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**Evidence from Vietnamese and Peruvian Panel Data**

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**Abstract**

Most developing countries are close to attaining universal primary completion, and enrolment at the secondary level has increased dramatically in the past two decades for most of these countries. Yet the skills learned while in school are disturbingly low compared to the learning that occurs in developed countries. Within developing countries there are large gaps in learning between “advantaged” and “disadvantaged” students. This paper uses recent data from Peru and Vietnam to decompose this learning gap into four components: a) Differences in child and household characteristics that increase learning, such as parental education, between the two groups; b) Differences across the two groups in the *impacts* of the child and household characteristics that increase learning; c) “Sorting” of advantaged children into better schools; and d) Differences in the impact of school characteristics on learning between advantaged and disadvantaged children *within* schools. Advantaged children are defined as those in the top two quintiles of the wealth distribution, while disadvantaged children are defined as those in the bottom three quintiles of that distribution. For both countries, the first component explains about half of the gap in mathematics test scores between these two groups, while the second explains very little. For Peru, the rest of the gap is primarily explained by the fourth component; advantaged children learn more than disadvantaged children in the same school. For Vietnam, half, and in some estimates more than half, of the gap is explained by the third component; disadvantaged children are more likely to be enrolled in lower quality schools and would learn more if they enrolled the same schools that advantaged children attend.

**I. Introduction**

Most, if not almost all, economists agree on the importance of human capital in determining a country’s standard of living, and that formal education is a large, and perhaps the largest, component of human capital. This consensus reflects the fact that economists and other researchers have accumulated a vast amount of evidence that education increases workers’ productivity and thus increases their incomes (Behrman, 2010). They have also shown that education leads to improvements in health and in many other nonmonetary aspects of the quality of life (Lochner, 2011).

While much progress has been made on getting almost all children enrolled in primary school, and most enrolled in secondary school, in developing countries, there is sobering evidence that many children are not learning very much during their time in school. This is seen in Table 1, which presents results from internationally comparable tests on mathematics among grade 8 students for selected developed and developing countries. The average scores on these tests are clearly higher for developed countries. Most worrying is the large percentage of students with very low scores, shown in the last column in Table 1.[[1]](#footnote-1) While the percentage of students with very low scores ranges from 1% to 12% in developed countries, in developing countries the range is from 38% to 79%. Yet at the same time there are a few students in developing countries who do very well, as shown in the second column of Table 1. This paper focuses on this “heterogeneity” of learning outcomes in developing countries.

More specifically, this paper attempts to explain the gaps in learning outcomes between “advantaged” and “disadvantaged” children in two developing countries, Peru and Vietnam, by assessing the contribution of four distinct factors that could explain these gaps: a) The child and household characteristics that increase learning, such as parental education, are higher among the more advantaged groups; b) The impacts of the child and household characteristics that increase learning are *stronger* for advantaged children; c) More advantaged children “sort” into better schools; and d) Learning increases attributable to school characteristics are higher for advantaged children (relative to disadvantaged children) *within* the same school.

Factors (a) and (c) have been the focus in most of the existing literature which tries to explain differences in school attainment of poorer and better of children. The fourth factor has begun to receive some attention in recent years. For example, in an influential book Banerjee and Duflo argue that to a large degree schools fail “because in many developing countries both the curriculum and the teaching are designed for the elite rather than the regular children who attend schools…” (Banerjee and Duflo, 2011; pp.93). The authors give examples, primarily from India and Kenya, where the majority of children appear to learn little or nothing due to teachers focusing their efforts on the students who they believe have the most potential. They emphasize evidence of persistence of “sociological determinism” where caste, class and ethnicity are used to justify low expectations and negative stereotypes of the poor. This paper examines whether this pattern of differential school effectiveness by socio-economic background is found in two other developing countries, Peru and Vietnam.

The results suggest that test score gaps in mathematics can arise from different factors in different countries. In Peru, differences in child and household characteristics explain at least half, of the overall gap. The main contribution of schools to this gap is that advantaged students appear to learn more than disadvantaged students when both types of students are assigned to the same schools, which is consistent with the claim of Banerjee and Duflo; sorting of advantaged students into better schools seems to play less of a role.

In Vietnam, household characteristics also appear to explain about half of the gap. Here, however, the sorting of disadvantaged students into lower quality schools seems to be the main factor explaining test scores gaps in mathematics with little of the gap explained by the phenomenon of advantaged students learning more than disadvantaged students in the same school.

The rest of the paper is organized as follows. Section II presents a brief review of the literature, which is followed by a description of the data from Peru and Vietnam. Section IV presents the methodology used to explain the gaps in test scores between advantaged and disadvantaged children in these two countries, which allows for the possibility that the former learn more than the latter even when they are in the same school. The following section describes the variables used in the analysis and presents descriptive statistics. The results are presented in Section VI, and the final section summarizes the results and concludes the paper.

**II. Literature Review**

**III. Data**

The data used in this paper are from the Young Lives study, a multi-country longitudinal study of child poverty in developing countries that tracks approximately 3,000 children in each of four countries: Ethiopia, India (Andhra Pradesh), Peru and Vietnam. In all four countries two cohorts of children are followed; one consists of children born in 1994-95 and the other of children born in 2000-01. This study uses data only from the younger of the two cohorts, which will be referred to as the “younger cohort”, and focuses on the data from Peru and Vietnam, where recent school surveys have been conducted; school data are also available for India but owing to the large number of very small schools attended by the younger cohort children, the data are less well-suited to identifying school effects.

In all four countries approximately one hundred children who were aged 6-18 months in 2002 were randomly selected from each of 20 sites in each country to form the “younger cohort” of approximately 2,000 very young children. This random selection implies that the data are statistically representative of the site level populations, but strictly speaking the data are not representative of the national population. However, the 20 sites in each country were purposively selected to represent diversity within each country on key socio-economic, demographic and geographic dimensions with a pro-poor focus.

The Young Lives study collects data at both the household and school levels. Three rounds of household data have been collected to date (in 2002, 2006-7 and 2009) and school-level data were collected in 2011-12 from the schools of a sub-sample of the younger cohort children in Peru and Vietnam,[[2]](#footnote-2) as explained in more detail below. School surveys have followed somewhat different designs across the four countries in order to reflect differences in schooling systems and differences in policy and research priorities. Nonetheless, all school surveys include child assessment tests in reading comprehension (Spanish in Peru and Vietnamese in Vietnam) and mathematics, as well as key indicators of school quality in terms of infrastructure, facilities and resources, and teacher knowledge, training and experience, collected through questionnaires and test instruments.

In Vietnam, the first school survey was conducted in October 2011 in all 20 sites included in the household survey. The sampling strategy included all younger cohort children enrolled in Grade 5 (the appropriate grade given their age) of primary school in the 2011-12 school year; all the schools attended by these children were surveyed, so that the sample represents a grade-cohort.[[3]](#footnote-3) A total of 91 schools and 1,131 children are included.

In Peru, the school survey was conducted at approximately the same time as in Vietnam, in nine of Peru’s fourteen regions. A stratified sampling design was employed using four school types as strata to ensure representativeness of these school-types - private urban, public urban, rural bilingual medium schools and rural non-bilingual (Spanish only) medium schools. All younger cohort children in the last group were sampled, due to the small number in this group. A random sample of younger cohort children attending schools in each of the other three groups was selected, and their schools were included in the sample (all younger cohort children in those schools were then surveyed). The resulting sample in Peru, after replacements, consists of 132 schools, attended by 548 children from the Young Lives younger cohort sample. The children included are mostly in Grade 4 (70%), with less than a third in grade 5.

Thus this paper employs data for 548 younger cohort children in Peru and 1,131 in Vietnam, for whom linked school and household data are available. A larger sample of children is, however, used to check the robustness of the findings.

Children’s educational attainment (the outcome of interest) is measured using scores on a mathematics test that was administered as part of the school survey in each country. In Vietnam, the test was comprised of thirty multiple-choice items designed to reflect the curricular expectations of Grade 5. It was developed following the practice of the Ministry of Education’s Grade 5 Assessment Study (World Bank 2011), working with consultants from with the Vietnamese National Institute of Educational Sciences (VNIES). In Peru, grade-specific tests were developed by GRADE (*Grupo de Análisis para el Desarrollo*) to reflect curricular expectations for grades 4 to 5. The tests contain both multiple-choice and free response questions, the latter being scored as correct or incorrect with no partial credit. Our measures of children’s background characteristics for both countries include individual, parental and household characteristics measured in the first two rounds of the main survey, before the children started school, at ages 1 and 5. We discuss these in more detail, and present some descriptive statistics, below.

**IV. Methodology**

This section explains the methodology used in this paper to decompose the (average) learning gap between advantaged and disadvantaged children into four distinct factors: a) The child and household characteristics that increase learning, such as parental education, are higher among the more advantaged groups; b) The impacts of the child and household characteristics that increase learning are stronger for advantaged children; c) More advantaged children “sort” into better schools; and d) Learning increases due to school characteristics are higher for advantaged children (relative to disadvantaged children) *within* schools. Particular attention is given to whether the impact of school and teacher characteristics on students’ acquisition of skills varies by the type of student, in order to investigate whether schools reduce or reinforce gaps generated by household characteristics. We discuss the relevant estimation issues after describing the variables used in estimation.

**A. Equations of Interest.** With only a small loss of generality, one can divide the younger cohort children’s lives into three time periods, each of which are denoted by t:

t = 1: First 1-2 years of life (corresponds to Round 1 data)

t = 2: Ages 2-5, which ends when the child enrols in primary school (Round 2 data)

t = 3: Ages 6-11, the primary school years (Round 3 and school survey data)

Cognitive and non-cognitive skills at the end of time period 2, denoted by S2 (which could be a vector), depend on early childhood nutrition in time period 1 (N1), preschool nutrition in time period 2 (N2), parental education (PE), parental time spent with the child during periods 1 and 2 (PT1 and PT2), pre-school attendance (including day care) in time period 2 (PRE2), and “innate ability” (IA):

S2 = S2(N1, N2, PE, PT1,PT2, PRE2, IA) (1)

This is a structural equation for skill formation before the child starts primary school; primary school variables have no effect since the child has not yet started primary school.

Skills at time period 3 (denoted by S3) are determined by skills acquired by the end of time period 2 (S2), which could be a vector, possible lingering effects of early childhood nutrition (N1 and N2), nutrition during time period 3 (N3), parental education (PE), parental time spent with the child in time period 3 (PT­3), educational inputs purchased by households such as tutoring and children’s books (EI3) innate ability (IA), and a vector of school and teacher characteristics (**SC**, which is bold because it is a vector):[[4]](#footnote-4)

S3 = S3(S2; N1, N2, N3, PE, PT3, EI3, IA; **SC**) (2)

This structural equation implicitly assumes that there is no need to include pre-school (PRE2) or parental time in periods 1 and 2 (PT1 and PT2) because their effects will be fully captured by S2.

As a first approximation to the process by which skills are formed, consider linear specifications of the above two equations:

S2 = α0 + α1N1 + α2N2 + α3PE + α4PT1 + α5PT2 + α6PRE2 + α7IA + u2 (1ʹ)

S3 = β0 + β1S2 +β2N1 + β3N2 + β4N3 + β5PE + β6PT3 + β7EI3 + β8IA + **γ**ʹ**SC** + u3 (2ʹ)

where the residual terms u2 and u3 represent two distinct phenomena: a) errors due to the linear approximation; and b) measurement errors in S2 in equation (1ʹ) and in S3 in equation (2ʹ). Both of these components of u2 and u1 are assumed to be uncorrelated with the explanatory variables in equations (1ʹ) and (2ʹ), respectively. Measurement error in the explanatory variables will be discussed below.

In general, as long as a nonlinear function is continuous, a linear expression of that function can approximate the nonlinear function very closely by adding higher order (e.g. quadratic) terms for each variable *and* by adding sufficient interaction terms between the variables in that function. These interaction terms can be grouped into three types: a) those between child and household level variables (N variables, PE, PT variables, PRE2, EI3 and IA); b) those between the school characteristic variables (**SC**); and c) those between the child or household variables and the school characteristic variables. One goal of this paper is to investigate the extent to which developing countries’ education systems reduce or reinforce inequalities in learning outcomes, in particular whether the impacts of school characteristics on child learning vary according to indicators of disadvantage such as wealth, initial learning and parental education, which is manifested in the third type of interaction.

One problem that has plagued estimates of education “production functions” is omitted variable bias. In particular, there could be dozens, if not hundreds, of school characteristics (**SC**) that affect the acquisition of skills, and many that could be very important (such as teacher motivation, pedagogical practices used, and teacher ability to diagnose students’ learning difficulties) are very difficult to measure. This paper avoids the problem of measuring all school characteristics that could affect students’ acquisition of cognitive skills by replacing **γ**ʹ**SC** in equation (2ʹ) with a set of school fixed effects:

S3 = β0 + β1S2 +β2N1 + β3N2 + β4N3 + β5PE + β6PT3 + β7EI3 + β8IA +δsDs + u3  (2ʹʹ)

where Ds is a dummy variable indicating school s and δs indicates the total impact of that school’s characteristics on student skill acquisition. These school fixed effects measure the impact of *all* school characteristics, *both observed and unobserved*, on student learning.

There are two important characteristics of equation (2ʹʹ). First, no additional assumptions were imposed on equation (2ʹ) to obtain (2ʹʹ); the latter simply converts each school’s **γ**ʹ**SC** term into a school fixed effect. Second, these school fixed effects can incorporate all possible interactions of the second type, that is between the various **SC** variables, which implies that (2ʹʹ) is more general than (2ʹ). Interactions of the first type, those that are between child and household variables, will be accommodated using interaction terms for those variables [**so far done to a small extent; need to check more.**]

The extent to which the education system contributes to inequalities in students’ acquisition of skills can be divided into two general phenomena: a) the tendency for disadvantaged students to go to lower quality schools, while more advantaged students go to higher quality schools; and b) the extent to which disadvantaged students learn less (or more) than advantaged students within a given school. To distinguish between these two phenomena, and to accommodate interaction terms of the third type (interactions of school characteristics and student or household characteristics), a relatively simple approach is to divide all students into two types, a “disadvantaged” group and an “advantaged” group. Assume that the impact of the school variables could differ across these two groups. This implies that equation (2ʹʹ) could be modified as follows:

S3 = **β**ʹ**X** +δsDs +θsDsA + u3 (3)

where A is a dummy variable indicating that a student is a member of an “advantaged” group and, to reduce clutter in the exposition, **β**ʹ**X** denotes β0 + β1S2 +β2N1 + β3N2 + β4N3 + β5PE + β6PT3 + β7EI3 + β8IA. The impact of a school s on a disadvantaged student is captured by the term δs, while the impact of the same school on an advantaged student is estimated by δs + θs. If schools contribute equally to the learning of both advantaged and disadvantaged students, then θs = 0. For further flexibility, the impact of child and household characteristics can also be allowed to vary over advantaged and disadvantaged students:

S3 = **β**Aʹ**X**AA + **β**DAʹ**X**DA(1 – A) +δsDs +θsDsA + u3 (3ʹ)

where the A subscript indicates advantaged children and the DA subscript indicates disadvantaged children.

Equation (3ʹ) provides a convenient “Oaxaca-Blinder” framework for decomposing the (average) learning gap between the advantaged group and the disadvantaged group into four components: a) Differences in child and household characteristics (the **X** variables) that increase learning, such as parental education, between the two groups; b) Differences across the two groups in the *impacts* of the child and household characteristics that increase learning; c) “Sorting” of advantaged children into better schools; and d) Differences in the impact of school characteristics on learning between advantaged and disadvantaged children *within* schools. To see how this decomposition can be obtained from equation (3ʹ), note that the average learning of advantaged and disadvantaged children, denoted by 3,A and 3,DA, respectively, are given by:[[5]](#footnote-5)

3,A = **β**AʹA + (δs + θs)s,A (4)

3,DA = **β**DAʹDA + δss,DA (5)

The decomposition method divides th gap in average test scores between the advantaged and disadvantaged groups into four components mentioned above, plus two “interaction” terms:

3,A – 3,DA = **β**AʹA – **β**DAʹDA + (δs + θs)s,A­ – δss,DA  (6)

= **β**DAʹ(A­ - DA) + (**β**A - **β**DA)ʹDA + (**β**A - **β**DA)ʹ(A­ - DA)

+ δs(s,A - s,DA) + θss,DA + θs(s,A - s,DA)

The decomposition in equation (6) is from the perspective of a disadvantaged student.[[6]](#footnote-6) The first term, **β**DAʹ(A­ - DA), indicates how much of the test score gap is due to differences in child and family characteristics between advantaged and disadvantaged students, applied to the “productivity” of a disadvantaged student (**β**DA). In other words, it reflects how different the attainment of the disadvantaged student would be if he or she had the family and child characteristics of an advantaged student but retained the “productivity” of a disadvantaged student. The second term, (**β**A - **β**DA)ʹDA, measures the contribution to the gap that is due to differences between advantaged and disadvantaged students in the “productivity” of child and family characteristics, applied to the average characteristics of a disadvantaged student (DA). That is, it indicates how different the attainment of a disadvantaged student would be if he or she had the “productivity” of an advantaged student, given his or her characteristics as a disadvantaged student. The third term allows for an interaction effect between the first two terms; the intuition for this term will be apparent in the discussion below of Figure 1. The fourth term, δs(s,A – s,DA), detects the extent to which the gap is due to advantaged and disadvantaged students attending different schools (as reflected in differences in the s variables across advantaged and disadvantaged students), measured in terms of the impact of each school on disadvantaged students (δs). The fifth term, θss,DA, measures how much of the gap is due to the fact that advantaged students may learn more than disadvantaged students in the same school, even after controlling for their individual and household characteristics, applied to the distribution of students in the disadvantaged schools (the s,DA variables). Finally, the sixth term, θs(s,A -s,DA), allows for interaction effects between the fourth and fifth terms.

A visual interpretation of this decomposition is given in Figure 1. For simplicity, assume that there is one X variable, which is on the horizontal axis. The average test score in the third time period (3) is shown on the vertical axis for given values of X. The average test scores of disadvantaged children for different values of X are depicted by the lower upward-sloped line, labelled “slope = βDA”, and the average test scores of advantaged children, conditional on X, are depicted by the higher upward-sloped line, labelled “slope = βA”. The mean value of X for the disadvantaged group is given by DA, which implies that the mean value of test scores for that group is given by 3,DA, and is also depicted on the graph by the point A. Similarly, the mean value of X for the advantaged group is given by A, and the mean value of test scores for that group is given by 3,A, and is depicted on the graph by the point D.

The “standard” Oaxaca-Blinder decomposition for equation (6) implicitly takes as its “base group” a person with X = 0, and the associated school fixed effect terms for that base group are δs and θS, as shown in the lower left corner of Figure 1. However, for the purpose of comparing the average disadvantaged student to the average advantaged student, it makes more sense to use the average disadvantaged student as the base group, that is X = DA, which implies that the relevant school fixed effects are and , as shown in the center of Figure 1. This choice for the base group will be used for all the analysis in this paper, and it is easy to implement for all X variables by subtracting the mean of each X variable for the disadvantaged population from the values of that variable for all the children in the sample.

The decomposition of the test score gap between advantaged and disadvantaged children in equation (6) is shown on the right side of Figure 1 for children in a given school; the figure does not show the impact due to the fact that different children attend different schools. **[Maybe this is possible, but not there yet.]** Once all X variables are normalized so that all their means equal zero for the disadvantaged group, the second term in (6) disappears. That term measures the extent to which the gap between a child with all (pre-normalized) X variables equal to zero and a child whose X variables are the means for the disadvantaged group is due to differences in the “efficiency” of those variables, but that gap is not relevant for the decomposition of interest, which compares differences between the average disadvantaged child and the average advantaged child.

The first term in (6) (the “composition effect”) is shown in Figure 1 as a move from point A to point B. The third term in (6), (**β**A - **β**DA)ʹ(A­ - DA), the interaction between the “increased productivity” of the advantaged child and the composition effect, is represented by the move from point C to point D. The fourth term in (6) cannot be shown in Figure 1 since that figure is for a given school while that term measures the part of the gap due to advantaged children attending better schools than the disadvantaged kids. The fifth term in (6) is accounted for by ; advantaged students may learn more in the same school than disadvantaged students, which moves them from point B to point C in Figure 1. Finally, the last term in (6) also cannot be shown in the Figure because it is due to differences across schools; it indicates whether advantaged students tend to enrol in schools that have a larger premium for those students.

**B. Estimation Issues**. The decomposition discussed above will be estimated using the Young Lives data from Peru and Vietnam. Yet several complications arise concerning these estimations. This section presents several estimation problems and the methods used to address them.

Perhaps the most pervasive estimation problem is omitted variable bias. In particular, if any of the child and household variables in equation (2ʹʹ) are not in the data, they become part of the error term and so may cause the error term to be correlated with the observed variables in (2ʹʹ), leading to biased estimates of all the coefficients. The Young Lives data contain a wealth of information dating back to when the students were about 6-18 months old which allows one to include many of the relevant inputs. In addition, however, we include controls for household wealth before the child started school, which is used to purchase at least some of the inputs that we may not be capturing fully. Technically, this implies that equation (2ʹʹ) is no longer a “pure” production function because other variables in it, such as parental education and child ability, also affect the purchase of educational inputs. But this should have little or no effect on estimates of the school fixed effects.

Another important specific omitted variable problem is that the data have no direct measures of innate ability (IA) in equation (2ʹʹ). This could also lead to bias in estimates of the structural impacts of observed variables because some of those variables may be correlated with IA, such as S2 and PE, as well as, potentially, with the type of school the child attends. Among the more unique features of the Young Lives data is availability of measures of children’s verbal and mathematics abilities before they started school. These are used to control for S2 and the approach taken here is to assume that S2 accounts for most of the impact of innate ability on S3. Omitted variable bias due to lack of data on that variable should then be minimal. We return to this issue in discussion below of the specific measures of S2.

A second general estimation problem is that some explanatory variables could have measurement error, such as S2 in the second equation, the N and PT variables in both equations. Fortunately there are previous or multiple measures of most of these, which should be useful IVs to deal with this problem. **[Not done yet.]** For example, PRE could be used as an IV for S2; PRE is a valid IV if it does not affect S3 other than its effect via S2.

A third major estimation problem is sample selection due to the fact that some of the schools from both the Peru and Vietnam samples do not have both advantaged and disadvantaged children in them. For schools that have no advantaged children, it is not possible to estimate θs in (6), and for schools with no disadvantaged children in them it is impossible to estimate δs, although one can still estimate δs + θs. Estimates must, therefore, be based on a sub-sample of schools that have both advantaged and disadvantaged raising concerns about sample selection bias. Such bias should be relatively small for Vietnam, where 82.3% of the children in the sample (931 out of 1131) attend schools that have both types of children (we discuss the exact definitions of the groups below). However, in Peru only 55.3% of the children in the sample (302 out of 546) are in schools that contain both advantaged and disadvantaged children.

Fortunately, there is another approach that, although somewhat less informative, is less likely to suffer from this selection bias problem. Consider schools that have only disadvantaged students. For those schools we can still estimate their contribution to the fourth term of the decomposition in (6), δs(s,A - s,DA), since we can estimate δs for those schools. Yet we cannot estimate the contribution of those schools to either the fifth or the sixth terms of the decomposition (θss,DA or θs(s,A - s,DA) ) since θs cannot be estimated for a school with no advantaged students in it. However, the contribution of those schools to the sum of these two components, that is to θss,A, can be estimated since for those schools s,A = 0, and so it does not contribute to θss,A. While it is more informative to be able to estimate θss,DA and θs(s,A - s,DA) separately, the term θss,A is still of interest because it reflects the weighted average of the “premium” that advantaged students receive *within* a school attended by both types of students. The advantage of this method is that it is less likely to suffer from selection bias since a much larger proportion of children (around 90% in both countries) can be included in the estimation. Thus our second set of estimates is based on a sample that includes not only schools with both types of students, but also those with only disadvantaged students, and for that sample we estimateθss,A, instead ofθss,DA and θs(s,A - s,DA) separately, which is somewhat less informative but should also be less likely to suffer from selection bias.

**V. Sample Characteristics**

This section defines the exact measures used in the analysis for the outcome and background inputs and presents summary statistics for these.

*Outcome Variables.* As discussed above, our measure of educational attainment is performance on a mathematics test administered as part of the school survey. Test data were subjected to item-response analysis using a three-parameter item-response theory (IRT) model to recover estimates of the underlying or latent performance trait on an interval scale, accounting for item-difficulty and discrimination, and for guessing on multiple-choice items. In Peru, the grade-specific tests were linked on a common IRT scale through the use of common anchor items which appeared on all tests. The scores in both countries were re-scaled to have a mean of 500 and a standard deviation of 100 for ease of interpretation. Note, however, that this common scaling does not allow direct comparison of scores between these two countries.[[7]](#footnote-7)

*Input Variables*. The variables included to capture the non-school inputs in the education production function in (2) are summarised in Table 2.[[8]](#footnote-8) They include key individual child characteristics such as age, sex, and ethnicity (the last for Peru only[[9]](#footnote-9)). In addition we include an indicator of the child’s cumulative health status since birth (height-for-age z-score) and measures of cognition related to verbal skills and understanding of concepts of quantity. The tests used to capture these (the Peabody Picture Vocabulary Test and Cognitive Development Assessment) have been validated in many contexts and have been shown to be correlated with broad-based measures of IQ. Both health and cognitive ability are measured shortly before the children started school and are thus likely to capture the effects of many of the inputs relevant to school performance made before the children started school. In addition, as noted above, the inclusion of good proxies for health and IQ also reduces concerns about bias in the estimates due to sorting into schools based on unobserved child heterogeneity as they control for some of the main often unobserved child characteristics, such as school readiness and innate ability, on which we would expect such sorting to occur.

Our input measures also include parent and household level variables which capture features of the environment in which the children were raised, which have direct effects on educational outcomes as well as indirect effects on the quality of the educational inputs acquired by parents. These are parental education, child-care arrangements when the child was an infant,[[10]](#footnote-10) and the number of siblings that the child has. In addition, the Young Lives study collected data on a feature of the child’s environment that is rarely observed but considered crucial for child development – quality of parenting. Specifically, there are measures of maternal stress and depression and parenting practices when the child was 6-18 months, as well as maternal life satisfaction and subjective well-being when the child was 5. Maternal stress is measured using the self-reported 20 item questionnaire (SRQ-20) recommended by the WHO for use in developing countries as a screening tool for depression. Parenting style is measured using a 14 item scale capturing mother’s responses to when a child cries. Maternal subjective well-being was measured using Cantril’s ladder (explained in detail under Table 2). Finally, proxies were included for the household environment and wealth, such as basic characteristics of the household (size, and gender and age of the household head), as well as wealth in infancy (measured by wealth index) and at the age of 5 (measured by consumption expenditure[[11]](#footnote-11)) are intended to capture the ability to purchase, and the quality of, educational inputs,. Note that with the exception of parenting styles, we include identical sets of controls for Vietnam and Peru.

*Descriptive Statistics:* Tables 3 (Peru) and 4 (Vietnam) present simple descriptive statistics for the test scores and control variables, described above, that are used in all of the regressions and associated decompositions. The Peru sample consists of 302 children in 36 schools for which both “advantaged” and “disadvantaged” children are observed. The Vietnam sample consists of 930 children in 48 schools for which both types of children are observed. As noted in the previous section, these are the sub-samples of full school survey samples for both countries for which it is possible to identify all of the terms of interest in the proposed decomposition. However, we conduct a number of robustness checks using larger sub-samples of the school survey and full household survey samples; these will be discussed in more detail below. In this section we focus on the descriptive statistics for the main analysis samples in Vietnam and Peru.

Table 3 shows that in Peru the test score gap between the advantaged children (“non-poor”, i.e. in the top 40% of the wealth distribution) and the disadvantaged children (“poor”, i.e. in the bottom 60% of the wealth distribution) is 55.7 points, which is about two thirds (0.645) of the standard deviation of the distribution of test scores for this population.[[12]](#footnote-12) In a number of key dimensions, including nutritional status (as measured by height-for-age z-scores), parental education, and maternal subjective well-being, disadvantaged children are worse off than advantaged children. Advantaged children also perform better (by nearly two-fifths of a standard deviation) on the CDA test (understanding concepts of quantity). However, in terms of receptive vocabulary at age 5 as measured by the PPVT score the difference is small (0.11 standard deviations) and not statistically significant.

The test score gap between advantaged and disadvantaged children in Vietnam is not as large as in Peru in terms of standard deviations of the test score variable (0.37) (Table 4). As in Peru, in almost all dimensions advantaged children are better off than disadvantaged children, the main exception being the number of siblings. Unlike in the case of Peru, advantaged children in Vietnam perform better on both tests administered at age 5. The PPVT score gap (0.45 standard deviations) in particular is comparable in magnitude to the gap in the maths test at age 12. The Vietnam sample is also different from Peru in that there are significant differences in parenting quality proxies: somewhat unexpectedly maternal stress is higher among the advantaged children and subjective well-being is lower.

**VI. Results**

This section presents the decompositions presented in Section IV for both samples of schools, focusing on mathematics scores in Peru and Vietnam. The results for Peru are shown in Table 5, while those for Vietnam are shown in Table 8. As explained above, the advantaged group is defined as children in the top two quintiles of the wealth distribution, and the disadvantaged group is defined as those in in the bottom three quintiles of the wealth distribution.

The decomposition results for Peru based on the sample that includes only schools with both types of children, which correspond to equation (6), are shown in the first column of Table 5. The first line shows the gap in average math test scores between the advantaged and disadvantaged groups that the decomposition is intended to explain. As discussed above, the gap in Peru is 55.68, which is (by definition) 0.56 standard deviations of the distribution of the math score in that country. The second line of Table 5 indicates that differences in the mean values of the **X** variables between the advantaged and disadvantaged groups explains about two fifths (42%) of the test score gap in that country; this contribution is statistically significant at the 10% level. In contrast, the third line in Table 5 shows that differences in the “productivity” of these household characteristics contribute very little to the gap (slightly less than 10%), and this contribution far from statistical significance.

The remaining lines in column 1 of Table 5 investigate the role of schools in explaining the learning gap for math scores in Peru. The contribution of “sorting” of advantaged students into better schools, in terms of the school fixed effect that applies to both advantaged and disadvantaged students (δs), appears to explain about one fourth of the gap, but this contribution is not statistically significant. In contrast, about three fifths of the gap is due to advantaged children learning more than disadvantaged children when they attend the same schools, which is the phenomenon highlighted by Banerjee and Duflo. This impact is statistically significant at the10% level. (This is a weighted average where the weights are the distribution of disadvantaged children in the schools; they indicate how much more those children would learn if they remained in their current schools but learned as much as their advantaged classmates do in those schools.) Finally, the last line in Table 5 is an estimate of the interaction between the sorting effect and the “premium” effect; it is relatively small (about 20% of the gap) and not statistically significant.

To summarize the results in the first column of Table 5, about two fifths of the gap of math test scores in Peru between the wealthiest 40% of the population and the least wealthy 60% is due to differences in child and household characteristics in those two types of households, and about three fifths is due to advantaged children learning more than disadvantaged children in schools attended by both types of children. The contribution of the differences in child and household characteristics between the two groups of children is examined in more detail in the first column of Table 6. Unfortunately, most of the estimated impacts are statistically insignificant. Only one is significant at the 5% level; disadvantaged children have experienced more early childhood malnutrition, as indicated by their lower height-for-age scores measured at age 5, which accounts for about one third (36%) of the contribution (8.6 out of 23.5) of differences in child and household characteristics to the overall test score gap. The other child characteristics that have some significance, child age, indicates an advantage of a similar magnitude due to the advantaged children being slightly older (1.9 months, as seen in the first column of Table 6), but this simply reflects small differences in when the data were collected.

As explained in Section IV, there are many schools in the Peru data that have only disadvantaged children in them, which means that it is not possible to apply the decomposition in equation (6) to the children in those schools. This could lead to misleading results because the decomposition in the first column of Table 5 excludes those children. Appendix Table 1 shows descriptive statistics for this sample relative to the full household survey sample of 1,963 children from which this sample is drawn. As expected, the analysis sample is significantly better off than average along most of the measured characteristics. A more representative sample of all children in Peru can be obtained by including those children in the decomposition who attend schools which in the data have only disadvantaged children, as discussed at the end of Section IV. This increases the children in the sample from 302 to 502, increases the number of schools from 36 to 104, and greatly reduces the differences relative to the full household survey sample (Appendix Table 1).

When the modified decomposition is estimated in order to include children in Peru who attend schools for which the sample includes only disadvantaged children, the results change, although mostly in ways that one would expect (Table 5, column 2). The first point to note is that the test score gap is much higher when those children are added, increasing from 55.7 to 90.3, which is an increase from 0.56 to 0.90 standard deviations of the distribution of test scores. Perhaps the most important difference between columns 1 and 2 of Table 5 is that the contribution to the test score gap of differences in child and household characteristics increases from about 42% to about 73% and so becomes by far the largest component of that gap. This estimated contribution is highly statistically significant, and indeed it is the only statistically significant component of the decomposition in column 2 of Table 5. While some of the contribution of child and household characteristics to the test score gap may be counteracted by the fact that the “productivity” of those factors may be lower for advantaged households, this estimated counteracting effect is only about one third of the gap and is not statistically significant.

Turning to school variables, the school sorting effect again accounts for about one fourth of the gap but this is still not statistically significant. Finally, the phenomenon that advantaged children learn more than disadvantaged children in the same schools has a smaller proportionate effect, accounting for about one third of the gap, but this estimate is not statistically significant. Indeed, one would expect this component to be able to explain less of the gap since the “premium” effect, when it is weighted by the distribution of advantaged students, cannot explain much even if it could be estimated because there are few advantaged students in these schools.[[13]](#footnote-13)

The large role played by child and household characteristics in explaining the learning gap when schools for which the sample has no advantaged children are added to the analysis raises the question of which of those characteristics are most important. This is shown in Table 7. Unlike Table 6, the height-for-age Z-score does not explain much of this component. Instead, the wealth index measured when the child was 6-18 months old accounts for about one third of this component (29.1 out of 90.3). The only other significant factor is age, which explains about one sixth of this component, but again this primarily reflects minor variation in when the data were collected.

One way to increase the sample sizes in the results shown in the first two columns of Table 5 is to use the math test scores obtained in the third round (2009) of data collection when the children were around eight years old. The advantage of using this test is that it was administered to all of the younger cohort children in Peru, as opposed to the subsample for which the school survey was implemented in 2011, so that the sample suitable for this analysis is larger. However, there are also two disadvantages to using this test as the outcome measure. First, compared to the test administered as part of the school survey, this test captures much fewer competencies and is less closely linked to school curriculum. Second, while the household data allows one to determine which children are in the same school (through school id’s), it contains no data about the schools. In contrast, the school survey collected very detailed school data that will be used in future extensions of this analysis to examine which school characteristics in particular explain variation in the school quality measure (school fixed effect) used in the decompositions.

Decomposition results based on the household data tests are shown in the remaining columns of Table 5 (Appendix Tables 1 and 2 show relevant summary statistics[[14]](#footnote-14)). The first of these columns, that is the third column in Table 5, includes the same 36 schools that are included in the analysis shown in the first column of that table. This is done mainly for comparison purposes, and the general findings are the same although the statistical significance is weaker. That is, about two fifths of the difference in test scores appears to be due to differences in child and household characteristics between the two groups of children, and most of the rest seems to come from the “school premium” effect enjoyed by advantaged children who are in the same schools as disadvantaged children.

The fourth column in Table 5 expands the sample from 36 to 71 schools, and from 265 students to 592 students. This sample is still limited to schools for which there are test score data from both advantaged and disadvantaged students, but since almost all students in round 3 took the math test the sample size increases accordingly. Indeed the decomposition results in this column are more precisely estimated than those in column 3, and the results are very similar, which is what one would expect because the types of schools being sampled are essentially the same in both columns. Indeed, they are similar to the results in column1, in that about half of the test score gap is due to differences in child and household characteristics and the other half is due to the finding that advantaged students learn more than disadvantaged students when both attend the same schools.

Turn next to the results for Vietnam, which differ in several ways from the findings for Peru. Beginning with the first column of Table 8, which is based on the sample of children from the school survey who attend schools for which there are both advantaged and disadvantaged children in the data, there overall gap is 35.7, which by definition is a gap of about 0.36 standard deviations of the distribution of test scores in Vietnam, which is a smaller gap in standard deviation terms than was found in Peru.[[15]](#footnote-15) The contribution of differences in child and household characteristics to this gap is estimated to be about 16.9, which is about half (47%) of the overall gap, and is both statistically significant (10% level) and a similar proportion to the analogous results for Peru seen in the first column of Table 5. Another similarity is that differences in the “productivity” of child and household characteristics across the two groups are small (about 20% of the total gap) and statistically insignificant.

Given this sizable role of child and household characteristics in explaining the test score gap, it is informative to investigate which of these characteristics seem to play the most important roles. This is seen in Table 9. The most important roles seem to be played by the skills that children bring with them to school when they entered at age 5. The math and PPVT scores together explain almost half (7.4 out of 16.9) of the gap attributable to child and household characteristics. The other factor with a statistically significant role is maternal stress, but this explains only about 15% of the gap (2.6 out of 16.9).

The role played by schools in Vietnam, however, is quite different from the role played by schools in Peru. First, the role of sorting is very strong in that if disadvantaged children attended the same schools as advantaged children, the entire gap would be closed; this contribution to the gap is highly statistically significant. Second, there is little or no “premium” for advantaged children when they and disadvantaged children attend the same schools. Finally, there is a significantly negative impact of the last term of the decomposition in equation (6). At first glance this may appear to be puzzling, but the best way to interpret this effect is to add this term, θs(s,A - s,DA), to the sorting effect for disadvantaged children, namely δs(s,A - s,DA). This sum, (θs + δs)(s,A - s,DA), is the sorting effect for advantaged students. It is close to zero (36.9 – 31.1 = 5.8) and not statistically significant. Overall, in Vietnam disadvantaged students would benefit greatly – indeed, the entire test score gap would be closed – if they were able to attend the same schools that the advantaged children attended. However, for advantaged children there is no such gain, their test scores would be little affected if they attended (in the same proportion) the schools attended by disadvantaged students. Given that the overall school premium for advantaged students is close to zero, this implies that advantaged children have a premium when attending schools that are mostly attended by disadvantaged children, while disadvantaged children have a premium, relative to advantaged children, when attending schools that are attended primarily by advantaged children.

The rest of Table 8 presents decomposition results for an expanded sample of children in the school survey, as well as samples from the household survey. Summary statistics for these can be found in Appendix Tables 3 and 4.

If the (school-based) sample is expanded to include disadvantaged children who attend schools for which the sample does not have any advantaged children, as done in the second column of Table 8, the results change very little. This is as one would expect because there are relatively few such children in the Vietnam sample. Although the number of schools increases from 48 to 83, the number of children in the sample increases by a much smaller proportion, from 930 to 1073.

As in Peru, the Vietnam sample would increase if the Round 3 math test were used instead of the school survey math test, since the latter was administered only to children in grade 5 while the former was administered to children in any grade (which primarily adds children in grade 4). Yet there is an additional complication in terms of comparing the results for the Round 3 test to those for the 2011 school sample test, which is the issue of satellite schools in Vietnam. In Vietnam, many primary schools have associated “satellite” schools which are physically different schools but come under the jurisdiction of the school principal in the “main” school. In the school sample in the first two columns of Table 8, satellite schools are treated as separate schools because they indeed are physically separate schools, typically located several kilometres away from the main school. However, in the household data the school codes do not allow one to distinguish between a main school and its satellite school(s), and so to compare the school survey results with the Round 3 household survey results the third and fourth columns of Table 8 repeat the decompositions in the first and second columns, respectively, after combining satellite schools with their associated main schools. Despite this change in grouping students into schools, the results in columns 3 and 4 are quite similar to the corresponding columns in 1 and 2, which simplifies the comparison of the school survey results with the Round 3 household survey results.

Finally, columns 5-7 in Table 8 can be compared with those in columns 3 and 4. Column 5 uses the same schools that were used in column 3, column 6 adds schools that did not have both advantaged and disadvantaged children of both types that took the school tests in 2011 but did have both that took the Round 3 tests in 2009, and column 6 adds schools that have disadvantaged kids but advantaged kids. The results are easily summarized; the main results using the household data are similar to those using the school survey data. The sole difference is that the school composition effect explains only about half of the overall gap in test scores, as opposed to explaining virtually all of it, while the differences in child and household variables explain about two thirds of the gap, as opposed to explaining about half of it.

The results for the decompositions in Tables 5 and 8 show that test score gaps can arise from different factors in different countries. In Peru, differences in child and household characteristics explain at least half, and perhaps more than half, of the overall gap. The main contribution of schools to this gap is that advantaged students appear to learn more than disadvantaged students when both types of students are assigned to the same schools, which is consistent with the claim of Banerjee and Duflo;[[16]](#footnote-16) sorting of advantaged students into better schools seems to play less of a role.

In Vietnam, household characteristics also appear to explain about half of the gap. Turning to the role of schools, the sorting of disadvantaged students into lower quality schools seems to be the main factor explaining test scores gaps in mathematics. In contrast to Peru, and counter to the claim of Banerjee and Duflo, little of the gap is explained by the phenomenon of advantaged students learning more than disadvantaged students in the same school.

**VII. Conclusion**

While many developing countries have greatly increased school enrolment in the past 20 years, there is compelling evidence that the amounts students learn when in school is much less compared to students of the same age in developed countries. Yet some students in developing countries – generally those from better off households – learn much more than others. Knowledge of the underlying sources of the learning gaps between advantaged and disadvantaged students in those countries can provide guidance for what types of education policies can increase learning among disadvantaged students. For example, if one of the main causes is due to greater child malnutrition among disadvantaged students then early childhood nutrition programs may be appropriate, yet if the main problem is that, conditional on student characteristics, disadvantaged students learn less than advantaged students when both attend the same schools then policies are needed to change pedagogical methods (and perhaps teachers’ attitudes).

This paper decomposes learning gaps between advantaged (top two quintiles of the wealth distribution) and disadvantaged (bottom three quintiles) students into four possible sources: a) The child and household characteristics that increase learning, such as parental education, are higher among the more advantaged groups; b) The impacts of the child and household characteristics that increase learning are *stronger* for advantaged children; c) More advantaged children “sort” into better schools; and d) Learning increases attributable to school characteristics are higher for advantaged children (relative to disadvantaged children) *within* the same school. This is done for two developing countries using very rich panel data, Peru and Vietnam.

The results from the decomposition analysis show that test score gaps can arise from different factors in different countries. In both Peru and Vietnam, differences in child and household characteristics explain about half of the overall gap. The main contribution of schools to this gap varies by country; in Peru advantaged students appear to learn more than disadvantaged students when both types of students are assigned to the same schools; sorting of advantaged students into better schools seems to play less of a role. In contrast, sorting of disadvantaged students into lower quality schools seems to be the main factor explaining test scores gaps.

**References**

Banerjee, Abhijit, and Esther Duflo. 2011. *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. Public Affairs: New York.

Behrman, Jere. 2010.

Lochner, Lance. 2011.

**Table 1: Student Performance on Math Tests (TIMSS) for Selected Countries**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Grade 8 math score | % advanced (625+) | % very low (<400) |
| South Korea | 613 | 47% | 1% |
| Japan | 570 | 27% | 3% |
| Russia | 539 | 14% | 5% |
| USA | 509 | 7% | 8% |
| England | 507 | 8% | 12% |
|  |  |  |  |
| Thailand | 427 | 2% | 38% |
| Chile | 416 | 1% | 43% |
| Indonesia | 386 | 0% | 57% |
| Ghana | 331 | 0% | 79% |
| Botswana (gr.9) | 397 | 0% | 50% |
| S. Africa (gr.9) | 352 | 1% | 76% |

Source: TIMSS 2011 International Results in Mathematics

**Figure 1: Test Score Gap Decomposition (for a given school s)**

C

B

(βA-βDA)(-DA)



βDA()





δs,0

θs,0

D

A

3,DA

3,A

slope = βA

slope = βDA

3

X

DA

A

**Table 2: Measures of child background characteristics included in the analysis**

|  |  |
| --- | --- |
| Child characteristics | Age (in months)  Gender  Ethnicity1  Height for age (z-scores)  Number of siblings  PPVT test score (measure of receptive vocabulary)  CDA test score (measure of understanding of concepts of quantity). |
| Parent characteristics | Mother has completed secondary or tertiary education  Father has completed secondary or tertiary education  Maternal depression score2 in Round 1 (i.e. when child was 6-12 months)  Parenting score3 in Round 1 (i.e. when child was 6-12 months)  Mother’s life satisfaction and subjective well-being4  Whether child was regularly looked after by someone outside the house in infancy (Round 1) |
| Household characteristics | Household size  Household head is male  Household head age  Log of value of real monthly per capita consumption  Wealth index when child was 6-18 months5 |

Notes:

1 In Peru, ethnicity is proxied by whether mother’s first language is Spanish as speaking a native language is considered a marker of ethnicity which can be associated with exclusion. In Vietnam only 2% of the students are ethnic minorities so **[finish sentence]**

2 SRQ 20 – maternal depression screening tool recommended by WHO (WHO, 1997)

3 Parenting score constructed from a 14 item scale – only administered in Peru, not available for Vietnam.

4 Measured using Cantril’s ladder (Cantril, 1965) – children’s mothers were asked to state their current position on a ‘ladder of life’, in which the top step, 9, represents the ‘best possible life achievable’ and step 1 the worst. This is the measure used in the Gallup World Poll for instance.

5 Wealth index constructed using measures of housing quality, access to key services and ownership of durables.

**Table 3: Descriptive Statistics for Peru**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Peru (all)** | **Peru**  **(non-poor)** | **Peru (poor)** | **difference in means (non-poor – poor)** |
| *Outcome* |  |  |  |  |
| Maths test score (age 10) | 539.99 | 563.41 | 507.73 | 55.68\*\*\* |
|  | (86.30) | (80.74) | (83.5) |  |
| *Controls* |  |  |  |  |
| Male | 0.45 | 0.49 | 0.41 | 0.08 |
|  | (0.50) | (0.50) | (0.49) |  |
| Age in months (age 5) | 64.47 | 65.27 | 63.37 | 1.9\*\*\* |
|  | (4.57) | (4.68) | (4.18) |  |
| Ethnic majority | 0.79 | 0.87 | 0.67 | 0.14\*\* |
|  | (0.41) | (0.33) | (0.47) |  |
| Height for age z-score (age 5) | -1.28 | -1.09 | -1.54 | 0.45\*\*\* |
|  | (1.04) | (0.91) | (1.14) |  |
| PPVT test score (age 5) | 313.34 | 315.29 | 310.66 | 4.63 |
|  | (42.39) | (41.99) | (42.96) |  |
| CDA test score (age 5) | 306.60 | 313.61 | 296.94 | 16.66\*\*\* |
|  | (43.13) | (40.39) | (45.04) |  |
| Was regularly looked after by someone outside the household in infancy (age 6-18 months) | 0.21 | 0.30 | 0.13 | 0.16\*\*\* |
|  | (0.41) | (0.44) | (0.33) |  |
| Number of siblings (age 5) | 1.75 | 1.53 | 2.06 | -0.54\*\* |
|  | (1.67) | (1.44) | (1.91) |  |
| Mother’s educ.: secondary plus | 0.23 | 0.33 | 0.11 | 0.22\*\*\* |
|  | (0.42) | (0.47) | (0.31) |  |
| Father’s educ.: secondary plus | 0.23 | 0.30 | 0.13 | 0.16\*\*\* |
|  | (0.42) | (0.46) | (0.34) |  |
| Maternal stress (age 6-18 months) | 5.80 | 5.73 | 5.90 | -0.17 |
|  | (4.12) | (4.06) | (4.22) |  |
| Parenting score (age 6-18 months) | 0.89 | 0.83 | 0.96 | -0.13 |
|  | (0.96) | (0.97) | (0.94) |  |
| Maternal subjective well-being (age 5) | 5.07 | 5.27 | 4.78 | 0.48\*\* |
|  | (1.72) | (1.70) | (1.73) |  |
| Household size (age 5) | 5.19 | 5.11 | 5.30 | -0.19 |
|  | (2.02) | (2.13) | (1.85) |  |
| Household head is male (age 5) | 0.90 | 0.89 | 0.91 | -0.01 |
|  | (0.30) | (0.31) | (0.29) |  |
| Household head age (age 5) | 38.03 | 39.0 | 36.76 | 2.2\* |
|  | (10.61) | (10.91) | (10.08) |  |
| Wealth index (6-18 months) | 0.51 | 0.58 | 0.41 | 0.17\*\*\* |
|  | (0.16) | (0.13) | (0.14) |  |
| Natural log of per capital monthly consumption expenditure (age 5) | 5.22  (0.62) | 5.43  (0.57) | 4.93  (0.56) | 0.50\*\*\* |
|  |  |  |  |  |
| Number of Observations | 302 | 175 | 127 |  |
| Number of Schools | 36 | 36 | 36 |  |

Note: Standard deviations in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names.

**Table 4: Descriptive Statistics for Vietnam**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Vietnam (all)** | **Vietnam**  **(non-poor)** | **Vietnam (poor)** | **difference in means (non-poor – poor)** |
| *Outcome* |  |  |  |  |
| Maths test score (age 10) | 504.09 | 523.68 | 487.88 | 35.81\*\*\* |
|  | (95.75) | (97.51) | (91.23) |  |
| *Controls* |  |  |  |  |
| Male | 0.51 | 0.51 | 0.51 | -0.00 |
|  | (0.50) | (0.59) | (0.50) |  |
| Age in months (age 5) | 64.52 | 64.66 | 64.41 | 0.26 |
|  | (2.78) | (2.76) | (2.79) |  |
| Height for age z-score (age 5) | -1.26 | -1.06 | -1.42 | 0.36\*\*\* |
|  | (0.96) | (0.97) | (0.91) |  |
| PPVT test score (age 5) | 304.77 | 315.91 | 295.54 | 20.37\*\*\* |
|  | (45.11) | (46.77) | (41.54) |  |
| CDA test score (age 5) | 307.10 | 312.70 | 302.47 | 10.22\*\*\* |
|  | (46.12) | (43.41) | (2.12) |  |
| Was regularly looked after by someone outside the household in infancy (age 6-18 months) | 0.44 | 0.41 | 0.46 | -0.05 |
|  | (0.49) | (0.49) | (0.50) |  |
| Number of siblings (age 5) | 1.12 | 1.10 | 1.13 | -0.03 |
|  | (0.90) | (0.89) | (0.90) |  |
| Mother’s educ.: secondary plus | 0.16 | 0.28 | 0.06 | 0.22\*\*\* |
|  | (0.37) | (0.45) | (0.01) |  |
| Father’s educ.: secondary plus | 0.23 | 0.37 | 0.12 | 0.26\*\*\* |
|  | (0.42) | (0.48) | (0.32) |  |
| Maternal stress (age 6-18 months) | 4.47 | 4.94 | 3.78 | 1.16\*\*\* |
|  | (4.06) | (1.38) | (1.36) |  |
| Maternal subjective well-being (age 6-18  months) | 4.31 | 3.8 | 5.02 | -1.21\*\*\* |
|  | (1.49) | (3.71) | (4.24) |  |
| Household size (age 5) | 4.53 | 4.66 | 4.43 | 0.24\*\* |
|  | (1.32) | (1.46) | (0.05) |  |
| Household head is male (age 5) | 0.88 | 0.87 | 0.89 | -0.02 |
|  | (0.33) | (0.34) | (0.32) |  |
| Household head age (age 5) | 38.25 | 39.22 | 37.45 | 1.77\*\* |
|  | (11.98) | (11.20) | (12.54) |  |
| Wealth index (age 6-18 months) | 0.48 | 0.60 | 0.39 | 0.21\*\*\* |
|  | (0.18) | (0.14) | (0.16) |  |
| Natural log of per capital monthly consumption expenditure (age 5) | 5.78  (0.52) | 6.08  (0.49) | 5.54  (0.41) | 0.54\*\*\* |
|  |  |  |  |  |
| Number of Observations | 930 | 420 | 510 |  |
| Number of Schools | 48 | 48 | 48 |  |

Note: Standard deviations in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table 5: Peru Decompositions** | | | | | | |
|  |  | **School Survey Sample** | | **Household Survey Sample** | | |
| **Component** | **Detail** | **Sample 1** | **Sample 2** | **Sample 1** | **Sample 1a** | **Sample 2a** |
|  |  | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| (3,A – 3,DA ) | Difference | 55.68\*\*\*  (10.83) | 90.26\*\*\*  (9.23) | 7.26\*\*\*  (1.73) | 7.26\*\*\*  (1.72) | 9.29\*\*\*  (0.98) |
| **β**DAʹ(A­ - DA) | Background composition (endowment) effect | 23.49\*  (14.09) | 65.8\*\*\*  (17.43) | 3.06  (2.38) | 3.74\*\*\*  (1.47) | 7.94\*\*\*  (1.51) |
| **(βA - βDA)ʹDA** |  |  |  |  |  |  |
| **(βA - βDA)ʹ(A­ - DA)** | “Increased productivity” of advantaged person (interaction) effect | -5.09  (19.55) | -30.40  (28.54) | 0.81  (3.53) | 0.13  (2.14) | -0.76  (2.91) |
| **δs(s,A - s,DA)** | School composition effect | 14.72  (13.01) | 25.30  (16.97) | 2.39  (2.21) | 1.26  (1.33) | 0.84  (1.56) |
| **θss,DA** | School “coefficient” effect (advantaged students learn more) | 33.67\*  (18.17) |  | 5.54 ^  (3.47) | 3.57\*  (1.89) |  |
| **θs(s,A - s,DA)** | Advantaged students go to better schools AND learn more | -11.11  (19.99) |  | -4.23  (3.23) | -1.63  (1.71) |  |
| **θss, A** |  |  | 29.50  (29.23) |  |  | 0.33  (2.91) |
| **Number of Children** |  | 302 | 502 | 265 | 592 | 1230 |
| **Number of Schools** |  | 36 | 104 | 36 | 71 | 329 |

**Note:** School survey Sample 1 includes all children in the school survey sample who are at schools with both advantaged and disadvantaged children; School survey Sample 2 includes all children in the school survey who are at school with a disadvantaged child; House survey Sample 1 includes all children in the third round of the household survey sample who were at school with both advantaged and disadvantaged children *and* were included in School survey Sample 1. Household survey Sample 1a includes all children in the third round of the household survey sample who were at school with both advantaged and disadvantaged children. Household survey Sample 2a includes all children in the third round of the household survey who are at school with a disadvantaged child.

|  |  |  |
| --- | --- | --- |
| **Table 6: Details of Decomposition for School Survey Sample 1: Peru** | | |
|  | (1) | (2) |
| VARIABLES | Endowment effect | Interaction effect |
| Male | 2.065 | -1.900 |
|  | (1.997) | (2.167) |
| Age in months | 9.002\* | -2.566 |
|  | (4.845) | (5.486) |
| Ethnic majority | -5.727 | 4.005 |
|  | (5.422) | (7.203) |
| Height-for-age z (Age 5) | 8.551\*\* | -3.635 |
|  | (4.028) | (4.812) |
| PPVT test score (age5) | 0.477 | 0.932 |
|  | (1.206) | (1.695) |
| CDA test score (age 5) | 8.134 | -37.19 |
|  | (24.31) | (37.73) |
| CDA test score squared | -9.656 | 40.99 |
|  | (22.13) | (35.83) |
| In chid-care (age 6-18 months) | -2.294 | -0.0941 |
|  | (3.610) | (4.194) |
| Number of siblings (age 5) | 0.874 | 0.195 |
|  | (2.729) | (4.107) |
| Mother’s education: sec plus | 7.521 | 2.732 |
|  | (6.498) | (7.290) |
| Father’s education: sec plus | 2.280 | -2.909 |
|  | (4.483) | (5.426) |
| Maternal stress (age 6-18 months) | 0.661 | -0.499 |
|  | (1.951) | (1.517) |
| Parenting score (age 6-18 months) | 0.0584 | -0.496 |
|  | (1.131) | (1.491) |
| Maternal Subjective well-being (age 5) | -0.973 | -0.0220 |
|  | (2.344) | (2.930) |
| Household size (age 5) | 0.943 | -1.037 |
|  | (1.603) | (1.877) |
| HH head: male (age 5) | -0.175 | 0.0110 |
|  | (0.626) | (0.625) |
| HH head: age (age 5) | 0.613 | 0.734 |
|  | (2.125) | (2.655) |
| Wealth index (age 6-18 months) | 6.609 | -19.37 |
|  | (11.71) | (15.51) |
| Ln pc consumption (age 5) | -6.032 | 9.622 |
|  | (8.289) | (10.70) |
| Total background effect | 23.49 | -5.09 |
|  | (14.09) | (19.55) |
| Observations | 302 | 302 |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names. All variables are expressed in deviations from the mean of the disadvantaged group.

|  |  |  |
| --- | --- | --- |
| **Table 7: Details of Decomposition for school survey Sample 2: Peru** | | |
|  | (1) | (2) |
| VARIABLES | Endowment effect | Interaction effect |
|  |  |  |
| Male | 0.340 | -0.301 |
|  | (0.916) | (0.853) |
| Age in months (age 5) | 14.70\*\*\* | -4.362 |
|  | (5.211) | (7.377) |
| Ethnic majority | 6.883 | -10.24 |
|  | (8.104) | (12.47) |
| Height for age z (age 5) | 6.343 | 1.778 |
|  | (4.579) | (7.178) |
| PPVT test score (age 5) | 1.938 | 5.343 |
|  | (3.937) | (5.864) |
| CDA test score (age 5) | 21.37 | -67.89 |
|  | (23.84) | (49.88) |
| CDA test score squared | -18.60 | 68.38 |
|  | (23.10) | (47.04) |
| In child-care (age 6-18 months) | -1.136 | -1.160 |
|  | (2.330) | (3.182) |
| Number of siblings (age 5) | 1.397 | 0.965 |
|  | (2.827) | (7.376) |
| Mother’s educ: sec pl | 3.558 | 9.321 |
|  | (7.476) | (8.830) |
| Father’s educ: sec pl | 2.049 | -2.851 |
|  | (4.387) | (5.846) |
| Maternal stress score (6-18 months) | 0.153 | -0.0616 |
|  | (0.653) | (0.332) |
| Parenting score (6-18 months) | 0.174 | -0.504 |
|  | (0.665) | (1.030) |
| Maternal subjective well-being (age 5) | 0.866 | -2.009 |
|  | (1.625) | (2.693) |
| Household size (age 5) | 2.443 | -2.765 |
|  | (2.316) | (3.695) |
| HH head: male (age 5) | -0.385 | 0.118 |
|  | (0.783) | (0.954) |
| HH head: age (age 5) | 0.349 | 0.498 |
|  | (0.692) | (1.241) |
| Ln pc consumption (age 5) | 0.0447 | 4.817 |
|  | (8.108) | (12.17) |
| Wealth index (6-18 months) | 29.12\*\* | -47.71\*\* |
|  | (14.08) | (20.38) |
| Total background effect | 65.8 | -30.40 |
|  | (17.43) | (28.54) |
| Observations | 502 | 502 |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names. All variables are expressed in deviations from the mean of the disadvantaged grou

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 8: Vietnam Decompositions** | | | | | | | |  |
|  |  | **School Survey Sample** | | | | **Household Sample** | | |
| **Component** | **Detail** | **Sample 1** | **Sample 2** | **Sample 1 sat** | **Sample 2 sat** | **Sample 1 sat** | **Sample 1a sat** | **Sample 2a sat** |
|  |  | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
| (3,A – 3,DA ) | Difference | 35.71\*\*\* (6.59) | 42.79\*\*\* (6.31) | 38.92\*\*\* (6.34) | 42.88\*\*\* (6.23) | 7.71\*\*\* (0.83) | 8.86\*\*\* (0.72) | 9.98\*\*\* (0.71) |
| **β**DAʹ(A­ - DA) | Background composition (endowment) effect | 16.86\*  (9.32) | 15.97\*  (8.80) | 21.40\*\*  (8.74) | 19.12\*\* (8.45) | 4.36\*\*\*  (1.16) | 6.18\*\*\* (1.05) | 6.76\*\*\*  (1.05) |
| **(βA - βDA)ʹDA** |  |  |  |  |  |  |  |  |
| **(βA - βDA)ʹ(A­ - DA)** | “Increased productivity” of advantaged person (interaction) effect | 7.34  (13.69) | 9.12  (14.14) | 3.92  (13.60) | 6.63  (13.79) | 1.05  (1.75) | -0.14  (1.56) | -0.36  (1.61) |
| **δs(s,A - s,DA)** | School composition effect | 36.87\*\*\* (11.57) | 43.64\*\*\* (11.56) | 34.87\*\*\* (11.39) | 39.82\*\*\* (11.42) | 3.00\*\*  (1.46) | 4.08\*\*  (1.65) | 4.59\*\*\*  (1.68) |
| **θss,DA** | School “coefficient” effect (advantaged students learn more) | 5.73  (11.37) |  | 5.66  (12.01) |  | 0.75  (0.90) | 0.77  (1.33) |  |
| **θs(s,A - s,DA)** | Advantaged students go to better schools AND learn more | -31.10\*\* (13.28) |  | -26.88\*\* (13.48) |  | -1.22  (1.74) | -2.02  (1.87) |  |
| **θss, A** |  |  | -25.8^ (16.70) |  | -22.53  (16.56) |  |  | -1.00  (2.15) |
| **Number of Children** |  | 930 | 1,073 | 1,009 | 1,074 | 973 | 1,588 | 1,750 |
| **Number of Schools** |  | 48 | 83 | 39 | 46 | 44 | 59 | 115 |

**Note:** School survey Sample 1 includes all children in the school survey sample who are at schools with both advantaged and disadvantaged children; School survey Sample 2 includes all children in the school survey who are at school with a disadvantaged child. School Survey Samples 1sat and 2sat treat satellite schools as one school; House survey Sample 1sat includes all children in the third round of the household survey sample who were at school with both advantaged and disadvantaged children *and* were included in School survey Sample 1sat. Household survey Sample 1asat includes all children in the third round of the household survey sample who were at school with both advantaged and disadvantaged children. Household survey Sample 2asat includes all children in the third round of the household survey who are at school with a disadvantaged child. All analysis using household data treats satellite schools as one school

|  |  |  |
| --- | --- | --- |
| **Table 9: Details of Decomposition for school survey Sample 1: Vietnam** | | |
|  | (1) | (2) |
| VARIABLES | Endowment effect | Interaction effect |
|  |  |  |
| Male | 0.0482 | 0.0243 |
|  | (0.380) | (0.198) |
| Age in months | 0.0519 | 0.0619 |
|  | (0.373) | (0.594) |
| Height for age z-score (age 5) | 0.0822 | 2.963 |
|  | (1.577) | (2.590) |
| PPVT test score (age 5) | 3.826\* | 6.692\* |
|  | (2.243) | (3.696) |
| CDA test score (age 5) | 3.550\*\* | -2.435 |
|  | (1.455) | (1.897) |
| Number of siblings (age 5) | 0.0472 | -0.183 |
|  | (0.197) | (0.429) |
| In chid-care (6-18m) | 0.433 | 0.280 |
|  | (0.513) | (0.707) |
| Mother’s educ,: secondary plus | -1.013 | 7.767\* |
|  | (3.685) | (4.619) |
| Father’s educ.: secondary plus | 2.763 | 1.330 |
|  | (3.136) | (4.156) |
| Maternal subjective well-being (age 5) | 2.291 | -5.061 |
|  | (3.598) | (5.680) |
| Maternal stress (6-18m) | 2.582\*\* | -3.045 |
|  | (1.298) | (2.085) |
| Household size (age 5) | -0.983 | 1.496 |
|  | (1.157) | (1.555) |
| HH head: age (age 5) | 0.540 | -0.777 |
|  | (0.660) | (1.104) |
| HH head: male (age 5) | 0.0911 | 0.00564 |
|  | (0.236) | (0.295) |
| Wealth index in (6-18m) | -5.486 | 10.12 |
|  | (7.370) | (12.14) |
| Ln pc consumption (age 5) | 6.942 | -10.44 |
|  | (6.345) | (9.248) |
| Total background effect | 16.86 | 7.34 |
|  | (9.32) | (13.69) |
| Total Observations | 930 | 930 |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names. All variables are expressed in deviations from the mean of the disadvantaged group

|  |  |  |
| --- | --- | --- |
| **Table 10: Details of Decomposition for school survey Sample 2: Vietnam** | | |
|  | (1) | (2) |
| VARIABLES | Endowment effect | Interaction effect |
|  |  |  |
| Male | 0.0413 | 0.0190 |
|  | (0.371) | (0.175) |
| Age in months | 0.197 | -0.00463 |
|  | (0.571) | (0.964) |
| Height for age z (age 5) | -0.905 | 4.608 |
|  | (1.712) | (3.027) |
| PPVT score (age 5) | 3.706\* | 6.502\* |
|  | (1.984) | (3.470) |
| CDA score (age 5) | 3.291\*\* | -2.042 |
|  | (1.280) | (1.950) |
| Number of siblings (age 5) | -0.0110 | -0.152 |
|  | (0.163) | (0.363) |
| In child-care (6-18m) | 0.0721 | 0.155 |
|  | (0.180) | (0.349) |
| Mother’s educ: sec plus | 0.508 | 6.500 |
|  | (3.542) | (4.536) |
| Father’s educ: sec plus | 2.688 | 1.616 |
|  | (3.016) | (4.166) |
| Maternal subjective well-being (age 5) | 2.281 | -4.941 |
|  | (3.032) | (5.196) |
| Maternal stress (6-18m) | 2.103\*\* | -2.463 |
|  | (0.985) | (1.617) |
| Household size (age 5) | -1.088 | 1.515 |
|  | (0.860) | (1.256) |
| Hh head: age (age 5) | 0.444 | -0.730 |
|  | (0.683) | (1.245) |
| Hh head: male (age 5) | 0.153 | 0.00581 |
|  | (0.319) | (0.467) |
| Wealth index (6-18m) | -3.934 | 9.232 |
|  | (7.339) | (13.24) |
| Ln pc consumption (age 5) | 5.230 | -8.851 |
|  | (5.381) | (8.793) |
| Total background effect | 15.97 | 9.12 |
|  | (8.80) | (14.14) |
| Observations | 1,073 | 1,073 |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names. All variables are expressed in deviations from the mean of the disadvantaged group

**Appendix Table 1: Descriptive Statistics for Peru – whole household sample compared to school survey and household samples used in decompositions presented in Table 5**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Peru full hh sample (round 3)** | **Peru school survey analysis sample (sample 1)** | **Peru school survey analysis sample (sample 2)** | **Peru household survey analysis sample**  **(sample 1a)** | **Peru household survey analysis sample**  **(sample 2a)** | **difference in means (full hh – school Sample 1)** | **difference in means (full hh – school Sample 2)** | **Difference in mean (full hh- hh Sample 1a)** | **Difference in mean (full hh- hh Sample 2a)** |
| Household Survey Maths test (age 8) | 300 | 304.18 | 300.16 | 301.15 | 297.62 | -4.17\*\*\* | -0.16 | -1.14\* | 2.39\*\*\* |
|  | (14.34) | (12.64) | (13.62) | (13.56) | (14.50) |  |  |  |  |
| Male | 0.50 | 0.45 | 0.47 | 0.51 | 0.51 | 0.05 | 0.03 | -0.01 | -0.01 |
|  | (0.50) | (0.50) | (0.50) | (0.50) | (0.50) |  |  |  |  |
| Age (months) (age 5) | 63.97 | 64.47 | 63.28 | 64.47 | 63.10 | -0.5\* | 0.69\*\* | -0.50\*\* | 0.87\*\*\* |
|  | (4.69) | (4.57) | (4.57) | (4.39) | (4.53) |  |  |  |  |
| Ethnic majority | 0.69 | 0.79 | 0.61 | 0.88 | 0.68 | -0.10\*\*\* | 0.07\*\* | -0.19\*\*\* | 001 |
|  | (0.46) | (0.41) | (0.49) | (0.33) | (0.47) |  |  |  |  |
| Height for age z(age 5) | -1.54 | -1.28 | -1.58 | -1.31 | -1.68 | -0.26\*\*\* | 0.04 | -0.23\*\*\* | 0.14\*\*\* |
|  | (1.12) | (1.04) | (1.03) | (1.04) | (1.05) |  |  |  |  |
| PPVT test score (age 5) | 300 | 313.26 | 299.53 | 306.35 | 291.77 | -13.26\*\*\* | 0.47 | -6.49\*\*\* | 8.23\*\*\* |
|  | (46.34) | (42.41) | (44.02) | (43.31) | (44.15) |  |  |  |  |
| CDA test score (age 5) | 300 | 306.60 | 296.23 | 301.66 | 292.39 | -6.60\*\* | 3.77 | -1.66 | 7.61\*\*\* |
|  | (49.99) | (43.13) | (45.80) | (45.33) | (48.93) |  |  |  |  |
| In chid-care (infancy) (6-18m) | 0.21 | 0.21 | 0.18 | 0.23 | 0.18 | 0.0 | 0.03\* | -0.02 | 0.02 |
|  | (0.41) | (0.41) | (0.38) | (0.42) | (0.39) |  |  |  |  |
| Number of siblings (age 5) | 2.14 | 1.75 | 2.31 | 1.74 | 2.34 | 0.39\*\* | -0.17 | 0.39\*\*\* | -0.20\*\* |
|  | (2.16) | (1.67) | (2.55) | (1.61) | (2.25) |  |  |  |  |
| Mother’s educ.: sec+ | 0.18 | 0.23 | 0.15 | 0.18 | 0.11 | -0.05\*\* | 0.03\* | -0.00 | 0.07\*\*\* |
|  | (0.38) | (0.42) | (0.36) | (0.38) | (0.31) |  |  |  |  |
| Father’s educ.: sec+ | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.01 | 0.01 | 0.01 | 0.01 |
|  | (0.40) | (0.39) | (0.39) | (0.39) | (0.39) |  |  |  |  |
| Maternal stress (6-18m) | 5.68 | 5.80 | 5.79 | 5.58 | 5.58 | -0.12 | -0.11 | 0.11 | 0.11 |
|  | (4.21) | (4.12) | (4.32) | (4.06) | (0.11) |  |  |  |  |
| Parenting score (6-18m) | 0.93 | 0.89 | 0.90 | 0.88 | 0.92 | 0.04 | 0.03 | 0.05 | 0.01 |
|  | (0.94) | (0.96) | (0.90) | (0.95) | (0.90) |  |  |  |  |
| Maternal subjective well-being (6-18m) | 4.91 | 5.07 | 4.91 | 4.99 | 4.86 | -0.16 | 0.00 | -0.08 | 0.05 |
|  | (1.86) | (1.72) | (1.92) | (1.77) | (1.92) |  |  |  |  |
| Hh size (age 5) | 5.51 | 5.19 | 5.54 | 5.29 | 5.59 | 0.32\*\* | -0.04 | 0.22\*\* | -0.09 |
|  | (2.08) | (2.02) | (2.22) | (2.05) | (2.07) |  |  |  |  |
| Hh head: male (age 5) | 0.89 | 0.90 | 0.91 | 0.90 | 0.90 | -0.0 | -0.01 | -0.0 | -0.01 |
|  | (0.31) | (0.30) | (0.29) | (0.30) | (0.29) |  |  |  |  |
| Hh head: age (age 5 | 38.41 | 38.03 | 38.06 | 38.38 | 38.16 | 0.37 | 0.34 | 0.03 | 0.25 |
|  | (11.63) | (10.61) | (12.33) | (11.25) | (11.80) |  |  |  |  |
| Ln pc monthly consumption exp. (age 5) | 5.01 | 5.22 | 4.99 | 5.15 | 4.88 | -0.21\*\*\* | 0.02 | -0.13\*\*\* | 0.13\*\*\* |
|  | (0.66) | (0.62) | (0.67) | (0.58) | (0.63) |  |  |  |  |
| Wealth index (6-18m) | 0.43 | 0.51 | 0.42 | 0.47 | 0.38 | -0.08\*\*\* | 0.01 | -0.04\*\*\* | 0.05\*\*\* |
|  | (0.19) | (0.16) | (0.18) | (0.17) | (0.17) |  |  |  |  |
| Number of Observations | 1963 | 302 | 502 | 592 | 1,230 |  |  |  |  |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names

**Appendix Table 2: Descriptive Statistics for Peru for Household Survey Sample 1a used for decompositions in Table 5, Col (4)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Peru (all)** | **Peru**  **(non-poor)** | **Peru (poor)** | **Difference in means (Non-poor – poor)** |
| *Outcome* |  |  |  |  |
| Household survey maths test score (age 8) | 301.15 | 304.84 | 297.71 | 7.13\*\*\* |
|  | (13.56) | (12.65) | (13.49) |  |
| *Controls* |  |  |  |  |
| Male | 0.51 | 0.52 | 0.51 | 0.01 |
|  | (0.50) | (0.50) | (0.50) |  |
| Age in months | 64.47 | 65.21 | 63.78 | 1.43\*\*\* |
|  | (4.39) | (4.43) | (4.25) |  |
| Ethnic majority | 0.88 | 0.93 | 0.83 | 0.10\*\*\* |
|  | (0.33) | (0.26) | (0.38) |  |
| Height for age z-score (age 5) | -1.31 | -1.09 | -1.52 | 0.43\*\*\* |
|  | (1.04) | (0.91) | (1.12) |  |
| PPVT test score (age 5) | 306.35 | 315.00 | 298.30 | 16.7\*\*\* |
|  | (43.31) | (42.66) | (42.42) |  |
| CDA test score (age 5) | 301.66 | 310.93 | 293.02 | 17.91\*\*\* |
|  | (45.33) | (40.84) | (47.61) |  |
| Was regularly looked after by someone outside the household in infancy (age 6-18 months) | 0.23 | 0.27 | 0.20 | 0.07\*\* |
|  | (0.42) | (0.45) | (0.40) |  |
| Number of siblings (age 5) | 1.74 | 1.50 | 1.97 | -0.47\*\*\* |
|  | (1.61) | (1.39) | (1.77) |  |
| Mother’s educ,: secondary plus | 0.18 | 0.28 | 0.09 | 0.20\*\*\* |
|  | (0.38) | (0.45) | (0.29) |  |
| Father’s educ.: secondary plus | 0.18 | 0.29 | 0.09 | 0.20\*\*\* |
|  | (0.39) | (0.45) | (0.28) |  |
| Maternal stress (6-18m) | 5.58 | 5.50 | 5.64 | -0.14 |
|  | (4.06) | (3.94) | (4.18) |  |
| Parenting score (6-18m) | 0.88 | 0.89 | 0.87 | 0.03 |
|  | (0.95) | (1.01) | (0.90) |  |
| Maternal subjective well-being (age 5) | 4.99 | 5.15 | 4.85 | 0.30\*\* |
|  | (1.77) | (1.68) | (1.84) |  |
| Household size (age 5) | 5.29 | 5.28 | 5.30 | -0.02 |
|  | (2.05) | (2.19) | (1.93) |  |
| Household head is male (age 5) | 0.90 | 0.90 | 0.90 | 0.00 |
|  | (0.30) | (0.30) | (0.31) |  |
| Household head age (age 5) | 38.38 | 39.49 | 37.34 | 2.15\*\* |
|  | (11.25) | (11.37) | (11.05) |  |
| Wealth index (6-12 months) | 0.47 | 0.56 | 0.38 | 0.19\*\*\* |
|  | (0.17) | (0.14) | (0.14) |  |
| Natural log of per capital monthly consumption expenditure (age 5) | 5.15 | 5.38 | 4.93 | 0.45\*\*\* |
|  | (0.58) | (0.53) | (0.53) |  |
| Number of Observations | 592 | 286 | 307 |  |

Note: Standard deviations in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names.

**Appendix Table 3: Descriptive Statistics for Vietnam – whole household sample compared to school survey and household samples used in decompositions presented in Table 8**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Full hh sample (round 3)** | **School survey analysis sample (sample 1)** | **School survey analysis sample (sample 2)** | **Household survey analysis sample**  **(sample 1a)** | **Household survey analysis sample**  **(sample 2a)** | **Difference in means (full hh – school Sample 1)** | **Difference in means (full hh – school Sample 2)** | **Difference in mean (full hh- hh Sample 1a)** | **Difference in mean (full hh- hh Sample 2a)** |
| Household survey maths test (age 8) | 300.00 | 304.22 | 303.24 | 300.41 | 299.36 | -4.21\*\*\* | -3.22\*\*\* | -0.39 | 0.65 |
|  | (15.00) | (12.44) | (12.72) | (14.20) | (14.55) |  |  |  |  |
| Male | 0.52 | 0.51 | 0.51 | 0.51 | 0.51 | 0.00 | 0.00 | 0.00 | 0.00 |
|  | (0.50) | (0.50) | (0.50) | (0.50) | (0.50) |  |  |  |  |
| Age (months) (age 5) | 63.06 | 64.52 | 64.39 | 63.21 | 63.09 | -1.47\*\*\* | -1.34\*\*\* | -0.15 | -0.04 |
|  | (3.75) | (2.78) | (2.84) | (3,67) | (3.73) |  |  |  |  |
| Height for age z(age 5) | -1.34 | -1.26 | -1.33 | -1.28 | -1.35 | -0.09\*\* | -0.02 | -0.06\* | 0.01 |
|  | (1.04) | (0.96) | (0.97) | (0.98) | (1.01) |  |  |  |  |
| PPVT1 (age 5) | 300 | 304.22 | 303.29 | 299.23 | 298.22 | -4.22\*\* | -3.29\* | 0.77 | 1.78 |
|  | (45.12) | (45.14) | (44.21) | (45.27) | (44.98) |  |  |  |  |
| CDA2 (age 5) | 300 | 306.87 | 305.47 | 300.47 | 299.23 | -6.87\*\*\* | -5.47\*\* | -0.47 | 0.77 |
|  | (48.19) | (46.16) | (46.55) | (48.88) | (47.80) |  |  |  |  |
| In chid-care (6-18m) | 0.38 | 0.44 | 0.42 | 0.39 | 0.38 | -0.06\*\* | -0.04\*\* | -0.02 | -0.00 |
|  | (0.49) | (0.50) | (0.49) | (0.49) | (0.49) |  |  |  |  |
| Number of siblings (age 5) | 1.18 | 1.12 | 1.13 | 1.12 | 1.15 | 0.07 | 0.06 | 0.06\* | 0.03 |
|  | (1.12) | (0.90) | (0.95) | (1.05) | (1.09) |  |  |  |  |
| Mother’s educ.: sec+ | 0.17 | 0.16 | 0.14 | 0.17 | 0.15 | 0.01 | 0.03\*\* | 0.01 | 0.02 |
|  | (0.38) | (0.37) | (0.35) | (0.37) | (0.36) |  |  |  |  |
| Father’s educ.: sec+ | 0.23 | 0.23 | 0.21 | 0.23 | 0.22 | 0.00 | 0.02 | -0.00 | 0.02 |
|  | (0.42) | (0.42) | (0.41) | (0.42) | (0.41) |  |  |  |  |
| Maternal stress (6-18m) | 4.37 | 4.47 | 4.37 | 4.44 | 4.40 | -0.09 | 0.00 | -0.07 | -0.02 |
|  | (3.92) | (4.06) | (4.01) | (3.96) | (3.93) |  |  |  |  |
| Maternal subjective  well-being(age 5) | 4.18 | 4.31 | 4.27 | 4.20 | 4.17 | -0.13\*\* | -0.09\* | -0.03 | 0.00 |
|  | (1.44) | (1.49) | (1.46) | (1.44) | (1.43) |  |  |  |  |
| Hh size (age 5) | 4.67 | 4.53 | 4.55 | 4.57 | 4.62 | 0.13\*\* | 0.12\*\* | 0.09\* | 0.05 |
|  | (1.51) | (1.33) | (1.36) | (1.42) | (1.46) |  |  |  |  |
| Hh head: male (age 5) | 0.88 | 0.88 | 0.89 | 0.87 | 0.88 | -0.00 | -0.01 | 0.01 | 0.00 |
|  | (0.33) | (0.33) | (0.32) | (0.33) | (0.33) |  |  |  |  |
| Hh head: age (age 5) | 38.54 | 38.25 | 37.92 | 38.65 | 38.50 | 0.28 | 0.62 | -0.12 | 0.04 |
|  | (12.23) | (11.98) | (11.94) | (12.26) | (12.33) |  |  |  |  |
| Wealth index (6-18m) | 0.44 | 0.48 | 0.45 | 0.46 | 0.44 | -0.04\*\*\* | -0.01 | -0.01\* | 0.00 |
|  | (0.22) | (0.18) | (0.19) | (0.20) | (0.21) |  |  |  |  |
| Ln pc monthly consumption exp. (age 5) | 5.76 | 5.78 | 5.74 | 5.78 | 5.74 | -0.03 | 0.02 | -0.03 | 0.01 |
|  | (0.61) | (0.52) | (0.52) | (0.57) | (0.57) |  |  |  |  |
| Number of Observations | 1970 | 930 | 1073 | 1,588 | 1,750 |  |  |  |  |

Note: Standard errors in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names

**Appendix Table 4: Descriptive Statistics for Vietnam for Household Survey Sample 1asat used for decompositions in Table 8, Col (5).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Vietnam (all)** | **Vietnam**  **(non-poor)** | **Vietnam (poor)** | **difference in means (non-poor – poor)** |
| *Outcome* |  |  |  |  |
| Household survey maths test (age 8) | 300.41 | 305.65 | 296.77 | 8.88\*\*\* |
|  | (14.20) | (13.79) | (13.31) |  |
| *Controls* |  |  |  |  |
| Male | 0.51 | 0.52 | 0.51 | 0.01 |
|  | (0.50) | (0.50) | (0.50) |  |
| Age in months (age 5) | 63.21 | 63.54 | 62.98 | 0.56\*\* |
|  | (3.67) | (3.6) | (3.7) |  |
| Height for age z-score (age 5) | -1.28 | -1.00 | -1.48 | 0.48\*\*\* |
|  | (0.98) | (0.98) | (0.94) |  |
| PPVT test score (age 5) | 299.24 | 312.95 | 289.72 | 23.22\*\*\* |
|  | (45.27) | (48.38) | (40.35) |  |
| CDA test score (age 5) | 300.51 | 309.06 | 294.56 | 14.49\*\*\* |
|  | (48.88) | (42.67) | (51.95) |  |
| Was regularly looked after by someone outside the household in infancy (age 6-18 months) | 0.39 | 0.41 | 0.39 | 0.02 |
|  | (0.49) | (0.49) | (0.49) |  |
| Number of siblings (age 5) | 1.12 | 1.11 | 1.13 | -0.01 |
|  | (1.05) | (0.94) | (1.12) |  |
| Mother’s educ,: secondary plus | 0.17 | 0.32 | 0.06 | 0.27\*\*\* |
|  | (0.37) | (0.47) | (0.23) |  |
| Father’s educ.: secondary plus | 0.23 | 0.42 | 0.11 | 0.31\*\*\* |
|  | (0.42) | (0.49) | (0.31) |  |
| Maternal stress (6-18m) | 4.44 | 3.92 | 4.80 | -0.88\*\*\* |
|  | (3.96) | (3.75) | (4.07) |  |
| Maternal subjective well-being (age 5) | 4.2 | 4.83 | 3.77 | 1.07\*\*\* |
|  | (1.44) | (1.33) | (1.35) |  |
| Household size (age 5) | 4.57 | 4.71 | 4.48 | 0.24\*\* |
|  | (1.42) | (1.51) | (1.36) |  |
| Household head is male (age 5) | 0.87 | 0.86 | 0.88 | -0.02 |
|  | (0.33) | (0.35) | (0.32) |  |
| Household head age (age 5) | 38.65 | 40.09 | 37.66 | 2.43\*\*\* |
|  | (12.26) | (11.70) | (12.55) |  |
| Wealth index (6-18 months) | 0.46 | 0.61 | 0.35 | 0.26\*\*\* |
|  | (0.20) | (0.17) | (0.16) |  |
| Natural log of per capital monthly consumption expenditure (age 5) | 5.78 | 6.14 | 5.54 | 0.60\*\*\* |
|  | (0.57) | (0.55) | (0.43) |  |
| Number of Observations | 1,588 | 649 | 939 |  |

Note: Standard deviations in parentheses. Age of child when time-variant variables are captured in parentheses next to variable names.

1. A score of 400 corresponds to “some basic mathematical knowledge. Students can add and subtract whole numbers. They have some recognition of parallel and perpendicular lines, familiar geometric shapes, and coordinate maps.” [↑](#footnote-ref-1)
2. In 2012, these children were aged approximately eleven years. They typically started school in or around 2006. [↑](#footnote-ref-2)
3. In addition, classroom peers of the younger cohort children were also sampled in both countries. These data are not used in this paper and so are not described. [↑](#footnote-ref-3)
4. In fact, the **SC** variables include not only teacher and school characteristics but also peer effects that reflect the characteristics of the students in those schools. [↑](#footnote-ref-4)
5. Equations (4) and (5) are obtained by taking the expectations of equation (3ʹ) condition on **X**, the Ds variables, and A (recall that u3 is assumed to be uncorrelated with the **X** and **SC** variables) and replacing the **X** and Ds variables with their mean values. [↑](#footnote-ref-5)
6. It is also possible to present a similar decomposition from the viewpoint of an advantaged student, but since we assume that the objective is to raise the performance of a disadvantaged student to that of an advantaged student, as opposed to lower the performance of an advantaged student to that of a disadvantaged student, this decomposition is the more relevant of the two decompositions. [↑](#footnote-ref-6)
7. Slight differences from the mean of 500 are found in the data employed in this paper due to the non-inclusion of a small number of pupils for whom household background data were not available. [↑](#footnote-ref-7)
8. As noted above school inputs **SC** are measured using a set of school fixed effects. [↑](#footnote-ref-8)
9. We do not include a control for ethnicity in the estimation using the Vietnam data as there is almost no variation within schools. **[So this ends up in the school fixed effect; let’s discuss.]** [↑](#footnote-ref-9)
10. We do not include controls for pre-school at the age of 5 as the great majority of children were in pre-school by that point. **[give numbers for this here.]** [↑](#footnote-ref-10)
11. Measures of consumption expenditure are not available in the first round of the Young Lives data (when the children were 6-18 months). [↑](#footnote-ref-11)
12. As discussed above in both countries the test scores were normalized to have means of 500 and standard deviations of 100 for the whole sample, but for both countries children who attend schools that have all advantaged children or all disadvantaged children are dropped from the sample, so that the means are slightly above 500 and the standard deviations are slightly below 100. [↑](#footnote-ref-12)
13. Note that the same premium can be calculated for column 1 by adding the last two rows in that column, which yields a figure (22.6) which is not much smaller than the estimate of 29.5 in column (2). [↑](#footnote-ref-13)
14. Note that the standard deviation for the household test is around 14 points. Therefore, similarly to the school sample, the gap in household survey Sample 1 constitutes about half of standard deviation for the whole sample. [↑](#footnote-ref-14)
15. This comparison may appear misleading since the two countries used two different tests. Yet when these countries take the same test, as done in Rounds 2 and 3, the standard deviation of test scores is lower in Vietnam, which implies that the gap of 0.36 standard deviations in Vietnam would be even smaller when expressed in terms of the standard deviation found in Peru. [↑](#footnote-ref-15)
16. An alternative explanation for this difference in learning within the same school may be that advantaged children live in environments that are more conducive to learning and have parents who value education more. In order to investigate this hypothesis, additional controls were added from the last round of the household data (when the children were around 8 years old and already in school, to capture these factors. The controls included time that children spend sleeping, studying and at school, number of books at home and per capita education expenditure in the household. The addition of these controls does not change the main results. [↑](#footnote-ref-16)