THE EFFICIENCY OF PRIVATE AND PUBLIC SCHOOLS IN URBAN AND RURAL AREAS: MOVING BEYOND THE DEVELOPMENT GOALS

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ABSTRACT

Data from the Young Lives study are used to evaluate the efficiency of education systems in four low and middle income countries: Ethiopia, India, Peru and Vietnam. A meta-frontier variant of data envelopment analysis is used to assess the relative performance of each country's system, and, within each country, to evaluate the impact of public and private schooling, and of urban and rural location. Comparisons are drawn between the four countries; the results indicate that in no country does the educational system perform uniformly badly or well. Conditioning on the inputs available, rural areas are often indicative of higher levels of efficiency, thus suggesting a number of implications for policy.

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1. Introduction

Investment in human capital is widely regarded as a prerequisite for economic development (Hanushek and Woessmann, 2008, 2011; Glewwe et al., 2013), and in turn the education sector is vital for human capital growth. This being the case, the development goals set by international organisations have frequently included targets in the sphere of education (Sachs, 2012). The United Nations' Sustainable Development Goals[1] (SDG), which came into effect in 2016, include – as SDG4 – the provision of education, covering both access to and learning outcomes for all children. Years of education are often used as a measure of schooling, but this masks important differences in the quality of human capital (Singh, 2015). Hence a natural question arises as to whether the education sector in a country is operating efficiently or not – whether output is maximised, and whether inputs are used effectively. Moreover it is important to understand the factors that result in variations across countries. Monitoring, and hence promoting, the efficiency with which education systems map inputs onto outputs can thus further economic development and alleviate poverty, not least in countries where, starting from a low base, the economic returns to education are high (Montenegro and Patrinos, 2014).

The provision of education in developing countries has been the subject of much research (see, for example, Glewwe et al., 2013; Glewwe and Muralidharan, 2015). Many of these countries have made significant progress towards universal access; for instance, in India the 2009 Right to Education Act protects the right of children to free and compulsory education. Access to high quality provision remains an issue however, and recent success in widening access may exert a downward pressure on learning outcomes as relatively large number of pupils from disadvantaged groups enter the education system. Rolleston et al. (2013) have examined four countries – Ethiopia, India, Peru and Vietnam – that are participating in the Young Lives study, and they conclude that the challenge of providing basic educational access to all is particularly severe in Ethiopia due to low levels of resource and high population growth. The other three nations struggle primarily with the challenge of raising learning levels or improving the distribution of quality schooling (Rolleston et al., 2013). But the evaluation of efficiency in this context has been limited, in marked contrast to the plethora of studies in developed economies. This paper aims to fill that gap by analysing the efficiency with which education is delivered within these four countries - Ethiopia, India, Peru and Vietnam.

To preview our findings, in no country does the educational system perform uniformly badly or well. Interestingly however, rural areas in many cases perform with greater efficiency than urban areas, converting low levels of input into output; this is particularly so when measures of affluence are included in the model as inputs. Further, efficiencies associated with the older cohort of pupils (aged around 15) are, for the most part, higher than those associated with the younger cohort (aged around 8). These results contribute to the literature on the role played by education in explaining regional differentials in growth, earnings, and wage inequality in developing economies (Hanushek and Kimko, 2000; Hanushek and Woessmann, 2008, 2011, 2012; Hanushek et al., 2011), and relate also to the cross-country growth literature about the sources of differences in worker productivity (Hall and Jones, 1999; Singh, 2014).

The paper has 7 sections of which this is the first. In section 2 we provide a review of the literature on efficiency in education in developing economies. We then, in section 3, discuss the methodology employed, followed by a description of data used in the present exercise in section 4. We present the results of the analysis in section 5, and discuss robustness tests in section 6. Conclusion and policy implications are drawn in section 7.

[1] http://www.undp.org/content/undp/en/home/sustainable-development-goals.html

2. Literature

Lockheed and Hanushek (1988) provide an early assessment of the state of knowledge on efficiency in education in developing economies. They take a ratio approach in comparing inputs to outputs, where output is measured as the standardised value of the effect of an intervention on pupil performance, and input is the cost of intervention. While useful as an evaluation technique, this approach does not take advantage of the richness offered by the multiple input and multiple output approach of data envelopment analysis (DEA).

A fairly small number of studies (including, for example, Gupta and Verhofen, 2001; Jarasuriya and Woodon, 2002; Herrera and Pang, 2006) use nonparametric methods such as DEA or the free disposal hull (FDH) to evaluate the efficiency of countries' education systems. These typically use data at national level, so that inputs include aggregate spending on education, while outputs include measures of educational attainment such as secondary school enrolment. Castano and Cabanda (2007a) use both an output-oriented DEA-Malmquist index and a DEA multi-stage model in evaluating the efficiency of state universities and colleges in the Philippines. They use input variables such as number of faculty members, property, plant and equipment, and operating expenses; their outputs include students enrolled, graduates, and total revenue. They argue that the main source of productivity growth is technical efficiency rather than technological. A second study by Castano and Cabanda (2007b) considers the relationship between technical inefficiency and age, ownership and autonomy status. In contrast to their findings for state universities, the authors find that improvements in technological progress were largely responsible for boosting productivity growth.

Some studies undertake a second stage analysis to identify the main determinants of efficiency scores. Mousa and Ghulam (2019) show that having university status and obtaining more than 20 years of experience has a positive impact on efficiency scores of educational institutions in Saudi Arabia during the 2008-14 academic years. Other factors that positively affect efficiency are lower secondary completion rates and the percentage of female students in secondary general education. Hashmi and Bradley (2018) use a second stage Tobit regression to show that teacher training and experience has a negative relation with the efficiency scores. They also suggest that socioeconomic variables such as father's education, age of student, health, and school size are important drivers of efficiency. The study uses LEAPS data (2003-05) for the Pakistani primary education system[2], and this includes both private and public sector. Liouaeddine et al. (2011) construct efficiency scores for primary education schools in Morocco using the TIMSS database[3], and further conduct an ordered probit model to confirm that socio-economic environment of a student has a significant impact on efficiency.

The use of non-parametric measures has thus allowed analysis to be applied to a large variety of countries, including developing economies. Inevitably, however, in many studies, information about the determinants of academic performance is lost owing to the absence of data about individual students. This makes the advent of data such as Young Lives particularly noteworthy, since it offers the availability of detailed microdata, focused on children's background, living conditions, education and transition to work in a selection of four developing countries. Most work on these data has used statistical (rather than nonparametric) methods. Much has focused on the impact of child labour on educational attainment (Mavrokonstantis, 2011; Woldehanna and Gebremedhin, 2015); these find that, at least in urban areas and using causal methods of analysis, child labour has a detrimental impact on student performance. Other work finds a strong relationship between nutrition, physical

[2] Learning and Educational Achievement in Punjab Schools data, available from http://microdata.worldbank.org/index.php/catalog/440/study-description.
[3] Trends in International Mathematics and Science Study data, available from https://timss.bc.edu/timss2015/international-database/.

development and educational development (Krause, 2012; Crookston et al., 2013; Fink and Rockers, 2014). To the best of our knowledge, however, the present study is the first to use the Young Lives data specifically to examine the question of efficiency in the context of education.

3. Methodological Approach

We evaluate efficiency using methods drawn from the literature on DEA. This technique was developed by Charnes et al. (1978) following earlier work by Farrell (1957), and uses linear programming to identify, separately for each decision-making unit in the data, a frontier against which can be evaluated the efficiency with which the unit maps inputs onto outputs. An important subsequent refinement, due to Banker et al. (1984) extends the constant returns to scale approach taken in this early work by allowing returns to scale to be variable.

Specifically in the present context, we use the DEA approach of meta-frontiers pioneered by Charnes et al. (1981), Portela and Thanassoulis (2001) and Rao et al. (2003) and subsequently applied in the context of education by Johnes (2006), Waldo (2007), De Witte et al. (2010), Thieme et al. (2013) and Johnes (2018).[4] This approach involves assessing the efficiency with which each pupil converts inputs (characteristics) into outputs (educational performance) relative, first, to the frontier within their own country, and secondly to the frontier across countries. Thus it is possible to evaluate the efficiency of the system of education in each country. Using an analogous approach, we then drill down to evaluate the relative efficiency of urban and rural schools within each country, and (for most countries) the relative efficiency of public and private schools (for both the younger and older age cohorts in our data).

The basic method of DEA can be illustrated simply. Figure 1 is a scatterplot in input:output space where each observation, denoted X, represents a decision-making unit. A piecewise linear efficient frontier (ABCDE) can be drawn through the set of efficient observations. Note that D is a virtual observation formed as a linear combination of C and E. The efficiency of a decision-making unit that lies below the frontier can then be evaluated as OM/OD; given the level of input, it is known that a linear combination of C and E, given by D, can produce more output than is produced by decision-making unit M, so this latter decision-making unit is inefficient.

Using linear programming methods, the basic insights underpinning this graphical analysis can be extended to a situation in which there are multiple inputs, i=1,…,m, and multiple outputs, r=1,…,s, produced by decision making units j=1,…,n. For the kth decision-making unit, the efficiency score obtained from the model of Banker et al. (1984) – henceforth referred to as BCC – is given by

$$\max \phi_k \text{ s.t. } \phi_k y_{rk} \leq \Sigma_j \lambda_j y_{rj}, \ \forall r; \ x_{ik} \geq \Sigma_j \lambda_j x_{ij}, \ \forall I; \ \Sigma_j \lambda_j = 1; \ \lambda_j \geq 0, \ \forall j \qquad (1)$$

To extend this analysis to the case where a meta-frontier approach is used to compare efficiency across different regimes, consider Figure 2. Here the decision-making units are drawn from two regimes, X and Y – these might represent two different countries, or they might represent the public and private sectors operating within a single country. For each regime, an efficiency frontier can be defined – as before, for those in regime X this is given by ABCDE, while for those decision-making units in regime Y the frontier is given by FGHJK. The overall efficiency frontier, meanwhile, across all regimes, is defined by ABCHJK. A score can then be obtained for an inefficient decision-making unit – a unit within system score. For decision-making unit M, as before, this is OM/OD. This shows how

[4]Other applications of DEA in the context of education, but not using the meta-frontier approach, include Athanassopoulos and Shale (1997), Bradley et al. (2001), Agasisti and Johnes (2009), Thanassoulis et al. (2011), Johnes and Ruggiero (2017), Johnes and Tone (2017) and Johnes (2017). A survey of applications of DEA in education is provided by Thanassoulis et al. (2016).

efficient the unit is relative to the most efficient units in the relevant regime. Moreover, a regime-within-all-regimes score can be defined, showing how efficient a given system is relative to the most efficient available system. For decision-making unit M, this is OD/OJ, and the fact that this is less than one indicates that (from the perspective of this decision-making unit) regime X is less efficient than regime Y. In the sequel, I treat individual pupils as decision-making units, and the regimes are defined initially at country level, and subsequently by ownership of school or by location.

4. Data

The data used in the present exercise come from the Young Lives study[5]. This major study is led by researchers at the Department of International Development at the University of Oxford and funded by the UK government's Department for International Development (DfID). It focuses on the Millennium Development Goals established at the Millennium Summit of the United Nations[6]; amongst these goals was the ambition to provide universal primary education. The Young Lives study gathers micro data to evaluate progress and gain insight specifically in four countries – Ethiopia, India[7], Peru and Vietnam. Figure 3 gives a brief description of how educational systems are designed in these four countries, in terms of compulsory education levels. Four sweeps of the study have been collected, providing longitudinal information about a sample of children in each country. These sweeps were undertaken in or around late 2002, late 2006, late 2009 and early 2014; and include two cohorts – the older cohort born around 1994 and the younger cohort born around 2001. An important feature of the survey data is that they do not suffer from selection bias resulting from non-enrolment or non-attendance, because the data were gathered by home visits for a random sample of children in a given cohort (Singh, 2014).

In each sweep, data are gathered about the child's education, family background, and living conditions. These include economic variables, details about the number of hours that the child spends studying both in class and in private study, highest grade achieved, age, and so on. There are also data concerning location – whether urban or rural, and the distance that the child needs to travel to attend school. The economic variables include data on average monthly household expenditure (which we use alongside information about household size to derive a per capita measure) and a wealth index. The latter index is constructed as an average value of three separate indices – representing housing quality (persons per room, adequacy of building materials), access to services (availability of electricity, water, sanitation, cooking fuel), and consumer durables (the proportion of different types of durables – such as radio, TV, phone - owned).[8] Each of the three indices, and hence also the overall wealth index, is constructed so that the measure lies in the unit interval, with a score of unity denoting maximum wealth.

The analysis that follows focuses specifically on the third sweep (2009), as this includes data on the child's performance in a standard test of vocabulary[9], administered as part of the survey, which serves as the (sole) output measure. In each country, at the time of the third sweep of the data, children are aged about 8 years (born in 2001) and about 15 years (born in 1994). After deleting a (very) small

[5] Further information about Young Lives is at https://www.younglives.org.uk/. The data may be downloaded from http://bit.ly/2IbSBZC, and the role of the depositors and archive are gratefully acknowledged.

[6] More recently it focuses on the Sustainable Development Goals (SDGs) that came into effect in 2016. These goals include provisions around education, such as SDG 4, and are related to both access and learning outcomes for all children.

[7] In the state of Andhra Pradesh.

[8] Further information is provided by Azubuike and Briones (2016). The available data do not allow us to analyse how efficiency is affected separately by each component of the wealth index.

[9] http://bit.ly/2H97UkG

number of observations on which there is incomplete data, this yields a sample of some 9205 observations.

Descriptive statistics are reported in Table 1a. Table 1b provides information split by rural and urban residence and Table 1c provides a similar split by school type. Note the existence in Ethiopia of a third category of school, and note also that lack of data precludes reporting on the public and private split in Vietnam. Over the whole data set, the wealth index has a mean of around 0.5. There are minor variations in the definition of the wealth index across countries; but, for example, in Ethiopia, an index of 0.5 might indicate occupancy of one person per bedroom, where the material of the walls of the home is satisfactory but that of the floor and roof is not, where the residents have access to a toilet and to adequate cooking fuel, but no electricity and no safe drinking water, and where the only household durables are a table and chairs, bed, sofa, radio, and bicycle. A wealth score of (or close to) 1 would imply lower rate of occupancy, satisfactory construction throughout, access to all the amenities, and ownership of an automobile and television[10]. Within each country, as expected, the wealth index for the average respondent in urban areas is higher than the corresponding average for rural areas.

The mean age of pupils covered by the survey at the third sweep is around 10, though there is a fairly wide dispersion, owing to the strategy of sampling two distinct age cohorts. On average, they have completed third grade (though again there is a lot of variation around this). Most study is undertaken in class, typically around 6 hours per day, with a further 2 hours devoted to study outside class. There is marked variation across countries in these averages. A minority of pupils are located in urban areas and a minority attend private schools, but in each case these minorities are quite large. Monthly household expenditure per capita amounts to an average of around $40, but there is considerable variation in this measure, reflecting in part the very different levels of development of the four countries under consideration. Per capita GDP in Ethiopia, India, Peru and Vietnam amounted, in 2016, to US$ 511, 1862, 6089 and 1735 respectively (at 2010 prices).

5. Analysis

The input variables used in the analysis are: the wealth index; household expenditure per capita (measured in US$ per month); daily hours spent in class; daily hours spent in private study; highest grade completed; and pupil age (in months). As mentioned in the previous section, child's performance in a standard test of vocabulary serves as the (sole) output measure. The BCC (variable returns to scale) variant of the DEA model is used with output orientation. The analyses reported in the sequel have been obtained using MaxDEA software.

The top row of Table 2a shows the mean efficiency score attached to pupils when a separate DEA is conducted within each of the four countries. These averages are markedly higher in the case of Peru and Vietnam than they are for Ethiopia and India.[11] Note, however, that within each country the pupils

[10] https://www.younglives.org.uk/sites/www.younglives.org.uk/files/YL-TN43_0.pdf includes information about the construction of the wealth index. Unfortunately, the available data do not allow separation of the wealth index into its constituent components.

[11] A series of Kolmogorov-Smirnov (KS) tests confirms that, at significance levels better than 0.1%, the country-specific efficiencies are drawn from different distributions. The values of the KS statistics are as follows:

	India	**Peru**	**Vietnam**
Ethiopia	0.096	0.392	0.379
India		0.386	0.394
Peru			0.122

that most efficiently convert inputs into output have a score of unity, and that other pupils in the same country are measured relative to these country-specific exemplars; this implies that the mapping from inputs to output is characterised by more dispersion in Ethiopia and India than in the other countries.[12]

The second row in Table 2a reports the average value across all pupils within each country of the ratio of efficiencies obtained when running a single DEA across all countries to the efficiencies resulting from the country-specific DEA. A value of unity for this statistic would indicate that the pupils within a given country all lie on the frontier for all countries, suggesting that, in comparison with the other countries, that country has an education system that is efficient for all pupils. In other words, a value of unity for this statistic would indicate that the frontier for that country lies everywhere above the frontier for other countries, suggesting that, in comparison with the other countries, that country has an education system that is unambiguously efficient. It is readily observed that this statistic is below one for all four countries, indicating that no one country clearly dominates the others. The figure of 0.9921 for Ethiopia is high, however, suggesting relatively good performance of the system in that country. To contextualise this, however, note that Ethiopia is by some distance the least developed of the four countries. The wealth index in Ethiopia averages just 0.329 (compared with well over 0.5 in each other three countries), and so the educational outcomes realised in this country are being achieved with relatively low inputs. Meanwhile the relatively low value obtained for Peru suggests that there might be institutional barriers affecting performance of the education system in that country.[13]

Tables 2b and 2c disaggregate the efficiencies for the younger (born around 2001) and older (born around 1994) age groups respectively. The pupil-within-country scores are higher for the older age group in all countries. With the exception of Ethiopia, the country-within-all-countries efficiency scores are also higher for the older age group. This is especially the case for India, and suggests, particularly for that country, that the secondary education system in that country is particularly efficient.

Table 3 concerns the relative efficiency, within each country separately, of the education system in urban and rural areas, and of private and public schools.[14] Taking the results as a whole, rural schools convert their inputs into outputs more efficiently (with the exception of the case of older students in Peru). The relatively high efficiency of rural schools likely follows from the higher level of inputs due to greater affluence in the urban areas.[15] It also implies that mere access to inputs is not a sufficient condition to enhancing the quality and efficiency of schooling. Evidence on the relative efficiency of public and private schools suggests that public schools convert inputs into outputs more efficiently than do private schools (with the exception of the case of older students in Ethiopia). The values of inputs tend to be higher for pupils attending private schools, and this puts downward pressure on the efficiency score – without necessarily implying low values of the output measure.

Analogous tests confirm that the underlying distributions of efficiencies for which summary statistics are reported elsewhere in the tables of results are likewise distinct at challenging levels of significance. Our choice of the KS test in preference to alternatives such as that of Li (1996) was dictated by software availability.

[12] In no country do the efficient observations appear to be outliers.

[13] Notably a World Bank (2007) report identifies gaps in management capacity as an obstacle to success of the education system in Peru.

[14] We could not report the disaggregation between younger and older cohorts for Ethiopia, for rural and urban schools, because of too few observations. Likewise lack of data precludes reporting results for private and public schools in Vietnam.

[15] In Ethiopia, the mean value of the output variable is 109.9 in urban areas and 61.4 in rural areas. The corresponding figures in: India are 91.8 and 80.0; Peru are 74.0 and 53.4; and Vietnam are 131.6 and 115.1. These figures are unadjusted for age or any other controls. The higher levels of efficiency observed in the rural areas thus reflect lower values of the inputs.

6. Robustness checks

A common concern raised about DEA exercises is that not all variables used as inputs or outputs are under the control of the decision-making unit. In the present context, socio-economic variables such as wealth and household expenditure are included as inputs into the production process. These cannot, however, be changed at the discretion of educational institutions, and they may more properly be described as contextual variables. In this section, we repeat the analysis of section 5, but this time remove the wealth index and the household expenditure per capita measure from the set of inputs, and in so doing we are able to evaluate whether the separability condition (identified by Simar and Wilson, 2007 and by Daraio et al., 2017) holds.[16] This has the further advantage of allowing us to test the robustness of the efficiencies to the exclusion of the wealth variable – which, as noted above, is measured somehat differently across the countries in the study. As we shall see, the results are qualitatively similar regardless of whether the wealth and household expenditure variables appear in the set of inputs.

Following Haug and Blackburn (2017), we note that, for the sample that pools all four countries, some 116 of the 9205 observations have efficiency scores of unity in the full model, but only 29 are deemed efficient in the model that excludes the wealth index and per capita household expenditure; moreover only a little over a half (60) of the 116 have efficiency scores over 0.9 in the more restricted model. This suggests that separability is potentially an issue, and that – even, as here, where a second stage is not modelled - the robustness of the results obtained earlier to a change in the specification of the model to exclude the contextual variables should be interrogated further.

Results analogous to those reported in Table 2 are, for the model excluding the wealth index and per capita household expenditure, reported in Table 4. As before, taking all age groups together, Table 4a shows that the average value of pupil within country efficiencies is lower in Ethipoia and India than in Peru and Vietnam; as expected (since there are fewer inputs in this specification) the average efficiencies are somewhat lower than those reported in Table 2a, but not hugely so. Turning to the country within all country results, the broad pattern is again similar to that observed in Table 2a, with Vietnam and (especially) Ethiopia having high average scores, and Peru having a relatively low score. It appears, therefore, that the wealth index and the household expenditure per capita variable (included as inputs in the calculation of Table 2a, but not in the calculation of Table 4) are not critical in determining the qualitative nature of our results. In this respect the results are robust to their exclusion from the model.

Separating out the results for the two age groups in the data, efficiency statistics that correspond with those in Tables 2b and 2c appear in Tables 4b and 4c. Once again, the effect of omitting the wealth index and per capita household expenditure is fairly modest. The low average pupil within country score obtained for the younger age group in India is again the most striking result.

Table 5 reports results analogous to those of Table 3a, this time omitting from the set of inputs both the wealth index and household expenditure per capita. The most striking feature of this table is that the finding, in Table 3a, that public sector schools are more efficient than those in the private sector is reversed. In the earlier finding, the apparent efficiency of public sector schools relative to those in the private sector was clearly boosted by the inclusion, as inputs, of measures of affluence that are

[16] We do this following the procedure advocated by Haug and Blackburn (2017) – essentially evaluating whether the deletion of the contextual variables from the DEA has a substantive effect on the set of decision-making units that lie on the efficiency frontier. Daraio et al. (2017) propose a more formal test of separability for which software remains unavailable at the time of writing.

typically lower for pupils attending state-funded schools. Meanwhile, once these affluence measures are excluded from the model, no clear pattern emerges between urban and rural areas – in two countries, urban schools now appear more efficient, while in the other countries rural schools are more efficient.

To sum up the robustness checks, findings about the relative efficiency of public and private sector schools and of urban and rural schools are sensitive to the inclusion or exclusion of affluence variables in the model; we regard this as unsurprising. However the broad patterns of pupil within country efficiencies and country within all country efficiencies are reasonably robust with respect to model specification.

7. Conclusions

The results obtained above are highly nuanced and suggest that in no country does the educational system perform uniformly badly or well. Arguably the most striking finding is that of the long tails (low pupil within country efficiency scores) apparent in Ethiopia and India, suggesting that in both countries there is scope to learn from good practice. While *outcomes* are typically better in urban than in rural areas, this is not necessarily indicative of higher levels of *efficiency* – conditioning on inputs, pupils in rural areas often perform relatively well.

A number of policy implications suggest themselves. First and foremost, there is a need to prioritise the achievement of learning outcomes rather than merely enrolment and grade completion; policy measures should be aimed at narrowing learning gaps. Secondly there may be lessons that policy makers can learn from the differences that we observe between efficiency scores obtained in rural and urban areas, or public and private schools; this might plausibly allow less efficient providers to learn from good practice, and might also encourage the authorities to examine and address the role played by differential allocation of resources.

The overriding message conveyed by the findings reported in this paper is that the contrast between simple output measures (as reported in footnote 15) and efficiency scores is striking. In all of the countries studied here, rural areas perform worse than their urban counterparts in terms of educational output. But the analysis of efficiency shows that, given their input (particularly if affluence variables are included as inputs), the schooling system in the rural areas are often relatively efficient. Improving educational performance in these areas therefore requires policy makers to address the imbalance in inputs – involving a shift of focus from simple growth accounting to a more detailed efficiency analysis. In turn this implies recognition that a prerequisite for solving problems in education is to ensure that society delivers the educational system with a strong vector of inputs.

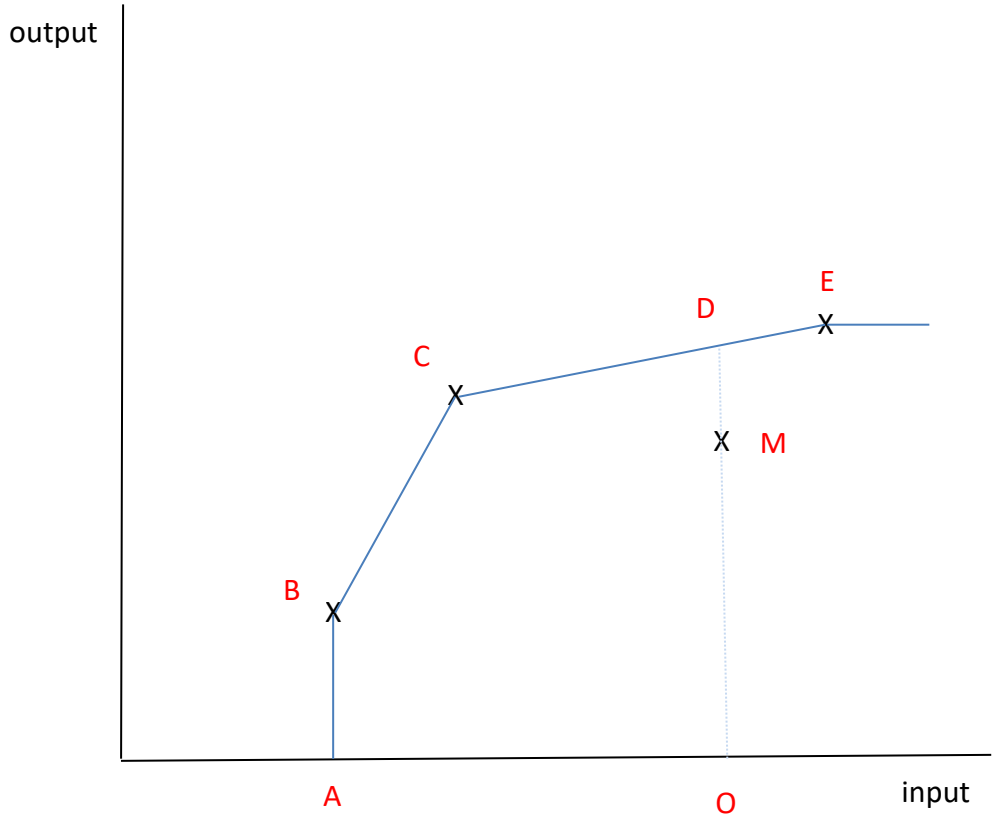

Figure 1 Data envelopment analysis

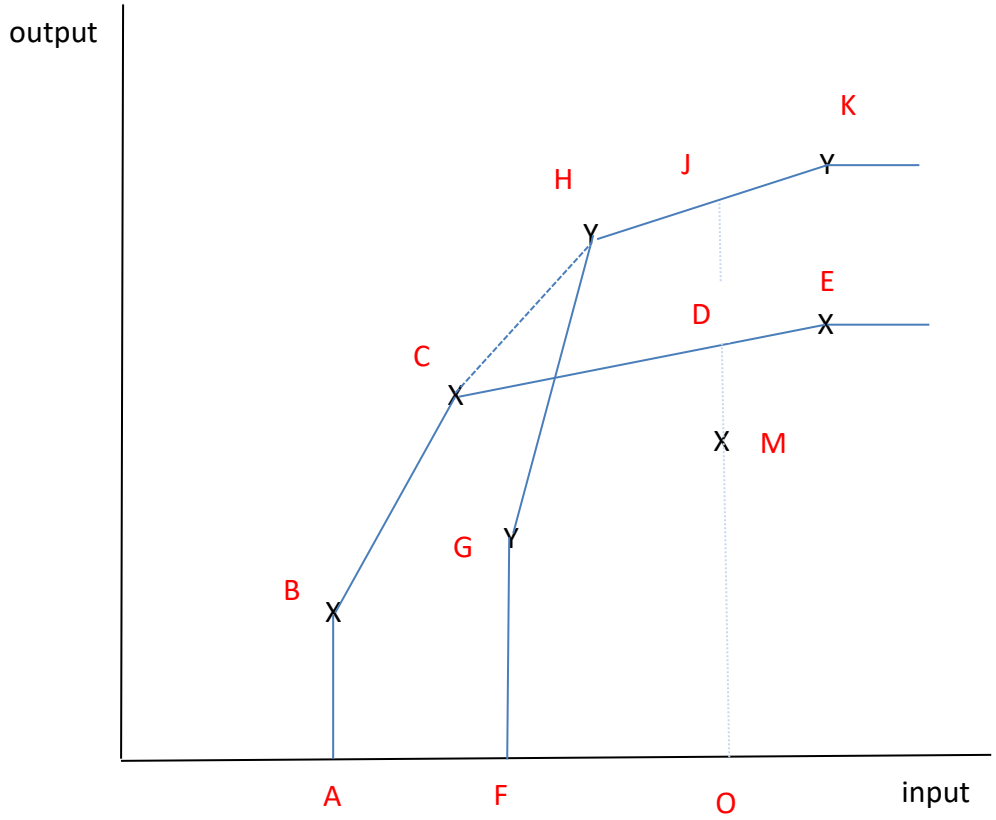

Figure 2 Data envelopment analysis with meta-frontier

Age	Peru	India	Ethiopia	Vietnam
19				
18			Preparatory Secondary	
17		Higher Secondary		Upper Secondary
16	Secondary Education		Secondary	
15		Secondary Education		
14		Upper Primary Education	Secondary Cycle Primary	Lower Secondary
13				
12				
11	Primary Education			
10		Primary Education	First Cycle Primary	Primary Education
9				
8				
7				
6				
5	Preschool			Preschool
4				
3				
2				
1				

Figure 3: Compulsory Education Levels (Source: Young Lives Policy Brief 30, December 2016)

Table 1a: Descriptive statistics

	mean	standard deviation
Score	0.61	0.23
Wealth index	0.51	0.21
Class hours per day	5.93	2.06
Home study hours per day	2.10	1.40
Highest grade completed	3.00	3.11
Age (months)	116.62	35.96
Private school	0.26	0.44
Urban	0.39	0.49
Household expenditure pc (US$ per month)	40.26	42.29
Ethiopia	0.25	
India	0.24	
Peru	0.25	
Vietnam	0.25	

Note: There is a total of 9205 observations. The descriptive for private schools reported here are based on 5941 observations, since we exclude Vietnam (where school type is not reported in the relevant round of the study) and those schools in Ethiopia for which no school type is reported.

Table 1b: Descriptive statistics split by rural and urban

	Ethiopia		**India**		**Peru**		**Vietnam**	
	urban	rural	urban	rural	urban	rural	urban	rural
wealth index	0.47	0.24	0.69	0.47	0.63	0.35	0.80	0.57
household expenditure per capita	22.71	13.95	36.06	23.68	81.94	41.38	64.49	34.96
class hours per day	6.12	4.04	8.05	7.83	6.10	6.13	5.54	4.56
home study hours per day	1.42	0.75	2.20	2.18	2.10	1.61	3.10	2.84
highest grade completed	1.24	0.55	3.74	3.72	3.15	2.35	4.02	3.89
age (months)	104.60	97.29	121.43	120.14	117.81	112.27	124.85	124.94

Table 1c: Descriptive statistics split by private and public

	Ethiopia			**India**		**Peru**	
	private	public	other	private	public	private	public
wealth index	0.57	0.34	0.24	0.64	0.45	0.73	0.52
household expenditure per capita	32.52	17.79	12.55	34.65	21.37	123.63	61.21
class hours per day	7.77	5.63	2.74	8.13	7.71	6.57	6.03
home study hours per day	1.54	1.25	0.47	2.25	2.14	2.39	1.89
highest grade completed	1.57	1.10	0.14	3.22	4.09	3.08	2.91
age (months)	111.41	100.28	96.86	116.60	123.09	114.67	116.57

Table 2a: Average value of pupil-level efficiencies

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.5326	0.5222	0.6636	0.6837
Country within all countries	0.9921	0.8434	0.5520	0.9107

Table 2b: Average value of pupil-level efficiencies – younger age group

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.5191	0.4313	0.6224	0.6031
Country within all countries	0.9924	0.7927	0.5276	0.8632

Table 2c: Average value of pupil-level efficiencies – older age group

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.9769	0.7758	0.8275	0.8630
Country within all countries	0.9405	0.9382	0.6067	0.9966

Table 3a: Average value of pupil-level efficiencies: further within-country analysis

	Ethiopia	India	Peru	Vietnam
Urban within country	0.9567	0.8236	0.9210	0.9608
Rural within country	0.9639	0.9948	0.9700	0.9775
Private within country	0.9472	0.9375	0.9364	
Public within country	0.9522	0.9427	0.9749	
Other schools within country	0.9340			

Table 3b: Average value of pupil-level efficiencies: further within-country analysis – younger age group

	Ethiopia	India	Peru	Vietnam
Urban within country		0.7774	0.9012	0.9447
Rural within country		0.9933	0.9706	0.9716
Private within country	0.9364	0.9237	0.9212	
Public within country	0.9514	0.9248	0.9681	
Other schools within country	0.9341			

Table 3c: Average value of pupil-level efficiencies: further within-country analysis – older age group

	Ethiopia	India	Peru	Vietnam
Urban within country		0.9250	0.9850	0.9893
Rural within country		0.9955	0.9662	0.9957
Private within country	0.9990	0.9542	0.9768	
Public within country	0.9907	0.9855	0.9949	
Other schools within country				

Table 4a: Average value of pupil-level efficiencies, restricted specification

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.4676	0.4645	0.5872	0.6462
Country within all countries	0.9896	0.9098	0.6136	0.9519

Table 4b: Average value of pupil-level efficiencies, restricted specification – younger age group

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.4523	0.3677	0.5357	0.5516
Country within all countries	0.9911	0.8753	0.5953	0.9264

Table 4c: Average value of pupil-level efficiencies, restricted specification – older age group

	Ethiopia	India	Peru	Vietnam
Pupil within country	0.9533	0.7414	0.8090	0.8461
Country within all countries	0.9461	0.9550	0.6105	0.9988

Table 5: Average value of pupil-level efficiencies: further within-country analysis, restricted specification

	Ethiopia	India	Peru	Vietnam
Urban within country	0.9772	0.9389	0.9150	0.9861
Rural within country	0.9117	0.9823	0.9736	0.9569
Private within country	0.9869	0.9943	0.9523	
Public within country	0.9618	0.8650	0.9262	
Other schools within country	0.9089			

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