nationally representative Vietnam Household Living Standards Survey (VHLSS)s suggest that the Young Lives sample is broadly representative of Vietnam as a whole (see Table A.1 in the Appendix). The next sub-section explains in more detail how the sample was chosen,[5] and the following sub-section describes the data, focusing on the test score variables.

3.1 Sample

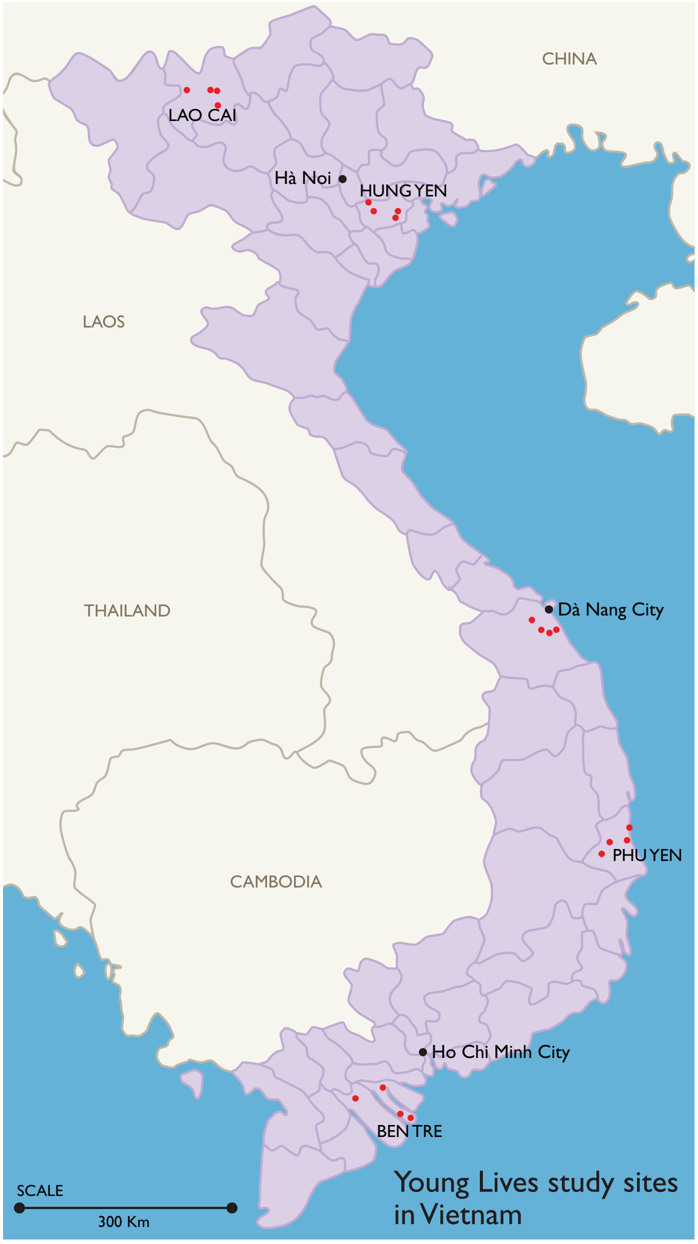
Vietnam can be divided into eight socio-economic regions: North-West, North-East, Red River Delta, North Central Coast, South Central Coast, South-East, Central Highlands, and Mekong River Delta. Each region includes urban and rural areas, but to ensure that the Young Lives sample included a major urban centre a new 'region' was created that consisted of all major urban provinces (namely, Hanoi, Ho Chi Minh City, Da Nang, Hai Phong and Ba Ria-Vung Tau). Of these nine 'regions', five (North-East, Red River Delta, Cities, South Central Coast, and Mekong River Delta) were chosen as 'representative' of Vietnam in the sense that they (1) include regions in the northern, central, and southern areas of Vietnam; (2) include urban, rural and mountainous areas; (3) are relatively poor; and (4) reflect some unique factors of the country, such as areas prone to natural disasters and areas heavily affected by past wars.

From each of these five regions, a 'typical' province was chosen after consultation with both government and international experts. The following five provinces were selected: Lao Cai (North-East region), Hung Yen (Red River Delta), Da Nang (Cities), Phu Yen (South Central Coast), and Ben Tre (Mekong River Delta). These provinces are shown in Figure 1. Within each province, at least four communes (also called 'sentinel sites') were chosen, giving greater weight to poor communes. More specifically, all communes in the province were ranked by poverty level: poor, average, better-off and rich. Two communes were selected from the poor group, one from the average group, and one from the above-average group (combining better-off and rich). The selection of communes from each group was *not* random; the criteria considered include (1) whether the commune represents common

5 For more details on the sampling procedure, see Tran et al. (2003).

provincial/regional features; (2) whether there was commitment from the local government for the research; (3) feasibility in terms of research logistics; and (4) population size. If a selected commune had a population of less than 6,000 persons, a 'similar' commune in the same poverty level group was selected to assure that 100 Younger Cohort children could be found in that 'sentinel site'. Following this procedure seven communes were selected in Lao Cai (North-East region), six in Hung Yen (Red River Delta), four in Da Nang (Cities), six in Phu Yen (South Central Coast), and eight in Ben Tre (Mekong River Delta), for a total sample of 31 communes.[6] Table A.2 in the Appendix provides a list of the communes in the sample, along with some basic information on primary schools.

Figure 1. *Young Lives study sites in Vietnam*



6 One commune in Da Nang City province was split into two between 2002 and 2006, and another was split into three, making a total of seven communes in Da Nang City province and 34 communes overall.

In each selected commune, lists were compiled (from April to June 2002) of all children born between 1 January 1993 and 31 December 1994 and all children born between 1 January 2000 and 31 December 2001. These two-year ranges were used because it was not clear exactly when data collection would begin. Simple random sampling was then applied to select 100 children who were aged from 6.0 to 17.9 months old and 50 children who were aged from 7.5 to 8.5 years old at the time of the fieldwork (which took place from July to November 2002). The refusal rate was very low – only slightly more than 1 per cent (36 out of 3,000 households) – and replacement sampling was used in the case of refusals.

For the Younger Cohort of 2,000 children in Round 1, 30 did not participate in Round 2, leaving a sample of 1,970. The main reasons for dropping out were that the child died (11 cases) or that the household could not be found (13), with the remaining cases being refusal or moving away from Vietnam. At least 82 households, and perhaps as many as 95, (of the 1,970 households that were re-interviewed) moved within Vietnam from 2002 to 2006, and all were found and interviewed. (There are 82 households that clearly moved, and another 13 for which missing data make it unclear whether they moved.)

Turning to the Older Cohort, of the 1,000 children who participated in Round 1, only ten did not participate in Round 2, yielding a sample of 990 for that round. The main reasons for non-participation are that the child died (2 cases), the household refused to participate (2 cases), or the household could not be found (3 cases). Finally, of the 990 Older Cohort households re-interviewed in 2006, 14 moved within Vietnam and were found and interviewed, and one additional household was interviewed but missing data make it impossible to determine whether that household moved.

3.2 Tests

The cognitive skills tests that were administered varied by cohort and by the round of the survey. In Round 1, the Younger Cohort was too young to take any tests, but in Round 2 they were given two tests: the CDA test of basic quantitative skills and the Peabody Picture Vocabulary Test (PPVT-III). The former test is the quantitative sub-test of the Cognitive Development Assessment (CDA-Q) test, which was developed by the International Evaluation Association (IEA).[7] It consists of 15 items, and for each item the child is shown a picture and asked a question, and he or she is asked to choose the best answer from three or four choices. An example is the following: ‘Look at the bowls of eggs. Point to the bowl that has the most eggs.’ Each correct answer scores 1 point and an incorrect or blank answer scores 0. The total or ‘raw’ score for CDA-Q is calculated as the number of correct answers. As explained below, one of these 15 questions (question 6) was found to have poor statistical properties in the sense that it was not sufficiently correlated with the average score on the test, and so it was dropped for purposes of calculating the raw score. Thus the maximum raw score is 14 correct answers.

The main purpose of the PPVT is to test vocabulary acquisition of children aged 2.5 years and older. It consists of 17 sets with 12 words each, and the 17 sets are ranked in order of difficulty. An initial set, called the basal set, is given based on the child’s age, and that set is selected to be very easy for the child. Each ‘question’ in a set consists of a picture, and the child is asked to say the name of the object or activity in the picture. If the child correctly answers 11 or 12 items in the basal set, the next more difficult set is administered, and the

7 For more information on these tests, see Cueto et al. (2009).

child is given increasingly difficult sets until he or she reaches a set that is too difficult (defined as being unable to correctly answer at least 5 of the 12 items in the set), which is called the ceiling set. The raw PPVT score is the number of correct items answered out of all sets taken by the child, plus the number of items in all sets that were considered 'too easy' for the child, that is, all sets that were easier than the basal set; the implicit assumption is that the child would have correctly answered all items in these easier sets. As in the CDA-Q test, some items were found to have poor statistical properties in the Vietnam context and thus were excluded from the calculation of the total scores. Henceforth, these total scores are referred to as the 'raw' PPVT scores.

Of the 1,970 Younger Cohort children who were surveyed in Round 2, not all took the PPVT and CDA-Q tests. For the CDA-Q test, 64 of the 1,970 children do not have scores in the data, leaving 1,906 children for whom test scores are available. The reasons why test scores are not available for these 64 children are not clear. For the PPVT test, test scores are missing for 223 of the 1,970 children. The main reason for this is that the PPVT was not administered properly to some children. In particular, according to the Young Lives documentation, the initial set of questions administered, which depends on the child's age (see above), was too difficult for 97 of the Younger Cohort children. Also, for 104 children the test was stopped 'too early', that is, before the child had reached the set that was too difficult for him or her.[8] If either of these two mistakes in test administration occurs, the test is considered invalid and no score is contained in the data. This leaves 1,769 children (1,970 minus 201), but another 22 also had missing PPVT test scores, leaving a sample of 1,747 with PPVT scores. Of these 22, the documentation indicates that 18 suffered from physical or mental disabilities that precluded them from taking the test, two were prevented from taking the test due to insufficient lighting and one could not take the test due to a vision or hearing problem, but a question in the data on the reasons is not completely consistent with the report (e.g. for seven cases the reason given is missing or 'other').

Finally, the data from both the CDA-Q test and the PPVT test were validated using Item Response Theory (IRT), which checks for ineffective questions. Ineffective questions are those that are not sufficiently correlated with students' overall scores on the test. More specifically, the Rasch model (see Bond and Fox 2007) was used to implement IRT analysis. In addition to checking for ineffective questions, the Rasch analysis rescales the scores to have a mean of 300 and a standard deviation of 50. These transformations are close to linear, so for a given set of students who took both tests it makes little difference whether one uses the raw score or the Rasch score.

In the analysis done in this paper, the raw scores are used instead of the Rasch scores, for two reasons. First, Rasch transformations are done only for groups of 100 or more students who took the same test, and since the tests were given in different languages in almost all cases there are no Rasch scores for students who took the test in a language other than Vietnamese. More specifically, of the 1,747 students who took the PPVT, 87 students took the H'mong language version of the test and 51 took it in other ethnic languages. Since these numbers are both less than 100, there are no Rasch scores for these 138 students; only ethnic minority students who took the test in the Vietnamese language have Rasch PPVT

8 One reason for stopping 'too early' seems to be that the stopping was done in the field at the time of the test, but after Rasch analysis was done some questions were discarded, and some children who incorrectly answered the discarded questions should have been allowed to go on. More generally, our attempts to reconcile all incomplete or missing data with the reasons given in the reports for why students did not take the tests were not successful. The figures given in this paragraph are based on analysis of the data.

scores. For the CDA-Q test, 105 students took the test using the H'mong language, so there are Rasch scores for that test for almost all H'mong children, but not for the 75 children who took the test in another ethnic minority language. (There are scores available for some ethnic minority children because they took the Vietnamese language version of the test.) Thus an analysis that focuses on the performance of ethnic minority groups will have little use for the Rasch scores because they are missing for most ethnic minority children in the sample.

The second reason for not using the Rasch scores is that when Rasch scores are generated for two different languages (which was the case for the CDA-Q test, the H'mong version of which was taken by more than 100 children), the scores were normalised separately to have a mean of 300 and a standard deviation of 50. Thus, by definition the Rasch scores for the children who took the test in the H'mong language will have a mean of 300, and the same is true for the children who took the test in Vietnamese, so the difference in the means of the Rasch scores for these two groups of children will be zero. Thus this normalisation removes the 'gap' in the scores between these two groups of children, so that there is nothing to investigate. Yet in the *raw* scores, the children who took the CDA-Q test in the H'mong language scored much lower, about 2.5 points lower out of 14 questions.

Next, consider the tests taken by the Older Cohort children, who were 8 years old in Round 1 (2002) and 12 years old in Round 2 (2006). Very simple reading and writing tests were administered in both Round 1 and Round 2 to the Older Cohort, and to ensure comparability, these tests were identical in both rounds. The reading test consisted of three parts: reading three letters (e.g. H, A and T); reading a single word that used those letters (e.g. HAT); and reading a simple sentence (e.g. 'The sun is hot'). Scoring was done as follows: 3 points if the child could read the sentence; 2 points if the child could read the word but not the sentence; 1 point if the child could read the letters but not the word or the sentence; and 0 points if the child could not read anything or for no response. In both rounds, the reading test results are missing for six children (these are *not* the same children in both rounds). Because the reading test was very easy, 87 per cent of the children received the highest score in Round 1 and 96 per cent got the highest score in Round 2, which leaves little variation to be explained.

The writing test for the Older Cohort was also quite simple. The test administrator began by saying out loud a simple sentence (e.g. 'I like dogs') to the child. The child received a score of 2 points if he or she could write the sentence without difficulty, 1 point if he or she could write but did so with difficulty or errors, and 0 points if he or she did not write anything or for no response. The writing level results are missing for seven children in both rounds (*not* the same children in both rounds). Again, this test was not difficult for most of the Older Cohort children in Round 1, as most (74 per cent) had a score of 2. Indeed, by Round 2 almost all (93 per cent) had the highest score.[9]

Mathematics tests were also given to the Older Cohort in both Rounds 1 and 2. The Round 1 mathematics (numeracy) test was very simple, consisting of one basic multiplication (2 times 4) problem. Of the 1,000 children in that round, 663 gave the correct answer, 107 gave an

9 Even though more than 90 per cent of the children in the Older Cohort sample had perfect scores on the reading and writing tests in Round 2, simple regressions do have some explanatory power. In particular, years in school and hours per day spent in school have positive effects, and the ethnic minority variable has a negative effect with a t-statistic of about 2.0. Since the mathematics test (discussed below) and the PPVT have much more variation, this paper focuses on those tests. Note that the Round 1 tests for the Older Cohort also have explanatory power for the Round 2 mathematics and PPVT tests when entered as explanatory variables, but since ethnic minorities did worse on the Round 1 tests, adding them as regressors would, in effect, hide some of the gap between Kinh and ethnic minority students in scores on the Round 2 mathematics and PPVT tests.

incorrect answer, and 230 did not respond. According to Tran et al. (2003: 43), the main reason for the 230 non-responses is ‘shyness’ among ethnic minority children (68 of the 230 were ethnic minorities, so among ethnic minorities only 47 per cent have a score for this test, while 81 per cent of Kinh have a score). For Round 2, the mathematics test consisted of ten questions chosen from the Trends in International Mathematics and Science Study developed by the IEA in 2003. Five of the questions were multiple choice questions, and the other five were open-ended questions. For comparability, the Round 1 numeracy question was also included. The ten mathematics questions were selected from the easier IEA questions, focusing on number sense and basic mathematical skills. Question 7 was excluded from the analysis owing to potential bias by gender, so the maximum raw score is 9 for the mathematics test. Of the 990 Older Cohort children who participated in the Round 2 test, nine do not have a raw mathematics score; for two children the test conditions were not appropriate, for the other seven the reason is not specified. Of the 981 children with a raw mathematics score, 921 (all but 60) also have a Rasch mathematics score, which by definition has a mean of 300 and a standard deviation of 50. The 60 Older Cohort children who have a raw mathematics score but not a Rasch score were those who took the test in an ethnic minority language because their mother tongue was not Vietnamese. As with the Younger Cohort, the raw score is used in order to retain as many ethnic minority children as possible.

Finally, the Older Cohort in Round 2 also took the same PPVT test that the Younger Cohort took in Round 2. According to the Young Lives documentation, one child did not take the test because of a serious mental or physical disability. For 11 children the PPVT test was stopped too early, and for 31 children the basal set was not correctly set during test administration. Finally, the test conditions were inadequate (insufficient light) for two children. Thus 45 of the 990 Older Cohort children in Round 2 do not have valid PPVT test scores, which leaves 945 children with valid test scores. Note also that 14 children did not have their tests stopped at the right point, but such continuing the test when one should stop still allows one to obtain the correct score (the one that would have been recorded if the test had been stopped at the correct point) and so these observations still have valid test scores. Finally, of the 945 Older Cohort children with PPVT test scores, all but eight (i.e. 937) also have Rasch test scores; the eight without scores took the test in a language other than Vietnamese, meaning that the sample was not large enough to calculate Rasch scores.

4. Methodological issues

Formal education increases individuals’ well-being primarily through their acquisition of skills, both cognitive (e.g. literacy and numeracy) and non-cognitive (e.g. social and organisational skills).[10] Economists call the process by which formal education produces those skills the *education production function*. At first, depicting education as production may seem strange, but upon further reflection this approach is useful because it provides a comprehensive framework for thinking about how formal education generates cognitive and non-cognitive skills. Most importantly, this framework provides crucial guidance on how to use education data to estimate the *causal* determinants of the skills that students acquire.

10 Much of the material in this section is taken from Glewwe and Lambert (2010).

The process by which both cognitive and non-cognitive skills are learned depends on many different factors. Production functions simply depict this process as a mathematical relationship. These relationships can be very flexible, allowing for almost any learning process. Thus one can argue that an education production function always exists, but at the same time one must realise that its existence does not guarantee that one can estimate it.

Factors that determine learning, henceforth referred to as variables or 'inputs' in the production process, can be divided into school, child and household variables. A simple yet flexible learning production function is:

$$A = a(S, \mathbf{Q}, \mathbf{C}, \mathbf{H}, \mathbf{I}) \qquad (1)$$

where A is skills learned ('achievement'), S is years of schooling, **Q** is the set of all school and teacher characteristics ('quality') that affect learning, **C** is all child characteristics (including 'ability') and **H** is all household characteristics that affect learning, and **I** is educational 'inputs' that households contribute, such as children's daily attendance and purchases of textbooks and other school supplies. While years of schooling (S) and educational inputs (**I**) can be grouped with child or household variables, equation (1) separates them from **C** and **H** because they are (in part) under parents' control.

Equation (1) shows how each variable affects learning *holding other variables constant*. This qualification is important. Consider an improvement in one school quality variable, call it Q_j, such as reducing class size. Equation (1) shows how changing Q_j affects learning *for given values of the other variables*. But changing Q_j (or any school quality variable) could change household behaviour, that is, it could change S or one of the **I** variables. For example, parents may keep children in school longer (increase S) or reduce educational inputs (reduce **I** variables) in response to improved school quality. Thus the 'full' impact of changing Q_j on skills (A) is *not* captured by that variable's impact as depicted in equation (1).

To obtain the 'full' impact of changing school quality, one must know how changes in both the **Q** variables and in other variables affect S and **I** in equation (1). These relationships can be expressed as:

$$S = f(\mathbf{Q}, \mathbf{C}, \mathbf{H}, \mathbf{P}) \qquad (2)$$

$$\mathbf{I} = g(\mathbf{Q}, \mathbf{C}, \mathbf{H}, \mathbf{P}) \qquad (3)$$

where **P** depicts the prices relevant for these household decisions, such as tuition, prices for school supplies, and even child wages (the 'price' of children's time spent in school).

Inserting (2) and (3) into (1) gives another expression for (A):

$$A = h(\mathbf{Q}, \mathbf{C}, \mathbf{H}, \mathbf{P}) \qquad (4)$$

which economists call a 'reduced form' relationship. It shows the *full* causal impact of school quality variables (and other variables) on learning. Equation (4) is not a production function because it depends on households' preferences (which guide households' decisions) and because it includes prices. While the production function in (1) shows the 'direct' impacts of all variables that influence learning, when analysing policy impacts one must estimate the 'full' impact, which includes *indirect* impacts that work by changing variables that households control. Equation (4) shows this 'full' relationship.

This paper attempts to estimate production functions for children in Vietnam, using the Young Lives data from that country. Thus, it presents estimates of equation (1), not of equation (4). Unfortunately, production functions (and other education relationships) are often very difficult to estimate. To see why, consider estimating the production function in equation (1). It can be estimated using linear regression methods, assuming linearity is not restrictive if one adds squared and interaction terms to the variables in (1). To see the estimation problems, consider a simple linear specification of equation (1):

$$A = \beta_0 + \beta_1 S + \beta_{Q1} Q_1 + \beta_{Q2} Q_2 + \ldots + \beta_{C1} C_1 + \beta_{C2} C_2 + \ldots \quad (1')$$

$$+ \beta_{H1} H_1 + \beta_{H2} H_2 + \ldots + \beta_{I1} I_1 + \beta_{I2} I_2 + \ldots + u_A$$

where each variable in **Q**, **C**, **H** and **I** is shown explicitly. An 'error term', u_A, is added, for several reasons. First, data never exist for all variables in **Q**, **C**, **H**, and **I**, so u_A accounts for all variables in (1) that are not in the data. Second, u_A indicates that (1′) is only a linear approximation of (1). Third, observed test scores (A) almost always measure actual skills with error, so u_A includes the difference between observed A and the 'true' A. Finally, the right-hand side variables in (1′) may also have measurement errors, so differences between their true and measured values are also in u_A.

While u_A may seem unimportant because it is unobserved, the causal impacts of the *observed* variables in (1′) on learning, the β coefficients, can be consistently estimated by ordinary least squares (OLS) *only if u_A is uncorrelated with ALL of the observed 'explanatory' variables*. Unfortunately, u_A is very likely to be correlated with those variables. The following paragraphs offer three reasons.[11]

Omitted variable bias. The explanatory variables in equation (1′) could be correlated with u_A because of omitted variable bias: the Young Lives data from Vietnam are extremely detailed, but no dataset contains all the variables in each set of variables (**Q**, **C**, **H,** and **I**), and many unobserved variables (which by definition end up in u_A) may well be correlated with some observed variables. Difficult to observe variables include: teachers' motivation (a **Q** variable), headteachers' management skills (**Q**), children's ability (**C**) and motivation (**C**), and parents' willingness (**H**) and capacity (**H**) to help, and the time they spend helping their children with schoolwork (**I**). OLS estimates of the β's in equation (1′) may be biased because these variables, if unobserved, are probably correlated with some observed variables in (1′). For example, 'high-quality' schools are usually better in many dimensions, both observed and unobserved. This produces positive correlation between u_A and observed school and teacher quality variables, leading to overestimation of the impacts of those variables. Similarly, parental tastes for children's education are rarely observed and probably positively correlated with parental education, causing overestimation of the latter's impact. Omitted variable bias can also lead to underestimation. For example, high school quality may lead parents to reduce time spent helping their children, generating negative correlation between school quality and u_A (assuming some parental efforts are unobserved, which is likely, and thus are in u_A).[12] Omitted variable bias affects estimates of the β terms not only for observed variables that are correlated with u_A but also for those that are uncorrelated with u_A.

Endogenous programme placement bias. School quality could also be correlated with u_A if governments improve schools with unobserved education problems (Pitt et al. 1993). Governments may also raise school quality in areas with good education outcomes, if those areas have political influence (World Bank 2001). The former causes underestimation of school quality variables' impacts on learning, while the latter causes overestimation.

11 A fourth problem, selection and attrition bias, is not discussed here as it seems unlikely to be a problem with the Young Lives data, which tests all children whether or not they are currently in school. See Glewwe and Lambert (2010) for an explanation of this type of bias.

12 When unobserved variables correlated with u_A are endogenous in the sense that households choose them, researchers sometimes call the resulting bias *endogeneity bias*.

Measurement error bias. Anyone who has seen household or school survey data collection in developing countries understands that even the best data contain many errors. Data on school characteristics (including tuition fees) may be inaccurate or out of date. Child, household and school input variables are also prone to errors. Because measurement error is the difference between the true and observed values of a variable, it causes u_A to be correlated with the observed variable. Random measurement error typically causes underestimation of true impacts, while non-random errors could cause underestimation or overestimation.

This paper will attempt to overcome each of these three problems. Regarding the first, omitted variable bias, the most obvious approach is to collect data on nearly all of the explanatory variables in equation (1′). Given the richness of the Young Lives Vietnam data, many, and perhaps even most, of the variables in that equation can be found in the data. In addition, for some regressions the impacts of all school quality variables can be controlled for by using a set of dummy variables for each commune.[13] This works best if there is only one school per commune, and all children enrol in the school located in their commune. Unfortunately, while children primarily enrol only in schools in their commune, there are quite a few communes that have more than one school. This is seen in Table A.2 in the Appendix, which shows that of the 34 communes in the sample in Round 2 (2006), 11 have more than one main primary school, seven have satellite primary schools in addition to a main primary school, and one has both multiple main primary schools and satellite primary schools, leaving only 16 communes with a single primary school. On the other hand, in most of the communes that had multiple main primary schools, those schools were probably very similar, since they had names such as ‘An Hoa Primary School No. 1’ and ‘An Hoa Primary School No.2’, and only three Older Cohort students were attending private primary schools.[14]

Turning to the second problem, endogenous programme placement bias, this seems unlikely to be a problem in the Vietnamese context. District governments are responsible for financing primary and pre-school education in Vietnam, and historically there has been little attempt by the central Government to provide additional resources to poorer districts (see World Bank 1997). The amount of money transferred by provincial or district governments to schools is a set amount per pupil, or more recently a set amount per child of school age, without reference to academic performance (World Bank 2003; Nordic Consulting Group 2008). In recent years the Government has instituted some programmes that are intended to provide more resources to poorer districts and communes, but the amount of funds allocated by these initiatives is very small (less than 1 per cent of total school expenditure) and the share of primary school expenditure received from these sources appears to be uncorrelated with district-level poverty rates (Nordic Consulting Group 2008), which suggests little reason to worry about bias from endogenous programme placement. Finally, regression estimates that use school fixed effects will avoid bias due to any omitted school variables, as explained in the previous paragraph.

Finally, the third estimation problem, measurement error bias, can be addressed using instrumental variable methods as long as the instruments do not suffer from the same types

13 Strictly speaking, this works only if the school quality variables do not interact with the other variables that determine test scores, which is unlikely to hold. Nevertheless, the ability of these dummy variables to fully control for the impacts that do not include interaction terms should remove the most serious estimation problems due to unobserved school quality variables.

14 We tried to get names of primary schools attended for Older Cohort children (as it would allow us to use school fixed effects instead of commune fixed effects), but all we have is current school attended, which for most children is the lower secondary school.

of measurement errors (i.e. as long as they are not correlated with the measurement errors). The variable most likely to suffer from measurement error is household expenditure per capita, and it will be instrumented using an index of household wealth. Another variable that could suffer from measurement error is the height-for-age z-score, which is an indicator of early childhood malnutrition. The measurement error arises from the fact that there is variation in height, and weight, even among healthy children, which implies that this z-score is a noisy measure of early childhood nutritional status.[15]

One of the main aims of this paper is to examine the underlying causes of differences in test scores between ethnic Vietnamese and ethnic minority groups in Vietnam. A useful method for exploring these differences is to use the decomposition proposed by Blinder (1973) and Oaxaca (1973). To see how this method works, consider estimates of equation (1′) that are done separately for the Kinh and ethnic minority populations:[16]

$$A_k = \beta_{0k} + \boldsymbol{\beta}_k'\mathbf{x}_k + u_{Ak} \qquad (5) \quad \text{(Kinh)}$$

$$A_m = \beta_{0m} + \boldsymbol{\beta}_m'\mathbf{x}_m + u_{Am} \qquad (6) \quad \text{(ethnic minority)}$$

where all the coefficients in equation (1′) other than the constant term have been incorporated into the **β** vectors, all of the variables have been incorporated into the **x** vectors, and the k and m subscripts indicate Kinh and ethnic minority, respectively. Note that the coefficients, i.e. the impacts of the variables on test scores, are now allowed to be different for the Kinh and the ethnic minority groups. This allows for the possibility that impacts of these variables could be different for these two groups.

Since the average values of the error terms (u_{Ak} and u_{Am}) in equations (5) and (6) equal zero, the following relationships hold, where 'bars' indicate mean values of variables for the respective ethnic group:

$$\overline{A}_k = \beta_{0k} + \boldsymbol{\beta}_k'\overline{\mathbf{x}}_k \qquad (5')$$

$$\overline{A}_m = \beta_{0m} + \boldsymbol{\beta}_m'\overline{\mathbf{x}}_m \qquad (6')$$

Thus, the difference in the mean test scores between Kinh children and ethnic minority children can be expressed as:

$$\overline{A}_k - \overline{A}_m = (\beta_{0k} - \beta_{0m}) + (\boldsymbol{\beta}_k'\overline{\mathbf{x}}_k - \boldsymbol{\beta}_m'\overline{\mathbf{x}}_m) \qquad (7)$$

Blinder and Oaxaca both showed how the difference in the terms in the second set of parentheses can be decomposed into two parts, one reflecting the difference in the mean values of the **x** variables across the two ethnic groups (which is multiplied by $\boldsymbol{\beta}_k$) and the other reflecting the difference in the coefficients across the two ethnic groups (which is multiplied by $\overline{\mathbf{x}}_m$):

$$\begin{aligned}\overline{A}_k - \overline{A}_m &= (\beta_{0k} - \beta_{0m}) + (\boldsymbol{\beta}_k'\overline{\mathbf{x}}_k - \boldsymbol{\beta}_m'\overline{\mathbf{x}}_m) + \boldsymbol{\beta}_k'\overline{\mathbf{x}}_m - \boldsymbol{\beta}_k'\overline{\mathbf{x}}_m \qquad (8)\\ &= (\beta_{0k} - \beta_{0m}) + \boldsymbol{\beta}_k'(\overline{\mathbf{x}}_k - \overline{\mathbf{x}}_m) + (\boldsymbol{\beta}_k - \boldsymbol{\beta}_m)'\overline{\mathbf{x}}_m\end{aligned}$$

15 In estimates not reported in this paper (but available upon request), we used each child's weight-for-age z-score as an instrument for his or her height-for-age z-score. This had little effect on the results, and in any case it is probably not a valid instrument because the same 'noise' in height-for-age also affects weight-for-age (among healthy children some are naturally taller, and they will usually also be heavier). Another possibility, which was not done in this paper, would be to use household toilet and water-source variables as instruments for height-for-age z-score.

16 In Vietnam, the Chinese ethnic minority is not considered disadvantaged, and shares many cultural similarities with the Kinh, so in virtually all studies of ethnic minorities in Vietnam, the Chinese are grouped together with the Kinh and together they are considered the 'ethnic majority'. This paper follows this classification, although in practice it makes no difference because only one of the 2,000 Younger Cohort children is Chinese and none of the 1,000 Older Cohort children is Chinese.

In fact, this decomposition can be done in another, analogous, way, which multiplies the difference in the means across the two groups by $\boldsymbol{\beta}_m$ and multiplies the differences in the $\boldsymbol{\beta}$'s of the two groups by $\overline{\mathbf{x}}_k$:

$$\overline{A}_k - \overline{A}_m = (\beta_{0k} - \beta_{0m}) + (\boldsymbol{\beta}_k'\overline{\mathbf{x}}_k - \boldsymbol{\beta}_m'\overline{\mathbf{x}}_m) + \boldsymbol{\beta}_m'\overline{\mathbf{x}}_k - \boldsymbol{\beta}_m'\overline{\mathbf{x}}_k \quad (9)$$
$$= (\beta_{0k} - \beta_{0m}) + \boldsymbol{\beta}_m'(\overline{\mathbf{x}}_k - \overline{\mathbf{x}}_m) + (\boldsymbol{\beta}_k - \boldsymbol{\beta}_m)'\overline{\mathbf{x}}_k$$

In most cases, these two methods of decomposing should give similar results. Both will be shown in the empirical work below.

To see how to interpret these decompositions, consider equation (8). The first term, $\beta_{0k} - \beta_{0m}$, shows the differences in the test scores that are not accounted for by differences in the means of the **x** variables nor by the differences in the impacts of those variables (differences in the coefficients), for some reference value for **x** (averaged over all groups). Many studies implicitly set **x** to equal zero, but this is somewhat arbitrary and could give misleading results if some or all of the **x** variables never attain a value of zero.[17] In this study the reference value for each of the **x** variables will be the lowest value for each variable. Thus, in this study $\beta_{0k} - \beta_{0m}$ shows the difference in the test scores of an individual for whom all the **x** variables take their lowest value. This should be kept in mind when interpreting the contribution of $\beta_{0k} - \beta_{0m}$ to $\overline{A}_k - \overline{A}_m$.

Next, consider the second term in equation (8), $\boldsymbol{\beta}_k'(\overline{\mathbf{x}}_k - \overline{\mathbf{x}}_m)$. Technically speaking, this is the sum, over all the **x** variables, of the contributions of the differences in the mean values of the **x** variables between Kinh and ethnic minority children to explaining the differences in the mean test scores across the two groups of children. For example, as will be seen below, on average Kinh children have better-educated parents than do ethnic minority children, and educated parents have a direct, positive impact on test scores. While this term is the sum of all of these effects over all the different **x** variables, the contribution of each variable can be obtained from the regression estimates, and indeed the contributions of each of the variables are shown below.

Finally, turn to the last term in equation (8), $(\boldsymbol{\beta}_k - \boldsymbol{\beta}_m)'\overline{\mathbf{x}}_m$. This is the sum, over all the **x** variables, of the contributions to the difference in mean test scores between Kinh and ethnic minority children caused by differences (across the two cohorts of children) in the impacts of the **x** variables on test scores. Following the example of the previous paragraph, it may be that the impact of parental years of education on test scores is higher for the Kinh than for ethnic minorities, for example because school quality is higher among the Kinh population. Again, this term in equation (8) sums up these effects for all the **x** variables, but the regression estimates can be used to identify these impacts for each variable, and those impacts are shown for all variables in the empirical results presented in the next two sections.

Even in a dataset as rich as the Young Lives dataset, it is not possible to have data on all of the elements of the **Q**, **C**, **H**, and **I** variables. Perhaps the greatest weakness of the Young Lives data is the lack of data on school quality (the **Q** variables). Only a relatively small

17 For example, consider the case of only one explanatory variable for a test score, namely years in school. Suppose that years of school has a stronger effect on Kinh children than on ethnic minority children, perhaps because the former attend higher-quality schools. If all children have had four or more years of schooling, fitting separate regression lines for both Kinh and ethnic minority children will lead to a line with a higher slope for Kinh children, which if extended back to the point where years of schooling equals 0 could lead to an intercept for Kinh children that is lower than that for ethnic minority children, i.e. $\beta_{0k} < \beta_{0m}$, which could be mistakenly interpreted as 'discrimination' against Kinh children even if the regression line for the Kinh lies above that of the ethnic minority children for all values of years of schooling in the population. The point here is that interpretation of $\beta_{0k} - \beta_{0m}$ must be done very cautiously.

number of questions about schools were asked in the community questionnaire (which is called the 'context instrument').

However, under certain assumptions it is possible to control for differences in school quality by using community fixed effects estimation methods. If there is only one school in each of the 31 communes from which the data were collected, then the impacts of school characteristics on test scores in any particular commune can be captured by a community-level dummy variable (which will also capture any effects of non-school community variables on test scores, but in general one would expect such effects to be small compared to the school effects captured by the community dummy variables). Thus, in the first set of regressions presented below, no school variables are included; instead community fixed effects are used to control for differences in school quality.[18] Note that, in most of the communities (22 or 23 out of 31, depending on the cohort), all the children are either Kinh children or ethnic minority children. In the few (6 or 9 out of 31) that are 'mixed', the effects of the school variables could vary by ethnic group, so in those communities alone the regressions include a variable that is an interaction between the community dummy variable and the ethnic minority dummy variable to capture this (potential) differential.

A final issue with the use of community fixed effects (community dummy variables) is that there is no longer a constant term for either ethnic group. In effect, the constant term for the Kinh is the (weighted) average of the community dummy variables in which the Kinh population resides, and the same is true for the ethnic minority population (in which case the interaction term between the ethnic minority dummy variable and the community dummy in the 'mixed' communes must be added to the community dummy). The averages of these dummy variables are shown in the results below. Note that they represent differences in school quality as well as the ($\beta_{0k} - \beta_{0m}$) term; estimation using commune fixed effects cannot distinguish between ($\beta_{0k} - \beta_{0m}$) and differences in school quality.

5. Analysis for the Younger Cohort

This section examines the test scores of the 1,970 children in the Younger Cohort, who were about 5 years old when they were tested in 2006. The analysis begins by comparing the test scores of ethnic majority (Kinh and Chinese) and ethnic minority students, first for the entire sample and then for the sub-sample of communes that have both Kinh and ethnic minority children. It then presents estimates of cognitive skills production functions that attempt to explain the determinants of test scores, and uses these results to examine why test scores are lower for ethnic minority children.

Table 1 presents means and standard deviations of the raw scores for the CDA-Q and PPVT tests, first for the full sample of the Younger Cohort and then separately for Kinh and ethnic minority children. The top half of the table shows statistics for all students while the bottom half limits the sample to the six communes that had both Kinh and ethnic minority children.

18 As explained above, about half of the communes have more than one school, but in many of these the schools seem to be very similar in the sense that they have the same names except that one is 'number 1', another is 'number 2', etc.

Table 1. *Mean test scores for ethnic majority and ethnic minority children (Younger Cohort, 5 years old)*

Student type	Variable (raw score)	Mean	Standard deviation	Number of observations
All communes				
Full sample	CDA-Q	9.79	2.51	1,906
	PPVT	37.0	18.2	1,747
Kinh	CDA-Q	10.20	2.29	1,631
	PPVT	39.4	18.0	1,480
Ethnic minority	CDA-Q	7.36	2.34	275
	PPVT	23.5	12.2	267a
Ethnic minority	CDA-Q	8.26	2.09	95
(speaks Vietnamese)	PPVT	30.1	12.1	92
Ethnic minority	CDA-Q	6.88	2.32	180
(speaks other language)	PPVT	20.1	10.7	174
Mixed communes				
Full sample	CDA-Q	8.94	2.35	369
	PPVT	32.1	14.8	356
Kinh	CDA-Q	9.78	1.97	209
	PPVT	37.0	14.6	202
Ethnic minority	CDA-Q	7.86	2.36	160
	PPVT	25.8	12.6	154
Ethnic minority	CDA-Q	7.90	2.23	61
(speaks Vietnamese)	PPVT	29.8	13.3	60
Ethnic minority	CDA-Q	7.83	2.45	99
(speaks other language)	PPVT	23.2	11.5	94

a Small discrepancies in some of these figures are due to missing data on whether one ethnic minority child speaks Vietnamese or another language.

Beginning with the first row in that table, the average child in the full sample correctly answered 9.8 of the 14 questions in the CDA-Q test of quantitative skills. The gap between Kinh and ethnic minority children is quite large: the former had a mean score of 10.2 while the latter had a mean score of 7.4, a difference of 2.8 points which is equivalent to 1.1 standard deviations of the distribution of test scores. Turning to the PPVT scores, the overall mean of 37.0 masks a large gap by ethnic group: the mean score for the Kinh was 39.4 while the mean score for ethnic minorities was 23.5. This gap of 15.9 points is equivalent to 0.9 standard deviations of the distribution of test scores.

It is also informative to distinguish between ethnic minority children whose ‘mother tongue’ is Vietnamese and those whose mother tongue is another language. About one-third of ethnic minority children report that they are in the former group, and their test scores are much higher than the two-thirds whose mother tongue is not Vietnamese. More specifically, their mean score on the CDA-Q (mathematics) test, 8.3, is about 0.5 standard deviations higher than the mean score on the same test for ethnic minority children whose mother tongue is not Vietnamese (6.9). The difference on the PPVT test is even higher; ethnic minority children whose mother tongue is Vietnamese have a score of 30.1, which is about 0.6 standard deviations higher than the mean score on that test for ethnic minority children whose mother tongue is not Vietnamese (20.1). Note that the ethnic groups least likely to speak Vietnamese as their mother tongue are the H’mong (only 3 per cent) and the Dao (24 per cent), while those most likely to speak Vietnamese are the Cham (97 per cent) and the Ba Na (64 per cent).

As explained above, part of the difference between the test scores of Kinh children and ethnic minority children may be due to the fact that they live in different communities and so they attend different schools. To 'control for' differences in communities and schools, the bottom half of Table 1 presents the same information given in the top half, but is limited to the six communes that have both Kinh and ethnic minority children in the sample. This comparison does result in somewhat smaller gaps. Examining the raw scores, the difference in the CDA-Q is 2.2, which is 22 per cent smaller than the gap of 2.8 when comparing all communes. Similarly, the difference in the raw PPVT score is 12.2, which is 23 per cent smaller than the gap of 15.9 when all communes are compared. Nevertheless, there are still large gaps even when comparing Kinh and ethnic minority children in the same commune. Note also that the gap in test scores between ethnic minorities who speak Vietnamese as their mother tongue and those whose mother tongue is another language is much smaller than for the ethnic minority sample as a whole; indeed for the CDA-Q test there is almost no difference.

To understand better the nature of the gaps, the rest of this section presents regressions that attempt to explain the differences in the test scores of Kinh and ethnic minority children in Vietnam. The results for the Younger Cohort on the CDA-Q test are shown in Table 2, and those for the PPVT test are shown in Table 3.

Recall that the Blinder-Oaxaca decomposition divides the overall difference in mean test scores between Kinh and ethnic minority children into three parts: (1) the differences attributable to different mean values of explanatory variables (difference in the means of the **x** variables); (2) the differences due to different impacts of those explanatory variables on test scores (difference in the **β**'s); and (3) differences in the constant terms (the β_0's). In fact, the Younger Cohort sample includes only 283 ethnic minority children, so the precision of the estimated **β**'s for ethnic minorities is often low, making these estimates not significantly different from the estimated **β**'s for the Kinh children. When this is the case, which happens more often than not, allowing separate estimates for Kinh and ethnic minority children can produce large apparent 'explanations' of the differences in the mean scores across those two groups that are, in fact, not statistically significant. Thus, whenever this difference in β_k and β_m was not statistically significant for a given explanatory variable, the two associated β's were constrained to be equal, which avoids spurious 'explanations' and should also increase the precision of estimates of the impact of differences in the mean values of the **x** variables on differences in mean test scores across Kinh and ethnic minority children.

Table 2. *Regression estimates for CDA-Q test, Younger Cohort*

Variables	β_k	β_m	$\beta_k - \beta_m$	$\bar{x}_k$	$\bar{x}_m$	$(\beta_k - \beta_m)' \bar{x}_k$	$\beta_m'(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_m$	$\beta_k'(\bar{x}_k - \bar{x}_m)$	$\beta_k (=\beta_m)$	$\beta_k'(\bar{x}_k - \bar{x}_m)$
Log (per capita expenditure)	0.087	1.128***	−1.043***	1.943	1.135	−2.027	0.911	−1.184	0.069	–	–
Father's education level	0.022**	0.022**	0.0	8.37	3.24	0.0	0.113	0.0	0.113	0.027***	0.138
Mother's education level	0.031***	0.031***	0.0	7.72	2.11	0.0	0.174	0.0	0.174	0.029***	0.163
Girl	0.015	0.015	0.0	0.49	0.463	0.0	0.000	0.0	0.000	0.014	0.000
Child age	0.042***	0.006	−0.035**	15.28	13.71	0.535	0.009	0.480	0.066	0.034***	0.054
Height-for-age	0.001	0.001	0.0	3.977	2.863	0.0	0.001	0.0	0.001	0.017	0.019
Log (educ.expenditure)	0.009	0.009	0.0	5.541	2.501	0.0	0.027	0.0	0.027	0.061	0.185
Time spent in crèche	0.000	0.000	0.0	6.739	0.555	0.0	0.000	0.0	0.0	0.000	0.001
Time spend in pre-school	0.004	0.004	0.0	17.62	11.48	0.0	0.025	0.0	0.025	0.004	0.021
Average constant (segregated)	−1.226	−2.545									
Average constant (mixed)	−0.868	−2.325									

Notes: Per capita expenditure is instrumented, using a household wealth index. Significance is based on robust standard errors, clustered at the commune level. Sample size is 1,815.

Significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively.

The first column of Table 2 shows the estimates of $\boldsymbol{\beta}_k$ in equation (5), and the second column shows the estimates of $\boldsymbol{\beta}_m$ in equation (6).[19] The third column shows the difference in the two estimates, and asterisks indicate whether the difference is statistically significant.[20] Note that the test score variable has been standardised to have a standard deviation of 1, which makes the coefficients easier to interpret. Somewhat surprisingly, household wealth (as measured by log of per capita expenditure) has no significant effect on Kinh children's mathematics test scores, although it has a large and statistically significant effect among ethnic minority children. This difference partially reflects the fact that ethnic minority children are poorer, and income effects may be stronger for poorer households, but a quadratic specification (not reported here) still shows much higher impacts of household wealth for ethnic minority households.

The next two rows in Table 2 show that parental education has a strong impact on the test scores of both Kinh and ethnic minority children (the differences by ethnic group in the parameters for these two variables were not statistically significant, and so they are constrained to be equal for both groups). Positive impacts of parental education on child learning are often found in other studies, and are quite intuitive. The only other variable in the regression that had a statistically significant impact on the CDA-Q (mathematics) test was child age, which was statistically significant for Kinh children but not for ethnic minority children. Presumably, this reflects the fact that older children are, *ceteris paribus*, more mature and thus have acquired more skills; recall that almost none of these children have started primary school so there is no variation in the sense that older children have been at school longer. It is not clear why this 'maturity' effect does not show up very strongly among ethnic minority children.

19 These are instrumental variable estimates; to minimise measurement error bias, the (log of) per capita expenditure variable is instrumented by an index of household wealth.

20 The actual regression coefficients are those in columns 1 and 3 of Table 2, and statistical significance is shown for those two columns. Column 2 is calculated as the difference, and calculating its statistical significance is straightforward.

None of the remaining variables – child sex, height-for-age z-scores, educational expenditure on the child, months spent in a community crèche from birth to 36 months of age, and months spent in a pre-school since 36 months of age – is statistically significant. Moreover, for all of these variables the difference between the coefficients for Kinh and for ethnic minority students is not statistically significant. The lack of statistical significance is rather surprising for the height-for-age z-score variable, though it does have some explanatory power in the regressions for the Older Cohort, as will be seen in the next section.

The last two lines of columns 1 and 2 in Table 2 show the average constant term (average community fixed effect) for Kinh and ethnic minority children, separately for communes that are segregated (all Kinh or all ethnic minority) and for communes that are mixed (integrated). There are two main lessons to draw from these figures. First, the constant terms for both Kinh and ethnic minority children are fairly similar, whether they live in segregated or mixed communes; in particular, there is no large advantage for ethnic minority children in living in a mixed commune and no disadvantage for Kinh children from living in such a commune. Second, there is a gap of about 1.3 or 1.4 standard deviations of a test score between ethnic minority children and Kinh children, even after controlling for all other variables. This is rather surprising given that the unadjusted difference in Table 1 was smaller, namely about 1.1 standard deviations. However, as discussed above, these differences in the (average) β_0 terms are difficult to interpret and may simply reflect 'adjustments' in the constant term to accommodate differences in the 'slope' parameters that are statistically significant across the two groups.

The Blinder-Oaxaca decomposition can be used to see how much of the observed gap between Kinh and ethnic minority children in their mean CDA-Q test scores is explained by differences in the means of the explanatory variables between the Kinh and ethnic minority populations, and how much is explained by differences in the impacts of those variables. The means are shown in columns 4 and 5 of Table 2. Note that any rows in which the variable does not have any significant explanatory power for either group will have little role to play.

The role played by per capita expenditure is the strongest. Since Kinh children live in households with higher incomes, they can gain (using the coefficient for ethnic minorities) about 0.9 standard deviations of a test score, although this effect is not seen when the very small Kinh coefficient is used (only 0.1 standard deviations). More consistent across the two decompositions is that the difference on those two coefficients is highly favorable to ethnic minority children; those children benefit much more than Kinh children from an increase in household income, adding between 1.2 and 2.0 standard deviations to their test scores. Overall (combining the two separate parts of the decomposition), rather than explaining why ethnic minorities score lower on the CDA-Q test than do Kinh children, household income in effect makes the gap wider, by about 1.1 standard deviations, because ethnic minorities' incomes have a strong positive impact on test scores that is not found among Kinh children.

Turning to other variables in Table 2 that play some role, higher fathers' and mothers' education among Kinh children together explain about 0.3 standard deviations of the gap in mean test scores between Kinh and ethnic minority children. That is, parental education raises test scores, and Kinh children's parents are much more educated than the parents of ethnic minority children; their fathers have, on average, five more years of education and their mothers have almost six more years of education. The only other variable in Table 2 that explains a sizeable part of the gap between ethnic minority and Kinh children's scores on the CDA-Q test is child age; Kinh children 'mature' in some way that ethnic minority children do not, which boosts their scores by about 0.5 standard deviations. But exactly what is happening here is far from clear; it is unlikely to be a 'biological' maturation so presumably it may reflect something about Kinh culture. On the other hand one cannot rule out that this difference could be spurious; there are nine explanatory variables in Table 2, and even if all the differences in the parameters between Kinh and ethnic minority children were zero, there is a 1 out of 20 chance that any given difference will be significant at the 5 per cent level, and this may be such a case.

Finally, the last two columns in Table 2 are estimates that exclude the per capita expenditure variable, which arguably does not belong in a production function; money does not directly affect children's learning, it has an indirect effect only via purchases of educational materials or services (and such expenditures are already included in the regressions in Table 2)[21]. The results are not very different from those based on regressions that include per capita expenditure as an explanatory variable. Most importantly, they also explain very little of the large gap in the CDA-Q test between Kinh and ethnic minority kids in the Younger Cohort.

Overall, while the regression coefficients usually have the expected sign, it is not clear that the Blinder-Oaxaca decomposition is providing clear insights into the causes of the differences in the CDA-Q test scores among the Younger Cohort. Perhaps the main lesson is that it matters little whether Kinh or ethnic minority children live in communities in which they are the only ethnic group or whether they live in mixed communities.

Table 3. *Regression estimates for PPVT test, Younger Cohort*

Variables	β_k	β_m	$\beta_k - \beta_m$	$\bar{x}_k$	$\bar{x}_m$	$(\beta_k - \beta_m)' \bar{x}_k$	$\beta_m'(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_m$	$\beta_k'(\bar{x}_k - \bar{x}_m)$	β_k $[\beta_m]$	$\beta_m'(\bar{x}_k - \bar{x}_m)$ $[\beta_k'(\bar{x}_k - \bar{x}_m)]$
Log (per capita expenditure)	0.341***	0.888***	−0.547***	1.943	1.135	−1.063	0.718	−0.621	0.276	–	–
Father's education level	0.020**	0.020**	0.0	8.37	3.24	0.0	0.103	0.0	0.103	0.029***	0.149
Mother's education level	0.033***	0.033***	0.0	7.72	2.11	0.0	0.185	0.0	0.185	0.035***	0.196
Girl	−0.041	−0.041	0.0	0.49	0.463	0.0	−0.001	0.0	−0.001	−0.027	−0.001
Child age	0.054***	0.018**	0.036***	15.28	13.71	0.550	0.029	0.493	0.085	0.052***	0.030
Height-for-age	0.050	0.050	0.0	3.977	2.863	0.0	0.056	0.0	0.056	0.017	0.019
Log (educ.expenditure)	0.008	0.008	0.0	5.541	2.501	0.0	0.024	0.0	0.024	0.061	0.185
Time spent in crèche	−0.002	−0.002	0.0	6.739	0.555	0.0	0.011	0.0	−0.012	0.000	−0.001
Time spend in pre-school	0.004	0.004	0.0	17.62	11.48	0.0	0.023	0.0	0.024	0.004	−0.004
Average constant (segregated)	−2.094	−2.086									
Average constant (mixed)	−1.913	−2.408									

Notes: Per capita expenditure is instrumented, using a household wealth index. Significance is based on robust standard errors, clustered at the commune level. Sample size is 1,668.

Significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively.

Next, consider the gap in test scores between Kinh and ethnic minority children in the PPVT test. The estimates in Table 3 are analogous to those in Table 2 for the CDA-Q test. The first result of note is that household expenditure per capita has a strong and statistically significant impact on the PPVT test for Kinh children, in contrast with the small and insignificant impact of that variable on the CDA-Q test for Kinh children. Moreover, the impact is even stronger for ethnic minority children, and the difference in these coefficients is quite large (and statistically significant).

Turning to parental education, both mothers' and fathers' education have positive and statistically significant impacts on both Kinh and ethnic minority children's PPVT scores, as they did on the CDA-Q scores, and the differences in the coefficients between the two groups

21 In these two columns, β_k and β_m are constrained to be the same.

were not statistically significant, so they are constrained to be equal. As with the CDA-Q test, the only other variable that is statistically significant is child age, but in this case it has a strong positive impact on PPVT scores for both Kinh and ethnic minority children, although again the impact on ethnic minority children is much smaller than on Kinh children, and that difference is highly statistically significant. Of course, it is intuitively obvious that children of better-educated parents learn more quickly, and that as they get older (even before entering primary school), they learn more.

Turning to other variables in Table 3, none has a statistically significant effect for either ethnic group, and the differences were also statistically insignificant (and so they were constrained to be equal). This is the same result as seen with the CDA-Q test for these variables.

Finally, the last two lines of the first two columns of Table 3 show average constant terms across communes for both Kinh and ethnic majority children, again separately for whether they live in segregated or mixed communes. As before, it matters little whether either type of child lives in a segregated or mixed commune. More interestingly, the difference across the two groups of children is much smaller than in Table 2: only about 0.5 standard deviations of a test score for mixed communes, and no difference at all for segregated communes. This implies that most of the raw difference in PPVT test scores seen in Table 1 is explained by the regression results (recall that the raw difference was equal to about 0.9 standard deviations of the distribution of the test score).

Now turn to the Blinder-Oaxaca decomposition for the PPVT scores of the Younger Cohort, keeping in mind that the difference in the raw scores across Kinh and ethnic minority children was about 0.9 standard deviations of the distribution of the PPVT score. The two decompositions indicate that the impact of differences in the mean of (the log of) per capita expenditures accounts for between 0.3 and 0.7 standard deviations of this difference, although the fact that the coefficient is much higher for ethnic minorities implies that, for an average child, there is a 0.6 to 1.1 standard deviation benefit to ethnic minority children, so it seems that, overall, per capita expenditure does not explain the differences (and in fact the combined effect makes the gap larger by about 0.3 standard deviations).

Differences in the mean value of parental education appear to explain about 0.3 standard deviations of the gap, after summing the effects of both parents, which is similar to the impacts of these variables on the CDA-Q test seen in Table 2. The fact that child age has a much larger impact on Kinh children than on ethnic minority children explains a very large part, about 0.5 standard deviations, of that gap. None of the other variables provides any sizeable explanation of the difference in the means of the test scores across Kinh and ethnic minority children – as one would expect, given that they are all statistically insignificant.

Finally, the last two columns in Table 3 present results that drop per capita expenditure as an explanatory variable. As in Table 2, this has little effect on the decomposition results and does not help to explain the learning gap between Kinh and ethnic minority children.

6. Analysis for the Older Cohort

This section analyses the data for the 990 children of the Older Cohort who were found and interviewed in Round 2. These children were about 12 years old when they were tested in 2006. As in the previous section, the analysis begins by comparing the test scores of ethnic majority (Kinh) and ethnic minority students,[22] first for the entire sample and then for the sub-sample of communes that have both Kinh and ethnic minority children. It then presents estimates of a cognitive skills production function that attempt to explain the determinants of test scores, and why these are lower for ethnic minority children.

Table 4 presents means and standard deviations of the 'raw' scores for the mathematics and PPVT tests, for the full sample of the Older Cohort and separately for Kinh and ethnic minority children. The top half of the table shows statistics for all students while the bottom half limits the sample to the nine communes that had both Kinh and ethnic minority children.

Table 4. *Mean test scores for ethnic majority and ethnic minority children (Older Cohort, 12 years old)*

Student type	Variable (raw score)	Mean	Standard deviation	Number of observations
All communes				
Full sample	Maths (IEA)	7.44	1.92	981
	PPVT	137.6	26.1	945
Kinh	Maths (IEA)	7.75	1.51	855
	PPVT	142.3	18.8	827
Ethnic minority	Maths (IEA)	5.28	2.78	126
	PPVT	104.3	41.5	118[a]
Ethnic minority (speaks Vietnamese)	Maths (IEA)	6.27	2.31	66
	PPVT	119.8	31.6	63
Ethnic minority (speaks other language)	Maths (IEA)	4.18	2.85	60
	PPVT	86.8	45.0	54
Mixed communes				
Full sample	Maths (IEA)	6.62	2.32	217
	PPVT	130.4	29.1	206
Kinh	Maths (IEA)	7.44	1.58	118
	PPVT	141.8	18.6	113
Ethnic minority	Maths (IEA)	5.64	2.66	71
	PPVT	116.6	33.3	68
Ethnic minority (speaks Vietnamese)	Maths (IEA)	5.86	2.47	49
	PPVT	117.9	30.7	48
Ethnic minority (speaks other language)	Maths (IEA)	4.32	3.40	22
	PPVT	117.9	33.3	19

a Small discrepancies in some of these figures are due to missing data on whether one ethnic minority child spoke Vietnamese or another language.

Beginning with the raw scores, the average Older Cohort child in the full sample correctly answered 7.4 of the 9 questions in the mathematics test. As with the Younger Cohort, the gap between Kinh and ethnic minority children is quite large: the former had a mean score of 7.8

22 None of the Older Cohort children were ethnic Chinese.

while the latter had a mean score of 5.3, a difference of 2.5 points, which is equivalent to 1.3 standard deviations of the distribution of test scores. For the PPVT scores, the overall mean of 137.6 masks a large gap by ethnic group: the mean score for the Kinh was 142.3 but the mean for ethnic minorities was much lower, 104.3. This gap of 38 points is equivalent to 1.5 standard deviations of the distribution of test scores. However, among the ethnic minority children there are some whose mother tongue is Vietnamese and some whose mother tongue is an ethnic minority language, and as with the Younger Cohort, those whose mother tongue is Vietnamese do much better than those whose mother tongue is an ethnic minority language.

As discussed above, part of the difference between the test scores of Kinh and ethnic minority children may reflect the fact that they live in different communities and so attend different schools. To 'control for' differences in communities and schools, Table 4 also presents similar information, but limited to the nine communes in the sample that have both Kinh and ethnic minority children. This comparison does reduce the gaps to some extent. Examining the raw scores, the difference in the mathematics test is 1.8, which is 28 per cent smaller than the gap of 2.5 when comparing all communes. Similarly, the difference in the raw PPVT score is 25.2, which is 34 per cent smaller than the gap of 38.0 when all communes are compared. Nevertheless, there are still large gaps even when comparing Kinh and ethnic minority children in the same commune. Note as well that in the mixed communes the gaps between the ethnic minority children whose mother tongue is Vietnamese and those whose mother tongue is another language are much smaller than was the case for all communes.

To understand better the nature of the gaps, the rest of this section presents regression estimates and Blinder-Oaxaca decompositions that attempt to explain the differences in the test scores of Kinh and ethnic minority children in Vietnam. This is done for the mathematics test in Table 5 and for the PPVT test in Table 6.

Table 5. *Regression estimates for mathematics (IEA) test, Older Cohort*

Variables	β_k	β_m	$\beta_k - \beta_m$	$\bar{x}_k$	$\bar{x}_m$	$(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_k$	$\beta_m'(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_m$	$\beta_k'(\bar{x}_k - \bar{x}_m)$
Log (per capita expenditure)	0.269**	0.269**	0.0	2.085	1.384	0.701	0.0	0.189	0.0	0.189
Father's education level	0.024**	0.024**	0.0	8.515	2.902	5.613	0.0	0.135	0.0	0.135
Mother's education level	0.024***	0.024***	0.0	7.651	1.619	6.032	0.0	0.145	0.0	0.145
Log (educ.expenditure)	0.014	0.014	0.0	6.027	2.905	3.122	0.0	0.044	0.0	0.044
Girl	−0.008	0.271*	−0.279*	0.502	0.503	−0.001	−0.140	−0.000	−0.150	0.000
Child age	0.009	0.009	0.0	15.163	13.669	1.494	0.0	0.013	0.0	0.013
Years of schooling	0.256***	0.358**	−0.102*	5.954	5.133	0.821	−0.607	0.294	−0.688	0.210
Hours in school/day	0.141***	0.141***	0.0	4.504	4.000	0.504	0.0	0.071	0.0	0.071
Hours spent studying/day	0.010	0.010	0.007	2.901	1.579	1.322	0.0	0.013	0.0	0.013
Hours spent working/day	−0.048*	−0.048*	0.0	1.826	3.495	−1.669	0.0	0.080	0.0	0.080
Extra maths class in last 6 months	0.003	0.003	0.0	1.913	0.291	1.622	0.0	0.005	0.0	0.005
Height-for-age	0.064**	0.064**	0.0	3.728	2.721	1.007	0.0	0.064	0.0	0.064
Hearing problem	−0.023	−0.023	0.0	0.208	0.007	0.201	0.0	−0.005	0.0	−0.005
Understands what parents say	−0.668***	−0.668***	0.0	0.015	0.031	−0.016	0.0	0.011	0.0	0.011
Long-term health problem	−0.043	−0.043	0.0	0.063	0.086	−0.023	0.0	0.001	0.0	0.001
Serious illness/injury in last 4 years	−0.244**	−0.244**	0.0	0.056	0.055	0.001	0.0	−0.000	0.0	−0.000
Average constant (segregated)	−3.327	−3.380								
Average constant (mixed)	−3.474	−4.582								

Notes: Per capita expenditure is instrumented, using a household wealth index. Significance is based on robust standard errors, clustered at the commune level. Sample size is 893.

Significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively.

The first column of Table 5 shows the estimates of $\boldsymbol{\beta}_k$ in equation (5), and the second column shows the estimates of $\boldsymbol{\beta}_m$ in equation (6), if they are significantly different from the estimates for $\boldsymbol{\beta}_k$, for the mathematics score of the Older Cohort children. The third column shows the difference in the two estimates, for the few cases where those differences are statistically significant. Note that, as in Tables 2 and 3, the test score variable has been standardised to have a standard deviation of 1, which makes the coefficients easier to interpret.

The first row of Table 5 shows that household income, as measured by (the log of) per capita expenditure, has a positive and statistically significant impact on the mathematics scores of both Kinh and ethnic minority children (the difference between the two coefficients is not statistically significant, so they are constrained to be equal). Another unsurprising result is that both mothers' and fathers' education have positive and statistically significant impacts on the mathematics scores of both Kinh and ethnic minority children.

Turning to child characteristics, although there are no gender differences for Kinh children there is a strong gender difference for ethnic minorities: girls score about 0.3 standard deviations higher than boys, *ceteris paribus*. Regarding years of schooling, this variable has a strong and statistically significant impact on both Kinh and ethnic minority children, with a significantly larger impact on the latter. Also, the hours per day that a child typically spends in school has a strong and statistically significant positive impact on both Kinh and ethnic minority children (the difference between these two impacts is not statistically significant). Finally, hours spent working has a negative impact, significant at the 10 per cent level for both Kinh and ethnic minority children.

The last five variables in Table 5 measure different aspects of health and disability. Of these, three are statistically significant for both Kinh and ethnic minority children (with no statistically significant difference in the impacts by ethnic group). First, the height-for-age z-score has a positive and significant impact. Second, children whose parents report that they have difficulty understanding what their parents are saying have much lower scores (0.7 standard deviations lower). Third, children whose parents report that their children had had an injury or episode of illness in the last four years that was so severe that the parents thought they might die have significantly lower scores (0.2 standard deviations lower).

Examination of the average constant terms at the bottom of the first two columns again shows that, for Kinh students, it matters little whether they are in a segregated or a mixed commune. However, for ethnic minority students, living in a mixed commune implies a drop of about 1.2 standard deviations in a test score relative to living in a segregated commune. Moreover, ethnic minority students seem to do worse in mixed communes than do Kinh students in mixed communes, a loss of about 1.1 standard deviations. Yet caution is in order for the result pertaining to ethnic minorities living in a segregated commune because they are based on a single commune.

Next, turn to the decompositions for the differences in the average test scores of Kinh and ethnic minority children in the Older Cohort. These are shown in the last four columns of Table 5. The first finding is that the difference in (log of) per capita expenditure between Kinh and ethnic minority students explains about 0.2 standard deviations of the gap between those two groups of students. Differences in fathers' and mothers' education together explain another 0.3 standard deviations. The fact that ethnic minority girls do much better than boys actually increases the gap by about 0.15 standard deviations.

Turn next to the time in school and time at work variables. First, although the fact that Kinh children have somewhat more years of schooling explains about 0.2 to 0.3 standard deviations of the gap, the larger impact of a year of schooling for ethnic minority children 'unexplains' 0.6 to 0.7 standard deviations of that gap. On the other hand, about 0.1 standard deviations of the gap are explained by the fact that Kinh children spend about 30 more minutes per day in school than do ethnic minority children, and the fact that they work 1.7 fewer hours per day explains another 0.1 standard deviations of that gap. Finally, another 0.1 standard deviations of the gap are explained by better nutrition among Kinh children, as measured by height-for-age. None of the other components of the decomposition is very large, and so none of them has noticeable explanatory power.

The regression results and decomposition analysis for the performance of the Older Cohort children on the PPVT test are shown in Table 6. For both Kinh and ethnic minority children, household per capita expenditure and fathers' education (but not mothers' education for Kinh) have strong impacts on learning. Girls do slightly worse, but the age of the child and years of schooling have significant positive impacts on the PPVT test score. Only one of the health variables, a hearing problem (as reported by parents), has a strongly significant effect; it has a large negative effect, which is intuitively plausible since it seems reasonable that hearing problems are more important for reading skills than for mathematics skills.

Table 6. *Regression estimates for PPVT Test, Older Cohort*

Variables	β_k	β_m	$\beta_k - \beta_m$	$\bar{x}_k$	$\bar{x}_m$	$(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_k$	$\beta_m'(\bar{x}_k - \bar{x}_m)$	$(\beta_k - \beta_m)' \bar{x}_m$	$\beta_k'(\bar{x}_k - \bar{x}_m)$
Log (per capita expenditure)	0.396***	0.396***	0.0	2.085	1.384	0.701	0.0	0.278	0.0	0.278
Father's education level	0.024***	0.024***	0.0	8.515	2.902	5.613	0.0	0.135	0.0	0.135
Mother's education level	0.007	0.099	−0.092**	7.651	1.619	6.032	−0.704	0.597	−0.149	0.042
Log (educ.expenditure)	−0.030	−0.030	0.0	6.027	2.905	3.122	0.0	−0.094	0.0	−0.094
Girl	−0.080	−0.080	0.0	0.502	0.503	−0.001	0.0	0.000	0.0	0.000
Child age	0.025***	0.025***	0.0	15.163	13.669	1.494	0.0	0.037	0.0	0.037
Years of schooling	0.320***	0.320***	0.0	5.954	5.133	0.821	0.0	0.263	0.0	0.263
Hours in school/day	0.036	0.036	0.0	4.504	4	0.504	0.0	0.018	0.0	0.018
Hours spent studying/day	0.001	0.001	0.0	2.901	1.579	1.322	0.0	0.001	0.0	0.001
Hours spent working/day	−0.011	−0.011	0.0	1.826	3.495	−1.669	0.0	0.018	0.0	0.018
Extra literature class in last 6 months	0.021*	0.021*	0.0	1.913	0.291	1.622	0.0	0.034	0.0	0.034
Height-for-age	0.037	0.037	0.0	3.728	2.721	1.007	0.0	0.037	0.0	0.037
Hearing problem	−0.618***	−0.618***	0.0	0.208	0.007	0.201	0.0	−0.124	0.0	−0.124
Understands what parents say	−0.191*	−0.191*	0.0	0.015	0.031	−0.016	0.0	0.003	0.0	0.003
Long-term health problem	−0.148*	−0.148*	0.0	0.063	0.086	−0.023	0.0	0.003	0.0	0.003
Serious illness/injury in last 4 years	−0.104	−0.104	0.0	0.056	0.055	0.001	0.0	−0.000	0.0	−0.000
Average constant (segregated)	−3.267	−5.402								
Average constant (mixed)	−3.370	−2.673								

Notes: Per capita expenditure is instrumented, using a household wealth index. Significance is based on robust standard errors, clustered at the commune level. Sample size is 860.

Significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively.

The average constant terms at the bottom of the first two columns show some difference (0.7 standard deviations) between Kinh and ethnic minority children who live in mixed communes, but there is no difference between Kinh children who live in segregated communes and those living in mixed communes. However, there is a large gap between ethnic minority children who live in segregated communes and those who live in mixed communes; the former have test scores almost 2.7 standard deviations lower. However, caution is in order as there is only one segregated ethnic minority commune in the sample.

Finally, turn to the decompositions in the last four columns of Table 6. Kinh children have test scores that are 0.3 standard deviations higher than ethnic minority children because, on average, they live in wealthier households. The positive impact of father's education, in conjunction with the higher levels of that variable among Kinh children, explains another 0.1 standard deviations. However, given the much higher impact of mother's education among ethnic minority children, overall that variable 'unexplains' about 0.1 standard deviations of the gap in test scores.

The significant estimated impact of years of schooling, combined with a higher value for that variable for the Kinh children, explains almost 0.3 standard deviations of the gap between Kinh and ethnic minority children. Finally, the parents of Kinh children are more likely to report that their children have a hearing problem, and this 'unexplains' about 0.1 standard deviations of that gap.

7. Impact of school characteristics

Only a small percentage of the Younger Cohort children analysed in Section 5 had been enrolled in primary school, so there is no scope for analysing the role of formal schooling in determining their cognitive skills. In contrast, almost all of the children in the Older Cohort had spent several years in primary school, and indeed most of them had started lower secondary school, although most of their time at school at the time of the Round 2 data collection (when they were 12 years old) had been time spent in primary school. Thus in theory the Older Cohort Round 2 Young Lives data from Vietnam can be used to examine the impact of school characteristics on student learning. This section first explains the data available and then reports estimates that attempt to measure the impact of school variables on the learning outcomes of the Older Cohort children.

7.1 School data in the Round 2 survey

A community questionnaire was completed for all 34 communes in the Round 2 survey. That questionnaire (the official name of which is 'Young Lives Study Context Instrument') has a section that collects information on schools in each commune. As discussed above, many of these communes have more than one primary school, but the commune questionnaire collects data on only one primary school in each commune. According to the instructions in the questionnaire, the primary school selected should be the one 'that receives more local children and adolescents'.

The information collected from the chosen primary school in the community questionnaire consists of the following: (a) tuition fees, Parent–Teacher Association fees, costs for required supplies (books, uniforms, etc.) and other required payments; (b) hours of class time per day, days of class per month, and months of class per year; (c) ownership (public, private or other); (d) the number of shifts per day; (e) whether the school accepts disabled students and, if so, their numbers, types of disabilities, accommodation made for them, and training of teachers in how to work with disabled students; (f) whether there is one teacher for the whole school, more than one teacher but more grades than teachers (multigrade classrooms) or at least one teacher for every grade; (g) language used by teachers when teaching; (h) language used by students informally (during breaks, when playing); (i) year the school opened; and (j) drop-out and repetition rates in the previous year.

While this information on schools is useful, it also has many limitations. First, as already mentioned, it is almost certain that some children in the communes with multiple schools were enrolled in another school, which could lead to problems of measurement error bias. Second, there is no information on lower secondary schools, which many of the children had already started to attend. Third, many types of information were not collected, such as teachers' experience and educational background, information on school principals, student–teacher ratio, and school management practices. This suggests potentially serious problems of omitted variable bias. Overall, the results presented below should be treated cautiously, and indeed it will be seen that the regressions that attempt to measure the impact of school characteristics on child learning yield at best only a small amount of useful information.

Before turning to the estimates, some of the school variables mentioned above cannot be used in the regression because of lack of variation. More specifically, in 33 of the 34 communes the teachers in the selected schools used Vietnamese to teach, and the language in the one exception was English, not an ethnic minority language. Similarly, there was only one school that had fewer teachers than grades (multigrade teaching). Third, none of the 34 schools were private schools. Finally, the information collected regarding accommodation for disabled students is unlikely to be useful given the small number of students with disabilities in the sample.

7.2 Estimated impact of school characteristics on mathematics and PPVT scores

All of the test score regressions presented in Sections 5 and 6 used commune fixed effects to control for variation in school characteristics and, more generally, variation in commune characteristics. This raises the question of whether introducing those fixed effects had any effect on the parameter estimates for the child and household variables. This can be checked by implementing a Hausman test that compares fixed effect and random effect estimates. For the mathematics test score, the Hausman test could not reject the hypothesis that the coefficients are the same for the fixed and random effects estimates. For the PPVT test the Hausman test could not be implemented (the difference in the two covariance matrices could not be inverted), but in any case visual examination of the parameters again suggests little effect. This suggests that removing the commune fixed effects, which must be done to introduce commune-level school variables into the regression, will not result in biased estimates of the impacts of the child- and household-level variables. Yet in any case the focus in this section is not on those variables, but on the school characteristics.

The simplest approach to seeing whether the school variables have any explanatory power is to enter them one by one in separate regressions. Results for this exercise are shown in Table 7, where each parameter estimate is from a different regression. For simplicity, the same household and child variables are used as in the above regression, but the parameter estimates for these variables are constrained to be equal for Kinh and ethnic minority children, and a dummy variable is added indicating that a child is a member of an ethnic minority group.

Table 7. *Impact of school variables on test scores of Older Cohort*

School variable	Mathematics (IEA)	PPVT
Annual class time (hrs/yr)	−0.023	0.460
Length of school day (hrs)	−0.025	0.092
Number of shifts	0.101	0.454**
One teacher in school	−0.030	0.175
Students speak to each other in language other than Vietnamese	−0.234***	−0.639**

Notes:

1. Each estimated coefficient comes from a separate regression. The other variables in the regression are lpcexp, kidminor, daded, mumed, lnedxkid, girl, yrs_sch, hrs_sch, hrs_stud, hrs_work, exclsmth, haz, hearprob, undrstpr, lnghlth8 and mightdie12.
2. The school variables refer to the primary school in the commune for which data were collected. See the text for details.
3. Sample sizes were 881 for the mathematics test and 848 for the PPVT for the last three regressions. For length of school day (annual class time) regression, the sample sizes were 831 (808) for the mathematics test and 800 (777) for the PPVT test.
4. Significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively.
5. Per capita expenditure is instrumented, using a household wealth index. Significance is based on robust standard errors, clustered at the commune level.

Three of the five school variables in Table 7 have no significant impacts on either the mathematics score or the PPVT score. These variables are hours of class time per day, hours of class time per year (the product of hours per day, days per month and months per year), and a dummy variable indicating schools that had only one teacher (which applied to 15 per cent of the Older Cohort children).

The number of shifts per grade has no significant effect on the mathematics test score, but having double shifts has an unexpected *positive* impact on the PPVT score; the latter effect is quite large, raising that test score by about 0.5 standard deviations. This is unexpected because double shifts (the data have only single shifts and double shifts, no higher number of shifts) in general reduce class time per shift and so should have a negative impact on test scores. However, double shifts are most common in urban areas (which are relatively wealthy) and in the Red River Delta (which has high levels of education among adults), so this positive effect may be picking up regional characteristics or unobserved school quality.

The other variable that is statistically significant (for both the mathematics test and the PPVT test) is schools where students speak to each other in a language other than Vietnamese during informal interactions outside of class, which has the expected negative sign. That is, such students have as their native language something other than Vietnamese, and since none of their teachers teach in those languages, presumably they are at a disadvantage. The effect is quite large, a loss of 0.2 standard deviations for the mathematics test and of 0.6 standard deviations for the PPVT test. Note that when this variable is added, the ethnic minority dummy variable becomes much smaller and loses statistical significance for both tests, which suggests that a major problem for ethnic minority students is not their ethnicity *per se* but their lack of familiarity with the Vietnamese language.

A final related issue is whether ethnic minority children attend schools that offer fewer resources to students, generally speaking. Perhaps the most obvious one is time spent in class. Many observers have noted that the hours that schools are open each day is relatively low in ethnic minority areas, but there is little systematic evidence on this. Surprisingly, the mean hours per day that the local primary school is open among Older Cohort ethnic minority children is somewhat greater than for Kinh children: 5.2 hours per day for the former and 4.6

hours per day for the latter.[23] Further, the mean number of shifts is also slightly lower for ethnic minority children (1.64) than for Kinh children (1.75). The one variable that suggests a lower-quality school, one-teacher schools, is much more common among ethnic minority children (50 per cent) than among Kinh children (10 per cent), but as seen in the regressions in Table 7, that variable had no statistically significant explanatory power for students' test scores.

8. Conclusions

Ethnic minority children in Vietnam score much lower on mathematics and reading tests than do ethnic Vietnamese (Kinh) children, both among a group of children aged 5 and among another group of children aged 12 (both of which were tested in 2006). Given the importance of education in determining adults' socio-economic success, and the generally lower incomes of ethnic minorities in Vietnam (Baulch et al. 2004), this suggests that today's ethnic minority children will be poorer than today's Kinh children when both groups of children become adults. A major policy challenge for the Vietnamese government, and for donor agencies active in Vietnam, is to understand the causes of these disparities and then to formulate policies that can reduce them.

The paper has used the Round 2 Young Lives data from Vietnam to investigate the reasons why ethnic minority children have lower cognitive skills. Admittedly, the findings raise as many questions as they answer, and so further research needs to be done. Yet some conclusions can be drawn based on the analysis in this paper.

A first, rather obvious but perhaps overlooked, finding is that these disparities are already very large even before children start primary school, as was seen with the Younger Cohort data. It is possible that pre-school and even crèche factors play a role in generating these disparities, but it is difficult to pin this down with the data available. Indeed, the time that children spent in crèches and pre-schools had no explanatory power in determining the Younger Cohort's test scores in Tables 2 and 3, so the problem may lie elsewhere.

Second, the role of language may be an important factor. Tables 1 and 4 show that, in general, ethnic minority children whose mother tongue was Vietnamese had much higher scores than those whose mother tongue was an ethnic minority language. Yet when comparisons are limited to children living in 'mixed' communes, these differences were smaller (and in one case disappeared), which suggests that it is really differences between communes, not language itself, that matter. One the other hand, the one school variable that had the most explanatory power in Table 7 was the language spoken by children outside of class; those who spoke an ethnic minority language did much worse. Perhaps one benefit of living in an ethnically mixed commune is that ethnic minority children interact with other children in Vietnamese, and so obtain much more facility in that language at an early age. Another factor to keep in mind here is that all tests were administered in whatever language the children wanted to take them in, so the poor performance of ethnic minority children on these tests is not simply due to being forced to take the test in Vietnamese. Clearly, much

23 Note that this does not necessarily contradict the finding in Table 5 that Kinh children spend more time per day in school than do ethnic minority children. That variable measures how much time children spend in school, not how long the school is open.

more research needs to be done on the role of mother tongue, and the mother tongue of children's peers, to understand more fully why ethnic minority children fall behind.

Third, the Blinder-Oaxaca decompositions offer at least a partial explanation of the Kinh–ethnic minority gap in test scores. For the Younger Cohort, the role played by household expenditure is puzzling because although ethnic minority children live in households that have lower incomes, they are more successful in 'converting' what little income they have into higher test scores. In contrast, for the Older Cohort there is no ambiguity; Kinh and ethnic minority children are equally capable at 'converting' household income into higher test scores, and the higher per capita expenditure of Kinh households explains about 0.2 to 0.3 standard deviations of the gap in test scores, out of a total gap of 1.3 to 1.5 standard deviations. Parental education also plays a role, usually explaining about 0.3 standard deviations of the gap for both the Younger and the Older Cohorts (the one exception being the impact of mother's education on the PPVT of the Older Cohort children, which is difficult to interpret). None of the other variables offered much explanatory power for explaining the gap among the Younger Cohort. Among the Older Cohort, more time spent in school, less time spent working, and higher levels of nutrition each explain about 0.1 standard deviations of the gap in the mathematics score, and more years of schooling among Kinh children explains about 0.3 standard deviations of the gap for the PPVT score.

Further progress on understanding the causes of the gap in learning between Kinh and ethnic minority children in Vietnam may require different data than those analysed in this paper. Qualitative research could be quite useful, and more quantitative analysis using a dataset with a larger number of ethnic minority students and more detailed school data (including all schools in a commune, instead of just one) could also play a role. The 2006 Vietnam Household Living Standards Survey (VHLSS) is a promising dataset for further analysis of this learning gap.

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Appendix

Table A.1. *Comparison of Young Lives data to nationally representative data*

Variable	Younger Cohort		Older Cohort	
	Young Lives data[a]	2006 VHLSS data[b]	Young Lives data	2006 VHLSS data
Enrolled in school (%)	N/A	N/A	96.6	94.0
Ethnic minority (%)	14.4	20.1	12.8	18.3
Mother's years of schooling	6.9	6.8	6.9	7.0
Father's years of schooling	7.6	7.6	7.8	7.8
Height-for-age z-score (2002 VNHS)	−0.53	−0.70	−1.42	−1.43
Stunted in 2002 (HAZ < −2) (%)	10.0	13.2	27.8	27.2
Family ownership of durable goods (%):				
Motorbike	61.7	53.9	64.6	53.5
TV	81.0	80.3	86.4	84.8
Refrigerator	19.9	19.5	20.5	19.2
Urban (%)	20.6	23.7	20.6	21.5
Electricity (%)	94.4	93.9	95.1	94.7
Water (%):				
Bore well	30.1	22.3	30.7	20.6
Piped	13.8	22.4	14.0	17.8
Other well	36.2	29.5	32.4	34.6
Rain water	11.6	11.1	12.9	12.5
Other	8.3	14.7	9.9	14.5
Toilet (%):				
Flush	32.6	31.1	34.7	28.6
Latrine	24.0	16.3	26.1	19.7
Field/pond	35.5	24.2	31.9	23.8
Other/none	7.9	28.4	7.4	27.9

a Data refer to Round 2, when the Younger Cohort children were about 5 years old and the Older Cohort were about 12 years old, except height-for-age, which is from Round 1.

b Vietnam Household Living Standards Survey. These data are for 5-year olds (Younger Cohort) or 12-year olds (Older Cohort) children. The height-for-age data are from the Vietnam Health Survey (VNHS), which was conducted in 2002.

Table A.2. *Communes in Young Lives survey for Vietnam*

Province	District	Commune (pseudonym)	Code	Number of primary schools	Number of satellite schools	Poverty rate (%)
Phú Yên	Tuy Hòa	Chu Se	VN001	2 (1 & 2)	0	24.3
	Tuy An	Tam Ky	VN002	2 (1 & 2)	0	23.7
	Sơn Hòa	Van Lan 1	VN003	1	2	27.0
	Sông Cầu	Tuy Duc 1	VN004	1	1	8.8
	Sơn Hòa	Van Lan 2	VN005	1	7	27.0
	Sông Cầu	Tuy Duc 2	VN006	1	1	8.8
Bến Tre	Bình Đại	Ha Tinh 1	VN007	1	0	13.8
	Bình Đại	Ha Tinh 2	VN008	1	0	5.9
	Châu Thành	Ly Hoa 1	VN009	2 (A & B)	0	14.2
	Châu Thành	Duc Lap 1	VN010	1	0	6.9
	Bình Đại	Ben Hai 1	VN011	1	0	13.8
	Bình Đại	Ben Hai 2	VN012	1	0	5.9
	Châu Thành	Ly Hoa 2	VN013	1	0	14.2
	Châu Thành	Duc Lap 2	VN014	2 (A & B)	0	6.9
Lào Cai	Bát Sát	Lang Ho 1	VN015	1	6	79.5
	Bắc Hà	Krong Buk 1	VN016	2 (A & B)	7	29.0
	Bảo Thắng	Play Kep	VN017	4 (1,2,3 & 4)	0	22.0
	Bảo Thắng	Gian Son 1	VN018	2 (1 & 2)	0	27.8
	Bát Sát	Lang Ho 2	VN019	1	5	79.5
	Bắc Hà	Krong Buk 2	VN020	1	2	29.0
	Bảo Thắng	Gian Son 2	VN021	3 (1,2 & 3)	0	27.8
Hưng Yên	Văn Giang	Na Hang	VN022	1	0	7.7
	Văn Giang	Ha Giang	VN023	1	0	7.7
	Phù Cừ	Phu Thong 1	VN024	1	0	26.6
	Phù Cừ	Cao Ky 1	VN025	1	0	24.7
	Phù Cừ	Cao Ky 2	VN026	2 (A & B)	0	24.7
	Phù Cừ	Phu Thong 2	VN027	1	0	26.6
Đà Nẵng	Thanh Khê	Dai Tu	VN028	1	0	2.0
	Hải Châu	Pho Lu	VN029	1	0	6.3
	Thanh Khê	Van Ban 1	VN032	1	0	3.5
	Thanh Khê	Van Ban 2	VN033	3	0	3.5
	Thanh Khê	Van Ban 3	VN034	1	0	3.5
	Liên Chiểu	Hania Lo 1	VN035	3 (2 (A&B))	0	6.3
	Liên Chiểu	Hania Lo 2	VN036	2	0	6.3

Note: Commune VN030 was split into two communes between 2002 and 2006; the new communes are called VN035 and VN036. Similarly, VN031 was split into three communes: VN032, VN033 and VN034.

Young Lives is an innovative long-term international research project investigating the changing nature of childhood poverty.

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Save the Children UK (staff in the Policy Department in London and programme staff in Ethiopia).

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