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Working Paper

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An International Study of Childhood Poverty

Do Extra Classes Improve Cognitive Test Scores?

Evidence from Vietnam

Le Thuc Duc and Bob Baulch

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Abstract

This paper examines whether participation in extra classes improves children's cognitive test scores, using data from the second and third rounds of the Young Lives survey in Vietnam. Using a standard value-added model, we find that that the number of hours pupils spend in extra classes is not associated with better cognitive (mathematics and vocabulary) test scores. However, a number of other factors (parental schooling, household wealth, ethnicity and gender) do influence children's test scores. These results are robust to different estimation methods and model specifications. The findings suggest that the large amounts that the parents of Young Lives children spend on extra classes cannot be justified from a cognitive standpoint.

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About Young Lives

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

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1. Introduction

Most children in Vietnam are enrolled in both regular school and extra classes *(hoc them*). Extra classes involve additional instruction in core academic subjects, are usually given by children's regular teachers and normally take place within children's regular schools. They can therefore be seen as a private supplement to Vietnam's public schooling, and are related to but distinct from the phenomenon of private tutoring that is common elsewhere in Asia (Bray and Lykins 2012; Dang and Rogers 2007). Behind the supply of extra classes is the need to supplement teachers' poor salaries.[1] On the demand side, reasons for taking the extra classes include the prevalence of half-day schooling, and fierce competition for the limited number of places in upper and post-secondary education. While a number of government decisions, decrees and circulars have been issued to regulate the growth of extra classes, these are widely perceived to be ineffective.

This paper examines what impact extra classes have on cognitive test scores, using data from Rounds 2 and 3 of the Vietnam Young Lives survey.[2] Round 2 of the survey was carried out in 2006 and Round 3 in 2009. In an earlier paper using Round 1 data (collected in 2002), Tran and Harpham (2005) found that 44 per cent of 8-year olds were enrolled in extra classes but that attendance at extra classes was not associated with better writing and numeracy skills after controlling for other factors.[3] Using data from Rounds 1 and 2 of Young Lives, Ko and Xing (2009) showed there was an association between taking extra classes and the subjective well-being of children in Vietnam. Dang (2007) worked with nationally representative household survey data from 1997–8 and found that 31 per cent of primary school, 56 per cent of lower secondary and 77 per cent of upper secondary school students attended extra classes. Using internal school grades, this study also found that expenditure on extra classes and private tutoring had a 'significant impact on students' academic performance', especially at the lower secondary school level (Dang 2007: 697). There remain, however, a number of unanswered questions about the effect that extra classes have on the development of children's cognitive ability, and about whether parental expenditure on extra classes is 'money well spent'.

The two additional rounds of the Young Lives survey that have been conducted since 2005 allow Tran and Harpham's analysis to be extended and deepened in several ways. First, the panel data for Rounds 2 and 3 (in which identical tests of cognitive ability were administered) allow the determinants of changes rather than just the level of test scores to be investigated. Second, the panel structure of the data allows the endogeneity of parents' decisions to enrol their children in extra classes to be controlled for via instrumental variable methods. Third, as the Young Lives cognitive tests were administered independently, they avoid the issue related to children's academic performance being evaluated by their regular teachers, many of whom teach extra classes as well (see Dang 2007). Accordingly, this paper examines

1 See, for example, Thanh Nien (2008) or Tuoi Tre (2010).

2 Young Lives (www.younglives.org.uk) is a longitudinal study of child poverty that is tracking 12,000 children in four countries (Ethiopia, Peru, Vietnam, and the state of Andhra Pradesh in India). The original Young Lives sample in each country included 2,000 children born in 2000–1 and 1,000 children born in 1994–5. In Vietnam, the Young Lives sample is drawn from 34 communes in five provinces.

3 Tran and Harpham did, however, find that extra classes improved 8-year-olds' reading ability.

what impact extra classes have on mathematics and receptive vocabulary scores in the tests administered in Rounds 2 and 3 of the Vietnam Young Lives surveys.

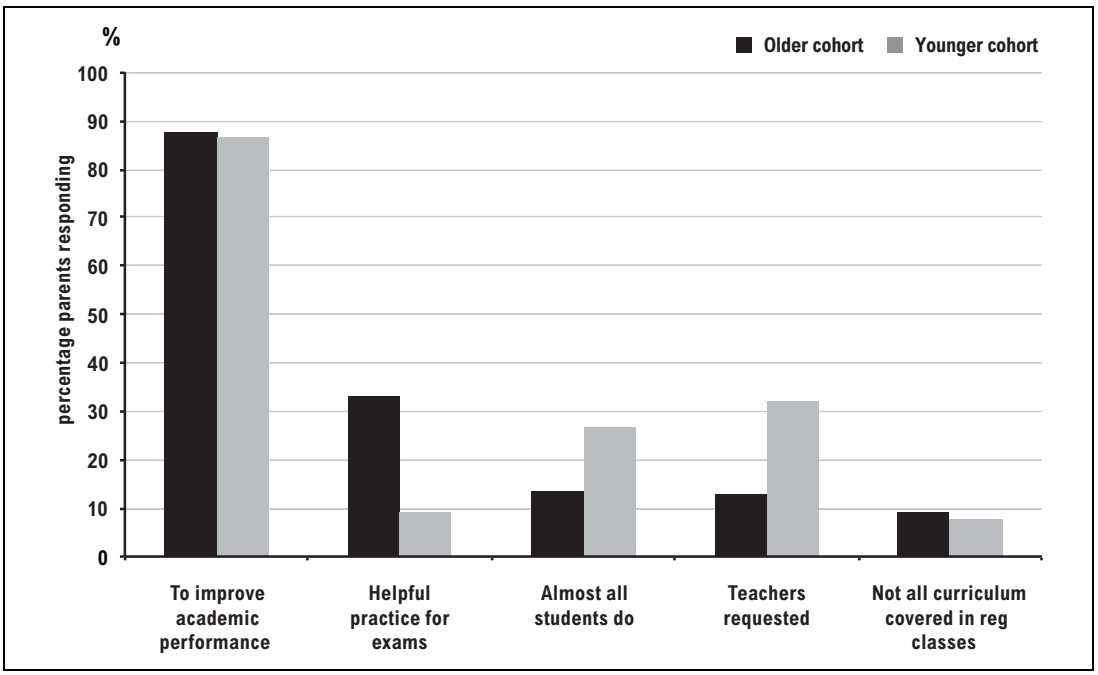
2. Background and data

A number of data sources demonstrate the importance of extra classes, both in terms of the numbers of children attending them and in relation to parental expenditure, in Vietnam. Analysis of the Vietnam Household Living Standards Survey (VHLSS) shows that 32 per cent of primary, 46 per cent of lower secondary and 63 per cent of upper secondary school pupils attended extra classes in 2008. Data from Round 3 of the Young Lives survey shows that 69 per cent of the Older Cohort (then aged 14–15 years old) and 65 per cent of the Younger Cohort (aged 8–9) attended extra school classes. However, if the sample is restricted to children who were still attending school on a full-time basis (almost a quarter of Older Cohort children had dropped out of school by Round 3), 75.3 per cent of pupils in the Older Cohort attended extra classes.

Parents of Young Lives children devote a considerable share of their total expenditure to fees for extra classes. In Round 3 the parents of Older Cohort children spent an average of 7.7 per cent of household non-food expenditure (or 31.8 per cent of educational expenditure) on extra classes. Meanwhile, parents of Younger Cohort children spent 5.5 per cent of their non-food expenditure (and 27.9 per cent of educational expenditure) on extra classes. Parents of Older Cohort children in the richest quintile spent 11.2 per cent of household non-food expenditure on extra classes, compared to 4.7 per cent for parents in the poorest quintile. Meanwhile, the parents of Younger Cohort children in the richest quintile spent 8.2 per cent of household non-food expenditure on extra classes, compared to 4.2 per cent for those in the poorest quintile. It is interesting to note that the Young Lives data show a considerably higher share of household expenditure is devoted to extra classes than the Vietnam Household Living Standards Survey.

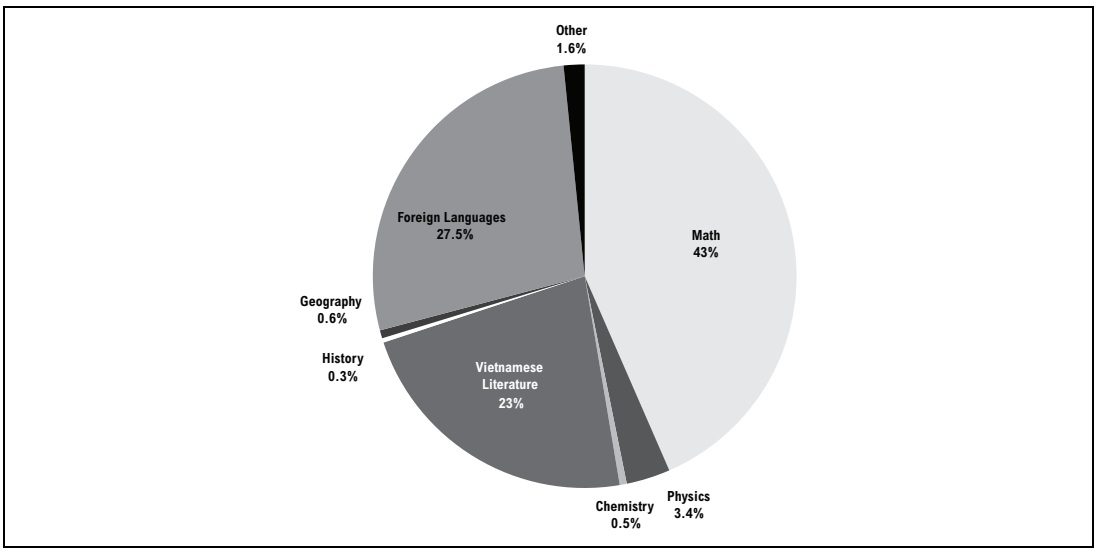
Parents' primary motivation for sending their children to extra classes is to improve their academic performance in regular school (Figure 1). When asked about the three main reasons why they sent their child to extra classes, the majority of parents stated it was to improve their children's academic performance. A third of parents (33 per cent) of Older Cohort children (of whom 28 per cent were in their last year at lower secondary school) also viewed extra classes as helpful practice for examinations. A higher percentage of parents of Younger Cohort children (27 per cent) stated that one of the main reasons for attending extra classes was that almost all other students in their children's classes did so (see Figure 1), than did Older Cohort parents (14 per cent). Similarly, around a third (32 per cent) of Younger Cohort parents stated that their children's teacher had requested that they attend extra classes, compared to 13 per cent for the Older Cohort. The fact that not all the curriculum was covered in regular school classes was mentioned by less than 10 per cent of pupils in both cohorts.

Figure 1. *Reasons for attending extra classes, Round 3*



Round 2 of the Young Lives survey also asked parents what subjects were studied in extra classes and who the teachers of extra classes were. Figure 2 shows that almost half (43 per cent) of the time Older Cohort children spent in extra classes was devoted to mathematics, with foreign languages and Vietnamese literature accounting for most of the remainder (28 and 23 per cent, respectively). For the Older Cohort, just over 64 per cent of extra classes in Round 2 were taught by pupils' main class teachers, while almost 27 per cent were taught by other teachers from the same school. The remaining 8 per cent of extra classes were taught by teachers from other schools or private teachers.[4]

Figure 2. *Subjects studied in extra classes by the Older Cohort, Round 2*



4 Unfortunately, the same questions were not asked again in Round 3 of the Young Lives survey, by which time around three-fifths of the Older Cohort had moved from lower to upper secondary school.

Teachers' motivation for engaging in extra classes is primarily a financial one. Official teachers' salaries are low in Vietnam, and most teachers find it necessary to supplement them. In 2009, a primary school teacher with one year's experience received a salary and allowances equivalent to just US$100 per month. The corresponding figure for a secondary school teacher with one year's experience was US$120 per month. As Carr-Hill (2011) notes, such salaries are 'low compared with the teachers' salaries in several other Asian countries. [So] many teachers teach extra classes or second shifts or have other forms of employment in order to supplement their incomes.'

Teachers' desire to supplement their incomes by enrolling their pupils in extra classes, together with the financial burden this places on parents, has come up in National Assembly (parliamentary) debates on education and training frequently. Concerns about the amount of time which schoolchildren of all grades spend attending extra classes, the impact this has on their attentiveness in regular classes and on their leisure time are also common in the media (Thanh Nien News 27 November 2008; Tuoi Tre 2010; Viet Nam News 2010). Since 1993 a number of regulations to restrict and control extra classes have been promulgated by both the Ministry of Education and Training and the Office of the Prime Minister. The latest regulation (03/2007/QD-BGDDT) specifies that extra classes should use the general education curriculum, be provided only by licensed organisations, should not create excessive study burden for students, and cannot be mandatory. Furthermore, extra classes are banned for primary school pupils and secondary schools with full-day teaching. Some provinces have instituted additional restrictions covering the number and length of extra classes.[5] However, possibly because of their complex and decentralised nature, these regulations are widely flouted.

Simple tabulations suggest that extra classes enhance children's cognitive ability. Table 1 shows the means of normalised tests scores in mathematics and receptive vocabulary for Younger and Older Cohort children attending school in Round 3, disaggregated by whether or not they attended extra classes. Mathematics ability was assessed with questions selected from the Trends in International Mathematics and Sciences Study (TIMSS) and measured on a scale from zero to 30.[6] Receptive vocabulary was assessed using the Peabody Picture Vocabulary Test (PPVT), which is measured on a scale from 20 to 200.[7] See Appendix 1 for descriptive statistics for the raw test scores. While higher and statistically significant differences in mathematics and PPVT scores are observed for children enrolled in extra classes in both cohorts, there are a number of factors (e.g. how parental education, household characteristics and wealth or school quality influence parents' decision to enrol their children in extra classes) which make this simple comparison potentially misleading.

5 For example, Decision 14/2011/QD-UBND of the Hanoi People's Committee specifies that no more than two sessions of extra classes each lasting no more than two hours may be taken per week by lower secondary school pupils, while upper secondary school pupils should not take more than three sessions lasting up to three hours per week. Similar regulations have been adopted by the provinces of Bac Giang, Ba Ria-Vung Tau, Ben Tre, Cau Mau, Da Nang, Dien Bien, Hung Yen Ninh Binh, Phu Yen, Quang Nam and Thua-Thien Hue.

6 For further information on TIMSS, which has measured trends in mathematics and science achievement at the fourth and eighth grades in around 60 countries since 1995, see www.timss.bc.edu.

7 The Peabody Picture Vocabulary Test (PPVT) is a widely used test of receptive vocabulary developed in the USA in 1959. The test requires respondents to select the pictures that best represent the meaning of a series of stimulus words read out by the examiner. The test is individually administered, untimed and norm-referenced. In Rounds 2 and 3 of the Young Lives survey, the PPVT-III was administered to Older and Younger Cohort children in Ethiopia, India and Vietnam (Dunn and Dunn 1997), and the PPVT-R in Peru.

Table 1. *Test scores of Older and Younger Cohort children, according to attendance at extra classes, Round 3*

	Mathematics		Vocabulary (PPVT)	
	Older Cohort	Younger Cohort	Older Cohort	Younger Cohort
Attending extra classes	0.34	0.10	0.28	0.18
Not attending extra classes	−0.08	−0.17	−0.10	−0.28
t-test	5.3	5.5	4.5	10.0
p-value	0.000	0.000	0.000	0.000
Number of observations	*728*	*1,889*	*719*	*1,799*

Note: Mean normalised raw test scores are reported. The t-test is unpaired with unequal variances.

Attendance at extra classes varies widely between geographical regions, ethnic groups, and according to households' socio-economic characteristics (Table 2). Although the percentage of children attending extra classes is 10 percentage points higher for children in the Older than the Younger Cohort, the time pupils in the two cohorts spend in them is about the same. Attendance at extra classes is highest in the Red River Delta where virtually all Younger and Older Cohort children still enrolled in school were attending extra classes during Round 3. Attendance at extra classes is also high in urban areas, but not in the mountains or the southern deltas.

For each cohort, attendance and time spent at extra classes varies with the schooling of the parents. Children whose parents have completed upper secondary school or post-secondary education are more likely to attend extra classes than children whose parents only completed primary school. Furthermore, children with more educated parents spend more hours per week attending extra classes. Extra class attendance also varies by ethnicity. In the Older Cohort, the children of Kinh (Viet) mothers are more than twice as likely to attend extra classes as ethnic minority children, although the number of hours spent in extra classes is similar.

Finally, for the poorest quartile (in terms of the household wealth index), the percentage of Older Cohort children taking extra classes is lower than that for Younger Cohort children (46 versus 52 per cent).[8] In the wealthiest quartile, on the other hand, extra class attendance is higher among the Older than the Younger Cohort (90 versus 76 per cent). Generally, there is a trend for the rate of attendance and hours spent in extra classes to increase with wealth index. Extra classes are more expensive for secondary school than for primary school pupils, which may explain the greater role of household wealth in the decision to enrol older children in extra classes.

8 The Young Lives wealth index is a simple mean of three components: housing quality, access to consumer durables and access to services. See the Vietnam Round 3 Country Report (Le Thuc Duc et al. 2011) for a detailed description of how the Young Lives wealth index is constructed

Table 2. *Attendance at extra classes and time spent there, according to child and household characteristics, Round 3*

	Younger Cohort		Older Cohort	
	Attending extra classes (% of children)	Time spent in extra classes[a] (hours per week)	Attending extra classes (% of children)	Time spent in extra classes[b] (hours per week)
	65.0	10.1	75.4	10.0
Geographical characteristics				
Mountains	56.8	9.3	53.5	9.6
Red River Delta	99.5	11.5	99.3	11.4
Coasts	62.0	10.0	61.1	6.9
Southern deltas	37.4	7.0	65.1	7.9
Urban	70.2	10.5	89.0	11.5
Maximum education level of parents				
Primary school	57.8	9.7	62.9	9.0
Lower secondary school	73.9	10.0	82.9	10.1
Upper secondary school	75.1	11.1	89.1	10.2
Post-secondary education	77.2	11.0	87.4	11.6
Gender of child				
Boys	65.6	10	69.8	9.6
Girls	64.3	10.2	80.2	10.4
Mother's ethnicity				
Majority	67.5	10.3	79.2	10.0
Minority	48.8	8.6	35.9	9.9
Round 2 wealth index quartile				
Quartile 1 (poorest)	51.9	9.1	45.6	8.8
Quartile 2	56.7	10.0	70.2	8.9
Quartile 3	76.2	10.4	85.8	10.5
Quartile 4	75.7	10.6	90.3	10.7
Number of observations	*1,903*	*1,231*	*733*	*548*

Note: [a, b] Applies to children attending extra classes.

3. Empirical strategy

Following the recommendations of Todd and Wolpin (2003, 2007), we estimate the commonly used 'value-added' and 'value-added-plus' models, in which Round 3 test scores are regressed on contemporaneous and lagged input variables plus test scores from Round 2. Let s_{it} represent the cognitive test scores of child i in round t, x_{it} represent observed inputs into child i's schooling in round t, and $y_{ik}, k = 1,K$ be variables on the child and the household characteristics; and $z_{il}, k = 1,L$ denote commune and geographic characteristics. The basic value-added model to be estimated is then:

$$s_{i3} = \alpha + \beta s_{i2} + \gamma x_{i3} + \sum_{k=1}^{K} \delta_k y_{ik2} + \sum_{l=1}^{L} \phi_l z_{il2} + \varepsilon_i \quad (1)$$

where $t=3$ and $t=2$ represent Rounds 3 and 2 of the Young Lives survey.

This basic model can be extended by adding lagged school input variables to the estimating equation to give the 'value-added-plus' model:

$$s_{i3} = \alpha + \beta s_{i2} + \gamma_2 x_{i2} + \gamma_3 x_{i3} + \sum_{k=1}^{K} \delta_k y_{ik2} + \sum_{l=1}^{L} \phi_l z_{il2} + \upsilon_i \quad (2)$$

where the additional term x_{i2} denotes school input for child i in Round 2.

These models can also be recast as a cumulative model with within-child fixed effects, in which changes in cognitive test scores are regressed on changes in school input variables. However, the cumulative model is more restrictive as it implicitly assumes a unitary coefficient on lagged test scores (Chaplin and Puma 2003). In addition, a concern we have with both models is that the lagged test score must be a sufficient statistic to control for all unobserved historical inputs (including the probability of children participating in extra classes in the past).

In this paper, the key school input is the number of hours a child spends in extra classes in a week. The factors to be controlled for consist of child and household characteristics, the community-level variables and broader geographical dummies. The most important child-level characteristics are the lagged test scores, which are assumed to carry all the information on unobserved factors that matter to the child performance in the tests under study. Other child characteristics are gender and ethnicity. Among household characteristics, we consider the number of siblings, parental education and wealth index. For parental education, we use the number of years it normally takes to complete the higher of the school grades that either parent achieved.[9] For the other household characteristics, the wealth index in Round 2 is found relevant to school inputs in both Rounds 2 and 3. The wealth index in Round 2 is less likely to be endogenous that that of Round 3. The geographical dummies show whether a commune is located in a coastal, delta, midland or upland area, while the three variables representing commune-level characteristics are described in the discussion of instrumental variables below.

Because of concerns about the endogeneity of the school input variables, we apply both ordinary least squares and two-stage-least-squares to estimate equations (1) and (2). We have to find instrumental variables that satisfy two conditions: (1) they must have explanatory power for the potentially endogenous school input variable, which in this case is the number of hours children spend in extra classes in Rounds 2 and 3; and (2) they must be uncorrelated with the error terms (ε and υ in equations (1) and (2) respectively). The basic idea behind our selection of instrumental variables is that there are some unexplained factors that make participation in extra classes more common in some communes than others. Figure 1 shows that the main reasons for Young Lives' children taking extra classes is to improve their performance in regular classes and/or to provide practice for exams. However, around 27 per cent of children in the Younger Cohort and 14 per cent of children in the Older Cohort also mentioned that almost all other pupils attended extra classes. If most of a pupil's classmates take extra classes, the pupil may feel s/he has to enrol in them too in order to avoid being in a disadvantageous position, in particular being treated worse by the teacher than the child's classmates – who by taking extra classes are contributing to the teacher's income. Thus, the popularity of extra classes in a commune presents a kind of externality, which may develop in its own way over time, independently from other socio-economic factors in the commune.

9 In cases where one or both of the parents have completed post-secondary training or college/university, 14 or 16 years of education are assumed.

We refer to the participation in extra classes that is not explained by the major socio-economic characteristics within the commune as the unexplained effect. Formally, the unexplained effects, which may vary by round, and are denoted by λ_t, are assumed to be determined as follows:

$$P_t = \mu_{0t} + \mu_{1t} z_1 + \mu_{2t} z_2 + \mu_{3t} z_3 + \lambda_t \quad (3)$$

where P_t stands for commune rate of participation in extra classes in round *t*, and z_1, z_2 and z_3 are three commune-level variables (all measured in Round 2). We use three commune-level variables in explaining the rate of attendance in extra classes. These are the average years of mothers' schooling in the commune, the average asset index in the commune in Round 2, and time (in minutes) to travel from the commune centre to the district capital by motorcycle.

The justification for the choice of these three variables is as follows. First, one of the major factors influencing participation in extra classes is the average education of women in the commune. In addition to being a measure of economic development, the average years of schooling of the mothers in the commune captures information on how much the community cares about education.[10] Second, the commune's average asset index is an indicator of the prosperity/poverty of the community and signals households' overall willingness to pay for extra classes, independently of individual household wealth.[11] This may influence a teacher's willingness to work in a commune. Finally, the distance from the commune centre to the district capital matters not only for access to schools, but for the quality of teachers as well. Teachers with professional experience and good qualifications tend to have more bargaining power with the education authorities, and are usually reluctant to take positions in remote villages. So the further the commune is located from the district capital, the less likely there are to be good teachers in the commune.

Table A2 in Appendix 2 presents the results of OLS regressions (at the child individual level) for equation (3). All three commune-level variables are important in explaining extra class attendance by the Older Cohort. Not only are t-statistics very high but also the adjusted R-squared is above 0.6. For the Younger Cohort, commune characteristic z_3, travel time to the district capital, does not help to explain attendance at extra classes, but average commune assets and average schooling of mothers are highly significant. For the sake of consistency, we include the same three commune variables for both the Older and Younger Cohorts among the regressors (for the first and second stage regressions).

Formally, as popularity factors λ_t are not observed, we apply P_t, the commune rate of participation in extra classes, as the instrumental variables for the variable on school inputs. In Appendix 2, however, we show that if z_1, z_2 and z_3 are included among the explanatory factors (included instruments), the final estimates for the effect of the extra classes are exactly the same as the ones that were the results of applying the corresponding unexplained effects $\lambda_t, t = 2,3$. While we believe that our selection of commune-level instrumental variables provides better identification than using commune fixed effects, it is important to note that there may still be unobserved household-level variables which are

10 Note that the maximum education of parents (at the household level) is also included as an explanatory variable in the value-added and value-added-plus models.

11 Note also that the household wealth index is included as an explanatory variable in the value-added and valued-added plus models.

highly correlated with attendance in extra classes and which therefore bias our results to some extent.

Unfortunately, it is impossible to find valid instrumental variables which can explain such within-commune variations in extra class attendance. As Murray (2006) puts it, 'all instruments arrive on the scene with a dark cloud of invalidity hanging overhead. This cloud never goes entirely away' (p. 111).

4. Empirical results

Using data from Rounds 2 and 3 of Young Lives, we estimated the value-added specification shown in equation (1) using contemporaneous values of all variables plus lagged cognitive (mathematics and PPVT) test scores. Explanatory variables include the number of hours the Young Lives child spends attending extra classes in Round 3, gender and birth order of the child, the number of siblings s/he has, parents' maximum completed level of education, the household wealth index, and a set of geographical dummies. Following Dang (2007), we also estimated an ordered logit model using the four class performance ranks reported by children's mothers and the same set of explanatory variables. We report the results of the ordered logit estimation in Appendix 3. The results of estimations in Table A3 in Appendix 3 suggest that participation in extra classes has a small but positive impact on the class performance of the Older Cohort children. With the Younger Cohort children, however, the figures in Table A4 indicate that the marginal effects of the hours spent in extra classes are statistically insignificant for all the outcomes of class performance.

A serious concern before carrying out this estimation was whether the variable representing hours spent in extra classes was determined simultaneously with the Round 3 PPVT score (i.e., hours spent in extra classes are endogenous). We therefore estimated the value-added specification using both ordinary least squares and two-stage least squares (2SLS) estimation. As discussed above, the variable chosen to instrument the hours children spent in extra classes in the 2SLS estimation is the commune-level average rate of participation in extra classes. A justification for the selection of this instrumental variable was provided in the previous section.

Table 3. *Value-added model, Older Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Hours spent on extra classes, R3	0.008	0.000	0.009	0.006
	(0.007)	(0.029)	(0.006)	(0.023)
Maths score, R2, normalised	0.487***	0.495***		
	(0.061)	(0.062)		
PPVT, R2, normalised			0.349***	0.349***
			(0.047)	(0.047)
Male	−0.172***	−0.183**	0.011	0.006
	(0.062)	(0.080)	(0.058)	(0.064)
Ethnic minority	0.009	0.020	−0.531***	−0.529***
	(0.166)	(0.159)	(0.136)	(0.129)
Number of siblings	−0.073***	−0.073***	−0.004	−0.004
	(0.023)	(0.022)	(0.032)	(0.031)
Wealth Index, R2	0.173	0.195	0.827**	0.836**
	(0.274)	(0.273)	(0.338)	(0.328)
Max. education of parents	0.034***	0.035***	−0.001	−0.001
	(0.009)	(0.009)	(0.009)	(0.010)
Commune average years of mothers' schooling	0.019	0.023	−0.028	−0.026
	(0.040)	(0.041)	(0.043)	(0.040)
Commune average asset index, R2	1.785	1.825	0.883	0.901
	(1.565)	(1.446)	(1.526)	(1.517)
Time to district capital (minutes by motorcycle)	0.003	0.002	−0.000	−0.000
	(0.003)	(0.003)	(0.004)	(0.004)
Mountains	0.017	0.001	0.044	0.037
	(0.150)	(0.159)	(0.192)	(0.199)
Red River Delta	Omitted category			
Coast	0.252	0.220	0.175	0.163
	(0.184)	(0.222)	(0.180)	(0.196)
Southern deltas	0.227	0.197	−0.249*	−0.262**
	(0.212)	(0.254)	(0.137)	(0.127)
Urban	0.296	0.289	0.113	0.110
	(0.265)	(0.255)	(0.254)	(0.244)
Number of observations	699	699	665	*665*
R-squared	0.336	0.334	0.328	*0.327*
Under-identification (p-value)		0.015		*0.017*
Kleibergen-Paap F		64.369		*48.368*

Notes: Standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 16.38, 15% maximal IV size 8.96, 20% maximal IV size 6.66.

Tables 3 and 4 present the results of both OLS and 2SLS estimation of the value-added model for the Older and Younger Cohorts, along with two tests for weak identification.[12] As the test results suggest that our instrument is valid, and given the well-known problem of

12 Note that, as the Young Lives data is clustered, the Kleinbergen-Paap F test should be compared to the Stock-Yugo critical values given in the notes.

efficiency associated with the use of instruments (Davidson and McKinnon 1993), we attach equal weight to the OLS and the 2SLS estimates. The results of the OLS and 2SLS estimates turn out to be remarkably consistent. In particular, the number of hours that children spend attending extra classes has a statistically insignificant and numerically unimportant impact on cognitive test scores in Round 3 in the vast majority of estimations.

Table 3 reports the estimation results for the value-added model for the Older Cohort. Four variables (lagged test scores, gender of the child, number of siblings, and parental education) turn out to be significantly associated with Round 3 mathematics scores, while three variables (lagged test scores, ethnicity and household wealth) influence PPVT scores. In the value-added specification, the lagged test score operates as a control for all unobserved factors, including children's ability and school quality (Chaplin and Puma 2003). Each one-point increase in a child's score in Round 2 is associated with a half of standard deviation increase in mathematics and one-third standard deviation increase in PPVT scores in Round 3. The positive association between test scores in Rounds 2 and 3 is suggestive that the type of 'self-productivity effects' hypothesised by Cunha and Heckman (2008) may exist, especially for mathematics.[13] Boys are found to do less well in mathematics, while ethnicity has a detrimental impact on receptive vocabulary scores. The effect of ethnicity on receptive vocabulary is consistent with the disadvantages which some ethnic minority children are known to face in school (World Bank 2009). In particular, ethnic minority children who do not speak Vietnamese in the home might be expected to have lower vocabulary scores than their Kinh classmates.

Two other variables which significant impacts on the test scores of the Older Cohort are household wealth index and parental schooling (Table 3). A one-year increase in parents' schooling is associated with a small increase in their child's mathematics score but has an insignificant impact on receptive vocabulary. A one-unit change in the wealth index is associated with large (approximately 0.83 of a standard deviation) increases in Round 3 PPVT scores. However, it is important to remember that the wealth index is constructed to vary between 0 and 1, and for the Older Cohort, the mean and the standard deviation of wealth index equal 0.46 and 0.17 respectively. Lastly, it is important to note that the variable on hours spent attending extra classes does not have a statistically significant impact on older children's cognitive test scores in Table 3. The absolute size of the coefficient on hours spent in extra classes is also relatively small, given that children who enrol in them, spend an average of ten hours per week attending extra classes.[14]

13 In their well-known work on human capital formation Cunha and Heckman (2008) suggest that self-productivity effects, in which the acquisition of skills early in life enhances subsequent skills, help to explain the existence of sensitive and critical periods in the production of cognitive and non-cognitive skills.

14 Similar results are obtained when a dummy for extra class attendance is used as the dependent variable (Appendix 5, Table A7).

Table 4. *Value-added model, Younger Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Hours spent on extra classes, R3	−0.000	−0.001	0.013**	0.006
	(0.006)	(0.025)	(0.006)	(0.027)
CDA-Q, R2, normalised[a]	0.199***	0.199***		
	(0.042)	(0.044)		
PPVT, R2, normalised			0.276***	0.278***
			(0.030)	(0.027)
Male	−0.021	−0.021	0.033	0.032
	(0.037)	(0.036)	(0.034)	(0.033)
Ethnic minority	−0.424***	−0.423***	−0.246*	−0.245*
	(0.159)	(0.153)	(0.128)	(0.126)
Number of siblings	−0.009	−0.009	−0.046***	−0.048**
	(0.026)	(0.024)	(0.017)	(0.019)
Wealth Index, R2	1.001***	1.002***	0.539**	0.545**
	(0.228)	(0.222)	(0.219)	(0.228)
Max education of parents	0.036***	0.036***	0.039***	0.039***
	(0.007)	(0.006)	(0.007)	(0.006)
Commune average years of mothers' schooling	0.022	0.023	0.064*	0.074
	(0.040)	(0.045)	(0.036)	(0.063)
Commune average asset index, R2	8.408***	8.375***	3.399	3.205
	(2.693)	(2.664)	(2.389)	(2.335)
Time to district capital	−0.005	−0.005	−0.002	−0.002
(minutes by motorcycle)	(0.003)	(0.003)	(0.003)	(0.003)
Mountains	0.002	0.002	0.056	0.057
	(0.234)	(0.229)	(0.184)	(0.177)
Red River Delta	Omitted Category			
Coast	0.540**	0.536**	−0.069	−0.091
	(0.240)	(0.249)	(0.167)	(0.157)
Southern deltas	0.422***	0.413*	0.047	−0.002
	(0.141)	(0.227)	(0.068)	(0.185)
Urban	0.302*	0.294	−0.263	−0.306**
	(0.167)	(0.213)	(0.161)	(0.155)
Number of observations	*1718*	*1,718*	*1,497*	*1,497*
R-squared	*0.318*	*0.318*	*0.348*	*0.346*
Under-identification (p-value)		*0.005*		*0.005*
Kleibergen-Paap F		*38.61*		*37.95*

Notes: [a] As mathematics tests were not administered to Younger Cohort children in Round 2, the Cognitive Development Assessment-Quantitative (CDA-Q) score in Round 2 is used for the valued-added model for mathematics.
Standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 16.38, 15% maximal IV size 8.96, 20% maximal IV size 6.66.

Table 4 shows equivalent results for the value-added model with the Younger Cohort. Again, the coefficient on the number of hours spent in extra classes is not statistically different from zero for maths test scores using both estimation methods, and for vocabulary test scores

estimated using instrumental variables.[15] The coefficient on extra classes is statistically significant for vocabulary test scores when OLS estimation is used but is numerically small (0.013 of one standard deviation).

Test scores in Round 2 are again an important determinant of subsequent test scores, reflecting children's innate ability and the quality of education they receive. Higher household wealth and better parental schooling also continue to be associated with better test scores, but the influence of gender disappears. Unlike the results for the Older Cohort, the effect of ethnicity on test scores is statistically significant for the Younger Cohort, although only weakly so in the case of receptive vocabulary. The number of siblings a child has is found to have a negative impact on PPVT scores. This is consistent with the impact that more children in the household (particularly children of school age) may be expected to have on household resources and education spending (Becker and Lewis 1973; Blake 1989). However, a similar effect is not found for mathematics.

Results of estimation of the value-added-plus model in equation (2) with data from the Older Cohort are presented in Table 5.[16] This model extends the basic value-added model by including a lagged school input variable (hours spent in extra classes in Round 2). The results continue to show that the hours spent in extra classes have a mostly insignificant effect on the test scores of children, although the OLS results show a small but significant impact of extra classes in Round 2 on mathematics test scores. Cognitive test scores in Round 2 are once again highly significant, suggesting the presence of self-productivity effects.[17] The coefficients of other variables in the value-added-plus model are consistent with those of the value-added model for the Older Cohort in Table 3 above.

Taken together, these results provide little evidence that extra classes improve children's cognitive test scores in either mathematics or receptive vocabulary, although other factors (in particular household wealth and parental schooling) are associated with higher test scores in Round 3.

15 In addition, none of the coefficients on extra classes is statistically significant if a dummy for attendance in extra classes is used instead of hours spent in extra classes (Appendix 5, Table A8).

16 It is not possible to apply the value-added plus model to the Younger Cohort, as most of them were not attending school during Round 2 of Young Lives.

17 Again, similar results are obtained when a dummy for attendance at extra classes is used as the dependent variable (Appendix 5, Table A9).

Table 5. *Value-added-plus model, Older Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Hours spent on extra classes, R3	0.007	−0.008	0.009	−0.010
	(0.007)	(0.035)	(0.006)	(0.033)
Hours spent on extra classes, R2	0.017**	0.024	0.011	0.051
	(0.008)	(0.069)	(0.007)	(0.065)
Maths score, R2, normalised	0.485***	0.499***		
	(0.060)	(0.062)		
PPVT, R2, normalised			0.346***	0.341***
			(0.048)	(0.052)
Male	−0.172***	−0.191**	0.010	−0.016
	(0.063)	(0.084)	(0.058)	(0.083)
Ethnic minority	−0.008	0.004	−0.538***	−0.556***
	(0.159)	(0.154)	(0.135)	(0.131)
Number of siblings	−0.064***	−0.061	0.001	0.023
	(0.024)	(0.041)	(0.032)	(0.042)
Wealth Index, R2	0.105	0.114	0.783**	0.664**
	(0.275)	(0.302)	(0.339)	(0.338)
Max education of parents	0.031***	0.032**	−0.003	−0.005
	(0.009)	(0.014)	(0.009)	(0.012)
Commune average years of mothers' schooling	0.022	0.030	−0.026	−0.011
	(0.040)	(0.049)	(0.043)	(0.043)
Commune average asset index, R2	1.384	1.290	0.612	−0.324
	(1.556)	(1.922)	(1.577)	(2.264)
Time to district capital	0.003	0.003	0.000	0.001
(minutes by motorcycle)	(0.003)	(0.003)	(0.004)	(0.005)
Mountains	0.053	0.041	0.066	0.121
	(0.158)	(0.200)	(0.200)	(0.250)
Red River Delta	Omitted category			
Coast	0.264	0.215	0.184	0.160
	(0.188)	(0.225)	(0.181)	(0.195)
Southern deltas	0.213	0.158	−0.258*	−0.350**
	(0.218)	(0.278)	(0.137)	(0.139)
Urban	0.252	0.222	0.084	−0.035
	(0.259)	(0.309)	(0.248)	(0.264)
Number of observations	*699*	*699*	*665*	*665*
R-squared	*0.341*	*0.335*	*0.330*	*0.285*
Under-identification (p-value)		*0.002*		*0.002*
Kleibergen-Paap F		*10.189*		*9.294*

Notes: standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 7.03; 15% maximal IV size 4.58; and 20% maximal IV size 3.95.

5. Summary and policy implications

Extra classes are a topic of considerable public interest in Vietnam. There has been much public debate and media coverage about the negative consequences of extra classes, which include the burden they place on household budgets and children's time, and the way in which they distort incentives for teachers. In recent years, questions on the equity and regulation of extra classes have been raised in the National Assembly. While a number of government regulations have been issued to restrict the growth of extra classes, this has not prevented the majority of secondary school pupils from attending them.

In this paper, we have examined whether participation in extra classes improves children's cognitive (mathematics and receptive vocabulary) test scores, using data from Rounds 2 and 3 of the Young Lives survey in Vietnam. By estimating standard value-added and value-added-plus models, we find that that participation in extra classes is generally not associated with higher cognitive test scores for either the Older or the Younger Cohort. However, a number of other factors (parental education, household wealth, ethnicity and gender) do influence children's test scores. These findings are robust to different estimation methods and model specifications.

These findings imply that: (i) the prevalence of extra classes in Vietnam is driven by factors which are largely independent of learning outcomes (the most important of which is teachers' desire to supplement their official earnings); and, (ii) if we focus on cognitive achievement only, extra classes are a wasteful expenditure. This does not, however, imply that extra classes are an unnecessary expenditure by parents or that the current regulations restricting the proliferation of extra classes should be enforced and extended. First, parents' primary motivation in enrolling their children in extra classes is to improve their examination results, which are influenced by many factors other than cognitive ability. Second, as Dang and Rodgers (2008) note in their cross-country survey of private tutoring, bans on private tutoring are difficult to enforce and have negative consequences for some children. Furthermore, as Bray (2009: 103–4) states, 'blanket bans [on private tutoring] have not succeeded anywhere, though prohibition of mainstream teachers providing additional private tutoring to their own pupils may be desirable'.[18] Bans on extra classes in Vietnam are likely to encounter similar difficulties in implementation. Other measures, such as raising teachers' salaries, extending full-day schooling, and limiting the number of hours that children can be enrolled in extra classes, may prove to be more effective ways of controlling the negative consequences of extra classes in the Vietnamese context.

18 See the appendix to Bray and Lykins (2012) for a country-by-country listing of, often unsuccessful, regulations on private tutoring in Asia.

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Appendix 1: Descriptive statistics for mathematics and vocabulary scores, Round 3

Table A1. *Descriptive statistics for test scores of Older and Younger Cohort children, Round 3*

	Number of obs.	Mean	Std.dev.	Min	Max
Older Cohort					
Maths raw score	728	19.8	6.8	1	30
PPVT raw score	719	172.3	23.3	45	200
Younger Cohort					
Maths raw score	1,897	19.4	5.8	1	29
PPVT raw score	1,807	94.5	28.2	20	187

Note: Table 1 (pxx) shows the number of observations with non-missing test scores and non-missing data on attending extra classes, whereas Table A1 only shows the non-missing test scores.

Appendix 2: A justification for selection of the instrumental variables

As noted in the main text, we intend to use a variable on commune unexplained effect λ_t as an instrumental variable, but it is unobserved, and we use a substitute for it. The unexplained effect is assumed to link to its substitute in the following presentation:

$$P_t = \mu_{0t} + \mu_{1t} z_1 + \mu_{2t} z_2 + \mu_{3t} z_3 + \lambda_t \quad \text{(A1)}$$

Equation (A1) is a repetition of equation (3) in the main text. Recall that P_t stands for rate of participation in Round *t*, while z_1, z_2 and z_3 are respectively the average years of mothers' schooling in the commune, the commune average asset index, and the time (in minutes) it takes to travel by motorcycle from the centre of the commune to the district capital. The results of OLS regressions are shown in Table A2.

Table A2. *Results of OLS regression of commune rate of participation in extra classes*

	Younger Cohort, Round 3	Older Cohort, Round 2	Older Cohort, Round 3
Commune average asset index	1.25***	1.18***	1.72***
	(6.81)	(7.48)	(13.50)
Commune average years of mothers' schooling	0.082***	0.097***	0.03***
	(18.4)	(19.65)	(8.38)
Time to district capital	−0.0002	−0.003***	−0.009***
(in minutes by motorcycle)	(−0.39)	(−5.82)	(−20.68)
Constant	−0.325***	−0.525***	0.093**
	(−5.04)	(−9.07)	(1.99)
Number of observations	*1,811*	*928*	*726*
F-Statistics	*293.1*	*481.9*	*498.0*
Adjusted R-squared	*0.33*	*0.61*	*0.67*

Note: t-statistics are in parentheses underneath the coefficients; * p<0.1, ** p<0.05, *** p<0.01.

It can be seen that all three variables on commune characteristics z_1, z_2 and z_3 are strong predictors of the commune rate of participation in extra classes for the Older Cohort. For the Younger Cohort, travel time to the district capital is not statistically significant and the overall fit is weaker but for the sake of consistency, we use the same three commune-level variables for both cohorts.

We can also prove that if z_1, z_2 and z_3 are included among the explanatory factors, the final estimates for the effect of the extra classes are exactly the same as the ones that were the results of applying the corresponding commune unexplained effects λ_t. For simplicity, we prove this claim for the value-added model using one instrumental variable only.

Recall that we want to estimate the following equation

$$s_{i3} = \alpha + \beta s_{i2} + \gamma x_{i3} + \sum_{k=1}^{K} \delta_k y_{ik2} + \sum_{l=1}^{L} \phi_l z_{il2} + \varepsilon_i$$

Now, we pay special attention to the three commune characteristics z_1, z_2 and z_3. For that purpose, we rewrite equation (1) in the main text in the following slightly different form, omitting the individual index, and reordering the set of variables on the commune and the geographical characteristics z_l to allow a more effective presentation

$$s_3 = \alpha + \beta s_2 + \gamma x_3 + \sum_{k=1}^{K} \delta_k y_{k2} + \sum_{l=4}^{L} \phi_l z_{l2} + \sum_{l=1}^{3} \phi_l z_{l2} + \varepsilon$$

If P_3 is applied as the excluded instrument, then by theory of 2SLS, at the result of OLS regression in the first stage, it determines the fitted values $\overline{x}_3$ that is the best suited to the (supposedly) endogenous variable x_3, and is in the following form

$$\overline{x}_3 = \delta_{03} + \delta_{13} s_2 + \sum_{k=1}^{K} \theta_k y_k + \sum_{l=4}^{L} \rho_{l3} z_l + \sum_{l=1}^{3} \rho_{l3} z_l + \sigma P_3 \quad \text{(A2)}$$

Let N be the number of observations in the sample under study. We interpret the columns as the instruments, which are s_2; $y_k, k = 1, K$; $z_l, l = 1, L$; the commune rate of participation in extra classes P_3 and the unexplained factors λ_3 as $N-$ vectors. Furthermore, let U be the $N \times (K + L + 3)$-matrix that consists of (i) the $N-$ vector for constant term; (ii) the $N-$ vector for s_2; (iii) K of the child and the household characteristics $y_k, k = 1, K$, the geographical characteristics $z_l, l = 4, L$, and three commune characteristics $z_l, l = 1,3$; and (iv) N-vector for commune unexplained effects λ_3. Furthermore, let V be another $N \times (K + L + 3)$-matrix formed by replacing last column in U (which is λ_3) by P_3. By definition, $V = U \times F$, where

$$F = \begin{pmatrix} 1 & 0 & \ldots \mu_{03} \\ 0 & 1 & \ldots 0 \\ 0 & 0 & \ldots \mu_{13} \\ 0 & 0 & \ldots \mu_{23} \\ 0 & 0 & \ldots \mu_{33} \\ 0 & 0 & \ldots 1 \end{pmatrix}$$

By definition, F is $(K + L + 3) \times (K + L + 3)$ matrix with all '1' in diagonal and zeros elsewhere, except the last column, which is in according to equation (A1) with $= 3$, for which, μ_{03} is the intercept, $\mu_{13}, \mu_{23},$ and μ_{33} are the coefficients for the three vectors on commune characteristics, and 1 is the coefficient for λ_3. It can be checked that the inverse matrix F^{-1} exists.

The fitted values from equation A2, which minimize total squared errors $(x_3 - \overline{x}_3)$, can be written as follows (see Greene 1997: 237):

$$\overline{x}_3 = V(V^T V)^{-1} V^T x_3 \quad \text{(A3)}$$

with V^T being the transpose matrix of matrix V, and subscript $^{-1}$ denoting inversed matrix. Replacing $V = UF$, (and therefore $V^T = F^T U^T$), we have

$$\overline{x}_3 = UF(F^T U^T UF)^{-1} F^T U^T x_3 \quad \text{(A4)}.$$

Now we apply repeatedly the Associate Law (Greene 1997: 11), and the formula for the inverse of matrix product (Greene 1997: 31), to transform the matrix in equation (A.2) into the following presentation[19]:

$$UF((F^T U^T U)F)^{-1} F^T U^T = U(FF^{-1})(F^T (U^T U))^{-1} F^T U^T =$$

$$U(U^T U)^{-1} (F^T)^{-1} F^T U^T = U(U^T U)^{-1} ((F^T)^{-1} F^T) U^T = U(U^T U)^{-1} U^T .$$

19 Recall Associate Law: ABC = A(BC), and the formula for the inversed matrix product: $(AB)^{-1} = B^{-1}A^{-1}$

Therefore,

$$\bar{x}_3 = U(U^T U)^{-1} U^T x_3 \quad \text{(A5)}.$$

Equation (A5) is the result of substitution of V in equation (A3) by U, and it implies that $\bar{x}_3$ can be interpreted as the fitted value of x_3, at the result of the first stage OLS regression that applies the columns in matrix U as the regressors. Equivalently, if λ_3 is substituted for P_3, it results in the same fitted values for the school input variable as the 2SLS regression.

For the second stage of the 2SLS regression, there is no longer a role for either λ_3 or P_3, as all the regressors, including $\bar{x}_3$, are the same, regardless of whether P_3 and λ_3 was used in the first stage regression. These arguments are valid for any round and can carry over to the value-added-plus model, in which the participation rate in extra classes in Round 2 is used to instrument schools' input in Round 2 while the participation rate in Round 3 is used to instrument the school variable in Round 3. That completes the proof.

Appendix 3: Ordered logit estimation of the impact of extra classes on self-reported class performance

Dang (2007) used the Vietnam Living Standards Survey data to estimate the impact of private tutoring on academic achievement. The academic performance variable in Dang's paper consisted of four self-reported school ranks: excellent, good, average and poor. In this appendix, we use similar data on class performance from the Young Lives survey, which is reported by the children's primary caregivers. Most caregivers are the children's mothers, who are informed about their children's performance in termly meetings with their schoolteachers. The class performance ranks of 'excellent', 'good', 'average' and 'poor' have been converted into 4, 3, 2, and 1, and are used as the dependent variable in an ordered logit model with the same co-variates as the value-added model.[20]

The results of the ordered logit estimation in Tables A3 and A4 show mixed results. For the Older Cohort children the figures in Table A3 demonstrate positive effects of the time used in extra classes. The statistically significantly positive marginal effects on the outcomes of 'good' and 'excellent' class performance may serve as an argument for parents to send their children to extra classes, and are consistent with the study by Dang (2007). The results in Table A3 also suggests that students who spend more hours in extra classes are less likely to be 'average' or 'poor' pupils, and also helps explain why parents are willing to pay for extra classes. However, while these effects are highly statistically significant they are not numerically large. Not at all significant are the marginal effects of the hours spent on extra classes on the class performance of the Younger Cohort children, as the figures in Table A4 indicate clearly. The implication from these estimates, however, should be interpreted with care, as it is hard to rule out the possibility of the school input being endogenous.

20 There was a fifth category, 'bad', but as very few caregivers reported that their children's school performance was 'bad', these have been combined with the 'poor' category.

Table A3. *Ordered logit estimations for marginal effect of factors on class performance, Older Cohort, Round 3*

	Poor/Bad	Average	Good	Excellent
Academic performance, R2	−0.0148***	−0.3881***	0.3941***	0.0088***
	(0.004)	(0.047)	(0.048)	(0.003)
Hours spent on extra classes, R3	−0.0007***	−0.0174***	0.0176***	0.0004***
	(0.0002)	(0.0047)	(0.0048)	(0.0001)
Male	0.0054**	0.137***	−0.1393***	−0.0031**
	(0.0025)	(0.0430)	(0.0439)	(0.0015)
Ethnic minority	0.004	0.0901	−0.0923	−0.0017
	(0.0070)	(0.1350)	(0.1397)	(0.0023)
Number of siblings	0.0007	0.0194	−0.0197	−0.0004
	(0.0009)	(0.0219)	(0.0222)	(0.0005)
Wealth Index, R2	−0.0093	−0.2458	0.2496	0.0056
	(0.0072)	(0.1689)	(0.1723)	(0.0039)
Max education of parents	−0.0006*	−0.0167*	0.0169*	0.0004
	(0.0003)	(0.0086)	(0.0087)	(0.0003)
Commune average years of mothers' schooling	−0.0001	−0.0017	0.0018	0
	(0.0007)	(0.0175)	(0.0178)	(0.0004)
Commune average asset index, R2	0.0317	0.8334	−0.8461	−0.0189
	(0.0379)	(0.9566)	(0.9722)	(0.0223)
Time to district capital (minutes by motorcycle)	−0.0001	−0.0028	0.0028	0.0001
	(0.0001)	(0.0026)	(0.0026)	(0.0001)
Mountains	−0.0015	−0.0417	0.0422	0.001
	(0.0033)	(0.0892)	(0.0902)	(0.0023)
Red River Delta	Omitted category			
Coast	−0.0047*	−0.148**	0.1478**	0.0048
	(0.0026)	(0.0716)	(0.0707)	(0.0036)
Southern deltas	−0.0058*	−0.1785**	0.1787**	0.0057
	(0.0032)	(0.0890)	(0.0880)	(0.0042)
Urban	0.0045	0.1053	−0.1077	−0.0021
	(0.0041)	(0.0853)	(0.0878)	(0.0016)

Note: Number of observations: 703, Wald Chi-squared (14): 346.32; Pseudo R-squared: 0.225
Standard errors in parentheses; * p<0.1, ** p<0.05, *** p<0.01.

Table A4. *Ordered logit estimations for marginal effect of factors on class performance, Younger Cohort, Round 3*

	Poor/Bad	Average	Good	Excellent
Hours spent on extra classes, R3	−0.0001	−0.001	0.001	0.0001
	(0.0003)	(0.0022)	(0.0023)	(0.0002)
Male	0.0167***	0.1412***	−0.147***	−0.0109***
	(0.0039)	(0.0217)	(0.0228)	(0.0034)
Ethnic minority	0.0251**	0.1659***	−0.1818***	−0.0093***
	(0.0110)	(0.0508)	(0.0594)	(0.0027)
Number of siblings	0.0051***	0.0436***	−0.0454***	−0.0032***
	(0.0015)	(0.0127)	(0.0131)	(0.0012)
Wealth Index, R2	−0.0302**	−0.2608**	0.2717**	0.0193**
	(0.0129)	(0.1082)	(0.1135)	(0.0083)
Max education of parents	−0.0034***	−0.0292***	0.0305***	0.0022***
	(0.0007)	(0.0048)	(0.0050)	(0.0006)
Commune average years of mothers' schooling	0	0.0002	−0.0002	0
	(0.0025)	(0.0216)	(0.0225)	(0.0016)
Commune average asset index, R2	0.004	0.0346	−0.036	−0.0026
	(0.1190)	(1.0258)	(1.0687)	(0.0762)
Time to district capital (minutes by motorcycle)	−0.0002	−0.0021	0.0021	0.0002
	(0.0002)	(0.0017)	(0.0017)	(0.0001)
Mountains	0.0062	0.051	−0.0536	−0.0035
	(0.0104)	(0.0803)	(0.0853)	(0.0055)
Red River Delta	Omitted category			
Coast	−0.0102	−0.0998	0.1002	0.0098
	(0.0096)	(0.1093)	(0.1054)	(0.0137)
Southern deltas	−0.012*	−0.115	0.1161	0.0109
	(0.0072)	(0.0775)	(0.0764)	(0.0085)
Urban	−0.0174***	−0.1739**	0.1716**	0.0197*
	(0.0063)	(0.0704)	(0.0667)	(0.0104)

Note: Number of observations: 1772, Wald Chi-squared (14): 259.53; Pseudo R-squared: 0.147
Standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01.

Appendix 4: First-stage regressions for main results

Table A5. *First-stage regression for value-added model*

	Older Cohort		Younger Cohort	
	Maths	**Vocabulary**	**Maths**	**Vocabulary**
Maths/CDQ, R2, normalised	1.234***		0.397**	
	(5.917)		(2.088)	
PPVT, R2, normalised		0.697**		0.325
		(2.308)		(1.545)
Male	−1.626***	−1.770***	0.018	−0.045
	(−5.231)	(−5.385)	(0.109)	(−0.226)
Ethnic minority	0.602	0.175	−0.547	−0.745
	(0.819)	(0.250)	(−0.624)	(−0.911)
Number of siblings	0.033	0.034	−0.186	−0.149
	(0.204)	(0.188)	(−1.570)	(−1.198)
Wealth Index, R2	1.631	1.396	1.510	1.880
	(0.834)	(0.694)	(1.122)	(1.348)
Max education of parents	0.181***	0.185***	0.111**	0.105*
	(3.640)	(3.189)	(2.002)	(1.817)
Commune average years of mothers' schooling	0.247	0.186	−0.021	−0.117
	(1.222)	(0.813)	(−0.052)	(−0.276)
Commune average asset index, R2	−15.924*	−14.339	−4.391	−8.820
	(−1.823)	(−1.541)	(−0.455)	(−0.930)
Time to district capital	0.060***	0.058**	0.020	0.015
(minutes by motorcycle)	(2.691)	(2.271)	(1.346)	(1.014)
Mountains	0.302	0.086	−1.317	−1.271
	(0.352)	(0.089)	(−0.828)	(−0.799)
Red River Delta	Omitted Category			
Coast	−3.086***	−2.678**	−1.714*	−1.716
	(−3.177)	(−2.545)	(−1.648)	(−1.607)
Southern deltas	−2.038***	−1.862**	−2.985***	−2.948***
	(−2.745)	(−2.237)	(−2.924)	(−2.900)
Urban	−0.454	−0.289	−1.591	−1.532
	(−0.552)	(−0.336)	(−1.239)	(−1.187)
Commune rate of participation in extra classes	12.402***	12.898***	8.899***	9.024***
	(8.023)	(6.955)	(6.213)	(6.160)
Number of observations	*699*	*665*	*1,718*	*1,497*
F-Statistic	*32.98*	*21.16*	*39.82*	*47.274*
R-squared	*0.385*	*0.360*	*0.398*	*0.389*

Notes: t-statistics in parentheses; * p<0.1, ** p<0.05, *** p<0.01.

Table A6. *First-stage regressions for value-added-plus model*

	School input R2		School input R3	
	Maths	**Vocabulary (PPVT)**	**Maths**	**Vocabulary (PPVT)**
Maths score, R2, normalised	0.220		1.231***	
	(0.857)		(6.006)	
PPVT, R2, normalised		0.438**		0.715**
		(2.094)		(2.413)
Male	−0.123	−0.061	−1.609***	−1.746***
	(−0.409)	(−0.192)	(−5.091)	(−5.159)
Ethnic minority	0.454	0.267	0.503	0.080
	(0.675)	(0.376)	(0.669)	(0.109)
Number of siblings	−0.506***	−0.504***	0.029	0.036
	(−5.246)	(−4.851)	(0.186)	(0.203)
Wealth Index, R2	3.906***	3.774***	1.640	1.392
	(3.006)	(3.054)	(0.851)	(0.700)
Max education of parents	0.169***	0.142***	0.180***	0.183***
	(3.449)	(2.980)	(3.610)	(3.123)
Commune average years of mothers' schooling	−0.461***	−0.520***	0.188	0.105
	(−4.373)	(−4.893)	(0.862)	(0.413)
Commune average asset index, R2	6.531	7.789	−18.361**	−17.749*
	(1.090)	(1.401)	(−2.120)	(−1.826)
Time to district capital	−0.009	−0.011	0.059***	0.058**
(minutes by motorcycle)	(−0.602)	(−0.666)	(2.611)	(2.270)
Mountains	−0.328	−0.444	0.587	0.431
	(−0.410)	(−0.544)	(0.634)	(0.431)
Red River Delta	Omitted category			
Coast	−0.343	−0.466	−2.987***	−2.584**
	(−0.739)	(−0.928)	(−3.082)	(−2.512)
Southern deltas	0.258	0.311	−2.204***	−2.105***
	(0.568)	(0.569)	(−3.328)	(−2.725)
Urban	1.159*	1.176*	−0.795	−0.749
	(1.864)	(1.946)	(−1.016)	(−0.857)
Commune rate of participation in extra classes, R3	0.807	0.895	11.662***	11.954***
	(0.668)	(0.678)	(5.821)	(5.118)
Commune rate of participation in extra classes, R2	5.668***	5.774***	1.316	1.713
	(5.370)	(5.436)	(0.724)	(0.786)
Number of observations	*699*	*665*	*699*	*665*
F-Statistic	*63.24*	*54.83*	*42.03*	*38.20*
R-squared	*0.338*	*0.342*	*0.386*	*0.362*

Notes: t-statistics in parentheses; * p<0.1, ** p<0.05, *** P<0.01.

Appendix 5: Value-added model with dummies for extra class attendance

Table A7. *Value-added model on cognitive achievement, Older Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Attends extra classes, R3	0.045	−0.001	0.028	0.070
	(0.078)	(0.323)	(0.083)	(0.267)
Maths score, R2, normalised	0.499***	0.500***		
	(0.060)	(0.058)		
PPVT, R2, normalised			0.351***	0.352***
			(0.046)	(0.045)
Male	−0.177***	−0.181**	−0.002	0.001
	(0.061)	(0.071)	(0.059)	(0.059)
Ethnic minority	0.021	0.019	−0.525***	−0.523***
	(0.171)	(0.167)	(0.137)	(0.137)
Number of siblings	−0.069***	−0.070***	−0.003	−0.002
	(0.022)	(0.023)	(0.032)	(0.032)
Wealth Index, R2	0.198	0.216	0.832**	0.815**
	(0.266)	(0.288)	(0.336)	(0.333)
Max education of parents	0.034***	0.034***	−0.000	−0.001
	(0.009)	(0.009)	(0.009)	(0.010)
Commune average years of mothers' schooling	0.025	0.024	−0.023	−0.022
	(0.040)	(0.040)	(0.043)	(0.043)
Commune average asset index, R2	1.638	1.719	0.902	0.832
	(1.490)	(1.490)	(1.531)	(1.636)
Time to district capital	0.003	0.002	−0.000	−0.000
(minutes by motorcycle)	(0.003)	(0.003)	(0.004)	(0.004)
Mountains	0.014	0.004	0.029	0.038
	(0.143)	(0.165)	(0.187)	(0.202)
Red River Delta	Omitted category			
Coast	0.242	0.236	0.137	0.142
	(0.164)	(0.170)	(0.177)	(0.178)
Southern deltas	0.198	0.191	−0.280**	−0.272**
	(0.201)	(0.215)	(0.138)	(0.124)
Urban	0.285	0.282	0.109	0.112
	(0.264)	(0.255)	(0.253)	(0.243)
Number of observations	*703*	*703*	*669*	*669*
R-squared	*0.335*	*0.335*	*0.324*	*0.324*
Under-identification (p-value)		*0.012*		*0.011*
Kleibergen-PaapF		*966.12*		*491.76*

Notes: Standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 16.38, 15% maximal IV size 8.96, 20% maximal IV size 6.66.

Table A8. *Value-added model on cognitive achievement, Younger Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Attends extra classes, R3	0.011	−0.011	0.038	0.051
	(0.070)	(0.211)	(0.061)	(0.243)
CDQ, R2, normalised	0.199***	0.199***		
	(0.041)	(0.040)		
PPVT, R2, normalised			0.281***	0.281***
			(0.028)	(0.029)
Male	−0.020	−0.020	0.031	0.031
	(0.037)	(0.036)	(0.033)	(0.033)
Ethnic minority	−0.421***	−0.419***	−0.246*	−0.247*
	(0.160)	(0.153)	(0.127)	(0.128)
Number of siblings	−0.008	−0.009	−0.048***	−0.047**
	(0.025)	(0.024)	(0.018)	(0.019)
Wealth Index, R2	1.003***	1.004***	0.549**	0.548**
	(0.228)	(0.223)	(0.226)	(0.226)
Max education of parents	0.036***	0.036***	0.040***	0.040***
	(0.007)	(0.007)	(0.007)	(0.006)
Commune average years of mothers' schooling	0.019	0.022	0.076*	0.074
	(0.039)	(0.044)	(0.043)	(0.065)
Commune average asset index, R2	8.460***	8.408***	3.117	3.146
	(2.712)	(2.657)	(2.376)	(2.328)
Time to district capital	−0.005	−0.005	−0.002	−0.002
(minutes by motorcycle)	(0.003)	(0.003)	(0.003)	(0.003)
Mountains	−0.004	−0.000	0.052	0.049
	(0.237)	(0.236)	(0.176)	(0.188)
Red River Delta	Omitted Category			
Coast	0.545**	0.541**	−0.102	−0.100
	(0.242)	(0.240)	(0.171)	(0.161)
Southern Deltas	0.430***	0.420**	−0.023	−0.018
	(0.134)	(0.168)	(0.067)	(0.110)
Urban	0.313*	0.301	−0.318**	−0.311**
	(0.160)	(0.187)	(0.146)	(0.135)
Number of observations	*1,723*	*1,723*	*1,501*	*1,501*
R-squared	*0.319*	*0.319*	*0.343*	*0.343*
Under-identification (p-value)		*0.002*		*0.002*
Kleibergen-Paap F		*2994.6*		*3376.1*

Notes: standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 16.38, 15% maximal IV size 8.96, 20% maximal IV size 6.66.

Table A9. *Value-added-plus model with dummy for extra class attendance, Older Cohort*

	Mathematics		Vocabulary (PPVT)	
	OLS	2SLS	OLS	2SLS
Attends extra classes, R3	0.020	−0.082	0.015	−0.125
	(0.082)	(0.385)	(0.086)	(0.363)
Attends extra classes, R2	0.188**	0.132	0.090	0.323
	(0.088)	(0.411)	(0.085)	(0.385)
Math score, R2, normalised	0.500***	0.502***		
	(0.061)	(0.058)		
PPVT, R2, normalised			0.353***	0.356***
			(0.047)	(0.048)
Male	−0.181***	−0.189**	−0.003	−0.016
	(0.061)	(0.074)	(0.058)	(0.068)
Ethnic minority	0.009	0.009	−0.526***	−0.532***
	(0.165)	(0.161)	(0.135)	(0.130)
Number of siblings	−0.061**	−0.065**	0.001	0.008
	(0.024)	(0.026)	(0.031)	(0.033)
Wealth Index, R2	0.095	0.166	0.786**	0.705**
	(0.262)	(0.288)	(0.330)	(0.324)
Max education of parents	0.031***	0.033***	−0.001	−0.002
	(0.009)	(0.011)	(0.009)	(0.010)
Commune average years of mothers' schooling	0.020	0.020	−0.025	−0.031
	(0.041)	(0.039)	(0.044)	(0.046)
Commune average asset index, R2	1.184	1.519	0.638	0.155
	(1.515)	(1.594)	(1.606)	(1.989)
Time to district capital (mins by motorcycle)	0.003	0.002	−0.000	−0.000
	(0.003)	(0.003)	(0.004)	(0.005)
Mountains	0.076	0.035	0.055	0.100
	(0.158)	(0.198)	(0.198)	(0.234)
Red River Delta	Omitted category			
Coasts	0.289	0.265	0.149	0.176
	(0.177)	(0.194)	(0.181)	(0.190)
Southern deltas	0.197	0.181	−0.284**	−0.314***
	(0.213)	(0.218)	(0.138)	(0.118)
Urban	0.256	0.258	0.092	0.040
	(0.256)	(0.262)	(0.249)	(0.243)
Number of observations	*702*	*702*	*668*	*668*
R-squared	*0.342*	*0.339*	*0.326*	*0.311*
Under-identification (p-value)		*0.000*		*0.000*
Kleibergen-Paap F		*80.495*		*55.824*

Notes: standard errors in parentheses; * p<0.1, ** p<0.05, *** P<0.01. Critical values for the Stock-Yogo weak identification test statistics are: 10% maximal IV size 7.03; 15% maximal IV size 4.58; and 20% maximal IV size 3.95

Do Extra Classes Improve Cognitive Test Scores? Evidence from Vietnam

This paper examines whether participation in extra classes improves children's cognitive test scores, using data from the second and third rounds of the Young Lives survey in Vietnam. Using a standard value-added model, the authors find that that the number of hours pupils spend in extra classes is not associated with better cognitive (mathematics and vocabulary) test scores. However, a number of other factors (parental schooling, household wealth, ethnicity and gender) do influence children's test scores. These results are robust to different estimation methods and model specifications. The findings suggest that the large amounts that the parents of Young Lives children spend on extra classes cannot be justified from a cognitive standpoint.

Young Lives
An International Study of Childhood Poverty

About Young Lives

Young Lives is an international study of childhood poverty, involving 12,000 children in 4 countries over 15 years. It is led by a team in the Department of International Development at the University of Oxford in association with research and policy partners in the 4 study countries: Ethiopia, India, Peru and Vietnam.

Through researching different aspects of children's lives, we seek to improve policies and programmes for children.

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Young Lives is coordinated by a small team based at the University of Oxford, led by Professor Jo Boyden.

- *Ethiopian Development Research Institute, Ethiopia*
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- *General Statistics Office, Vietnam*
- *Child and Youth Studies Group (CREET), The Open University, UK*
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