Education: other empirical studies

Lecture 4/3 - 2/2016

Chayanee Chawanote

Educational inputs and student performance

- Indicators/Inputs: Teacher-pupil ratio; Teacher education - experience - salary; Expenditure per pupil
- 8 of 30 studies find a significant results supporting smaller classes; almost half find statistically insignificant
  - With a wide set of environments in developing countries, it does not support the policy to reduce the class size.
- 16 of 46 studies display significant positive benefits from more teaching experience, but 28 of these find it statistically insignificant.
- The majority of studies support that more education for teachers improves student performance.

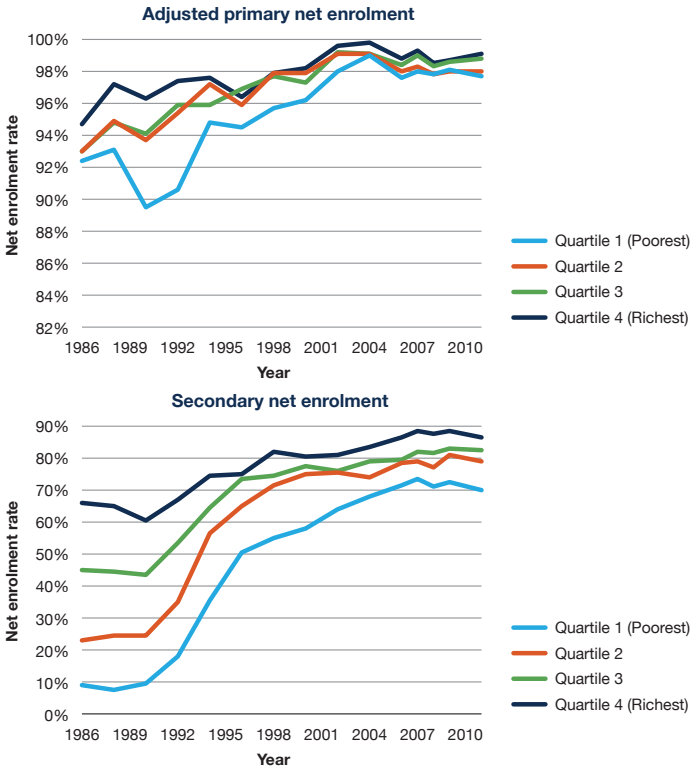
Educational inputs and student performance

- No compelling support for the notion that higher wages yield better teachers.
  - But, this maybe because of data limitation
- Still unclear what relationship between total expenditure per pupil and student performance.
- Schools show very large differences in their ability to improve student achievement, but these differences are not highly correlated with measured characteristics of teachers and schools.
  - Only 16% of the variance (differences) in school quality is related to teacher attributes (education and gener) and school attributes (class size and facilities)

Quality vs. Access

- Should policy maker choose expanding the availability of education or providing high-quality schools?
- Low quality may be an explanation for the failure to take advantage of the high returns in investment in education
  - Students tend to stay in good schools and drop out of poor ones.
  - Estimates of rate of return to schooling that do not account for quality differences will systemarically overstate the productivity gains associated with additional years of schooling, because the estimates will include quality differences that are correlated with quantity.
- Hanushek and Lavy (1994)'s study in Egypt shows that school quality affects students' decisions to drop out. Holding achievement and opportunities constant, students going to high-quality schools are much more likely to stay in school than those going to low-quality schools.

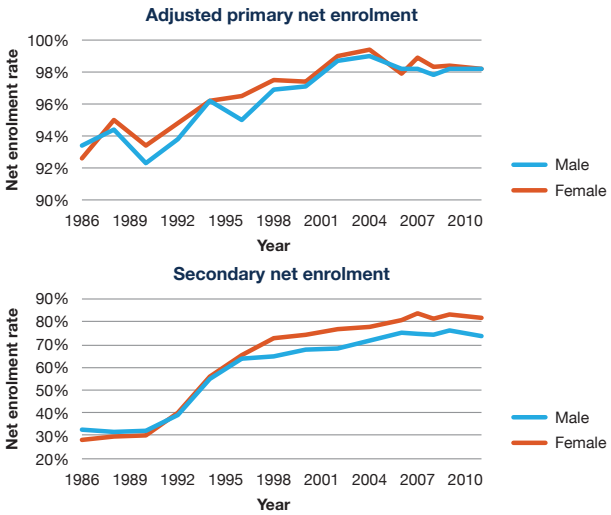
Figure 2.1
Adjusted primary and secondary net enrolment rates – by wealth quartile



Note: Children are divided into four wealth quartiles (the poorest in Quartile 1 and the richest in Quartile 4) according to their family per capita monthly expenditure,[5] expressed in adult-equivalent units.[6]

Source: World Bank staff calculations based on Thailand Household Socioeconomic Survey (various years).

Figure 2.2
Adjusted primary and secondary net enrolment rates – by gender

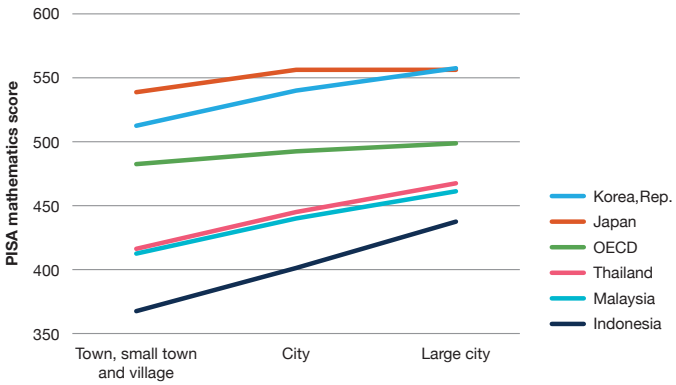


Source: World Bank staff calculations based on Thailand Household Socioeconomic Survey (various years).

[5] Per capita monthly expenditure was used instead of household income to rank individuals into wealth groups, since expenditure data are generally recorded more accurately than current income in socioeconomic surveys of households. Current spending is also less volatile and is a better proxy for family wealth than income.

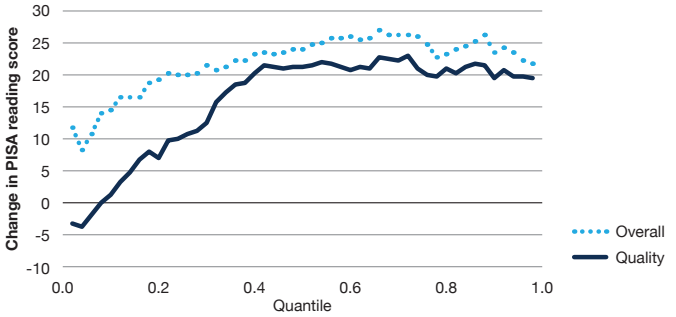
[6] The Thai Household Socioeconomic Survey (SES) datasets contain measures of monthly household income and expenditure. In order to compare expenditures across households, it is important to correct for household composition and household size by dividing total consumption expenditure by the number of "adult equivalents" in the household to obtain the per capita monthly expenditure in adult-equivalent scale. Each child under age 15 is treated as equivalent to 0.5 adults. All individuals in each round of the SES dataset are then classified into four wealth quartiles based on their household's per-capita expenditure.

Figure 2.7
Urban-rural differences in student performance in PISA 2012 mathematics



Source: World Bank staff calculations based on OECD PISA 2012.

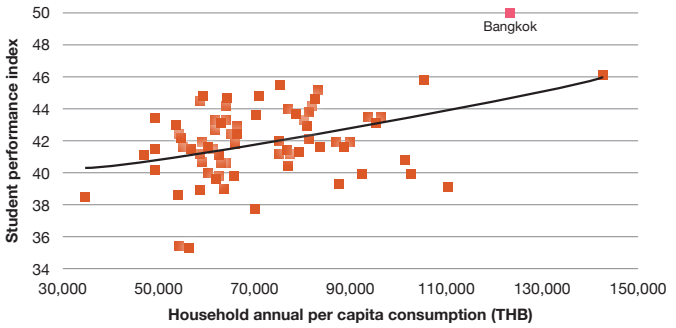
Figure 2.8
Contributions of changes in quality to changes in PISA reading scores for Thailand from 2003 to 2012 across the test score distribution



Note: The median or 0.5 quantile is equivalent to the 50th percentile, the 0.2 quantile is equivalent to the 20th percentile, and so on.

Source: World Bank staff calculations based on OECD PISA 2003 and 2012 data.

Figure 2.9
Socio-economic inequality in learning outcomes in Thailand – student performance index by average per capita consumption level



Source: World Bank staff calculations based on Thailand Household Socioeconomic Survey 2011 and NIETS 2010.

figure suggests that inequality in test scores was attributable more to changes in education quality than to changes in observed student characteristics.

Closer examination of student performance by socio-economic background indicates that the weaker performers tend to come from more disadvantaged backgrounds. Large disparities in student performance can be seen across schools serving students from diverse socio-economic backgrounds. Figure 2.9 plots provincial average household per capita annual consumption in 2011 against the student performance index for the 2010 Ordinary National Education Test (O-NET) exams.[17] A clear positive and exponential relationship can be seen, with per capita consumption

[17] The student performance index (which ranges from 0 to 100) is a weighted index of the 2010 O-NET exams in mathematics and science for students in Grades 6, 9, and 12. Details on the computation of the index are provided in Section A5.3 in the Technical Appendix to Annex 5 at the end of this report.

Figure A3.1. Key Characteristics of OBEC Schools – Ranked by Student Performance

Figure A3.1.1. Student Performance Index

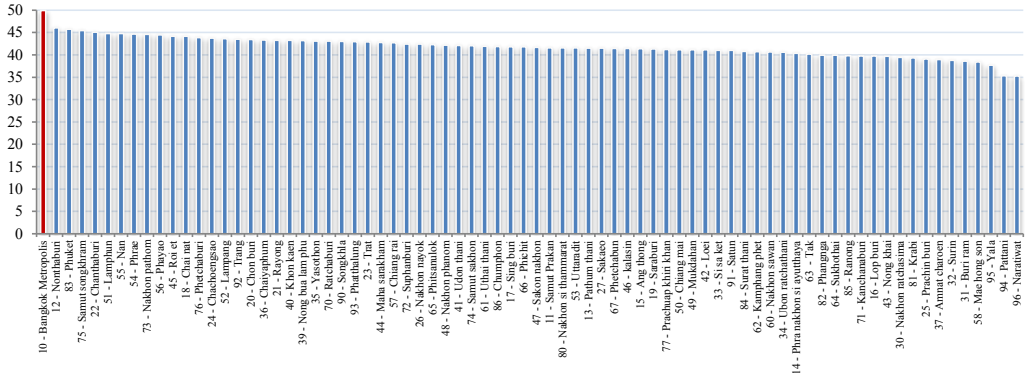


Figure A3.1.2. Share of Teachers with Higher than Bachelor's Degree

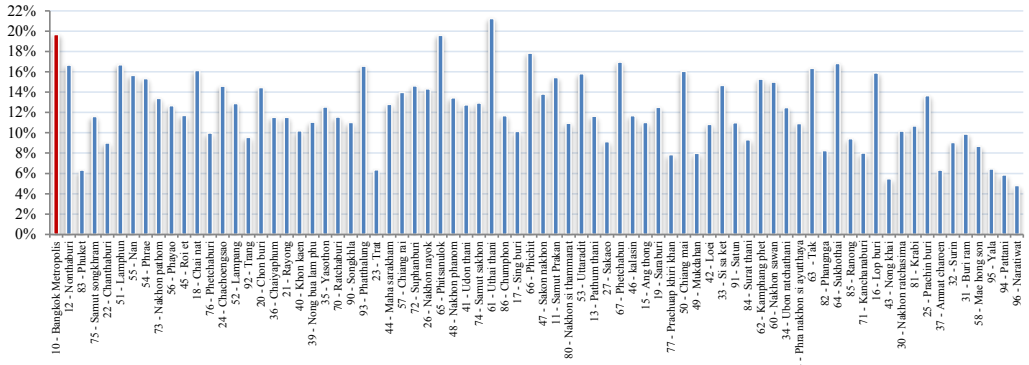


Figure A3.1.3. Average Teacher Experience (Years)

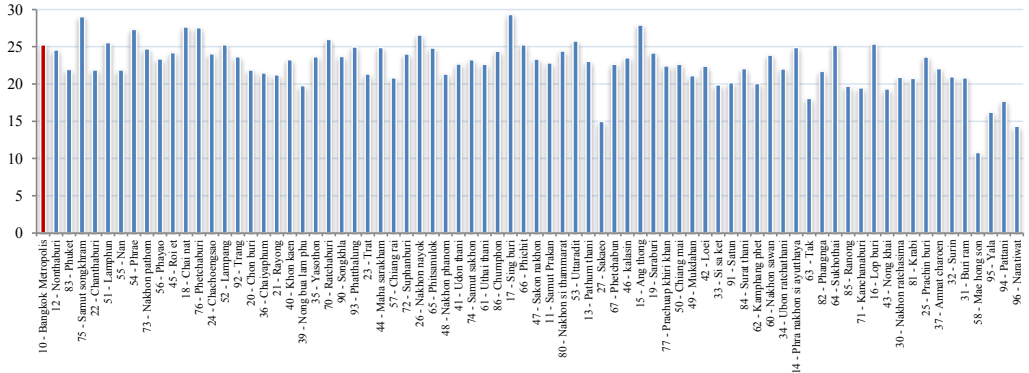


Figure A3.1.4. Average Number of Teachers per Classroom

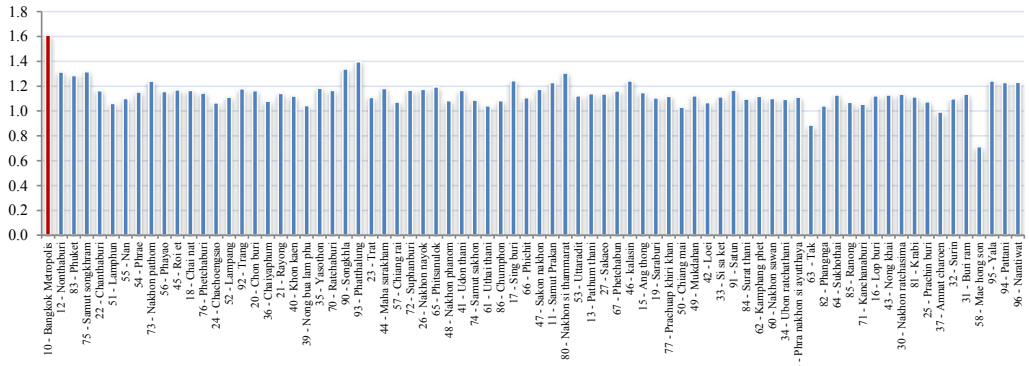


Figure A3.1.5. Average Class Size

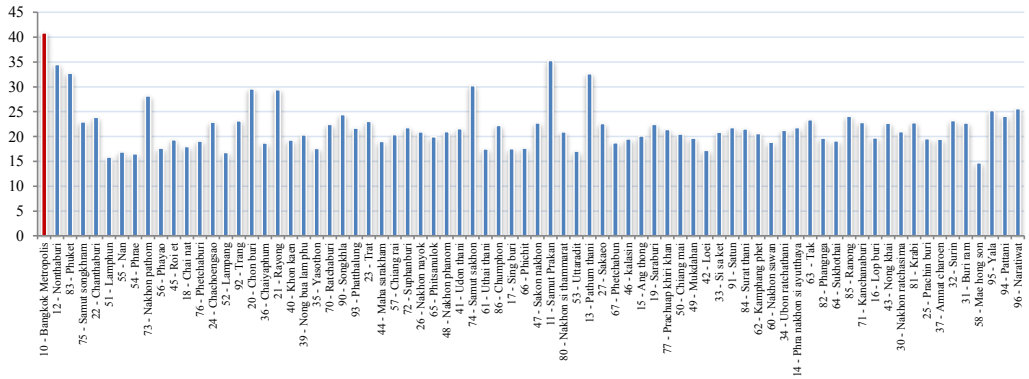
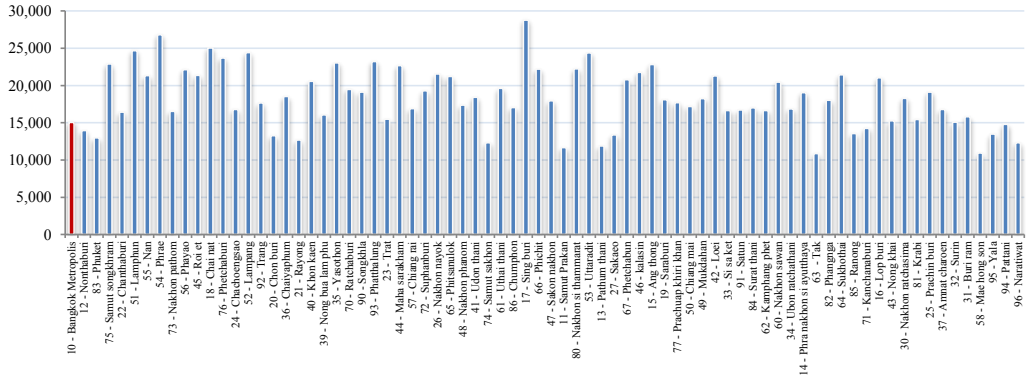


Figure A3.1.6. Average Personnel Salary Per Student



Source: World Bank Staff Calculations based on OBEC and NIETS

Annex A4: What is the evidence that organizing learning with better teachers will improve learning?

This annex presents the empirical evidence that staffing classrooms in poor schools with adequate number of good quality teachers will have a large impact on student learning. Our empirical analysis in this annex employs the concept of an Educational Production Function where it is conceptualized that schools employ some production technology to combine various inputs into producing student learning.[2] Using this framework, we estimate the causal relationships between school-average student achievement[3] and key measures of school quality, namely, the proportion of teachers with higher than bachelor's degree qualification, the teacher workforce average years of teaching experience, the "unobserved teacher quality index",[4] and the average number of teachers per classroom. Due to data limitations, however, we will not be able to evaluate the impacts of material educational resources and physical infrastructure on student learning.[5]

Since the focus of this annex is to evaluate potential interventions that are needed to close the school performance gap, we will be estimating the effects of these school quality variables on the entire distribution of school-level student performance outcome. An estimation method that "goes beyond the mean" will have to be employed for this particular purpose. In this study, we use the "Unconditional Quantile Regression" (UQR) method introduced by Firpo, Fortin, and Lemieux (2009) to estimate the causal impacts of the key measures of school quality on student achievement at different performance quantiles. Issues relating to the estimation of the educational production function model using the UQR technique is described in Technical Appendix to Annex A4, where detailed discussions of the results are also provided. The rest of this annex highlights the key findings.

All four measures of school quality show positive and statistically significant effects on student performance. Our analysis begins with analyzing the effects of measured school quality variables on average student performance outcome at the school level. In particular, it is found that 1) an increase in the unobserved teacher quality index of one standard deviation is associated with an increase of 0.9 percent in student performance, 2) a 10 percentage point increase in the share of teachers with higher than bachelor's degree qualification is expected to raise student performance by 0.27 percent, 3) an increase of 10 years in the average experience of the teacher workforce is estimated to improve student performance outcome by 1 percent, and 4) allocating one more teacher for each classroom is expected to raise performance by as much as 2.6 percent, holding other factors constant.

Gains in student learning from having better quality teachers are found to be much larger for low-performing schools. The estimated causal effects of the three measured teacher quality variables show greater impacts on student achievement for schools ranked at the lower end of the performance

---

[2] The empirical study in this chapter uses a 2010 cross-sectional school data collected by the Office of the Basic Education Commission (OBEC), the Ministry of Education in Thailand (see Annex section A4.3).

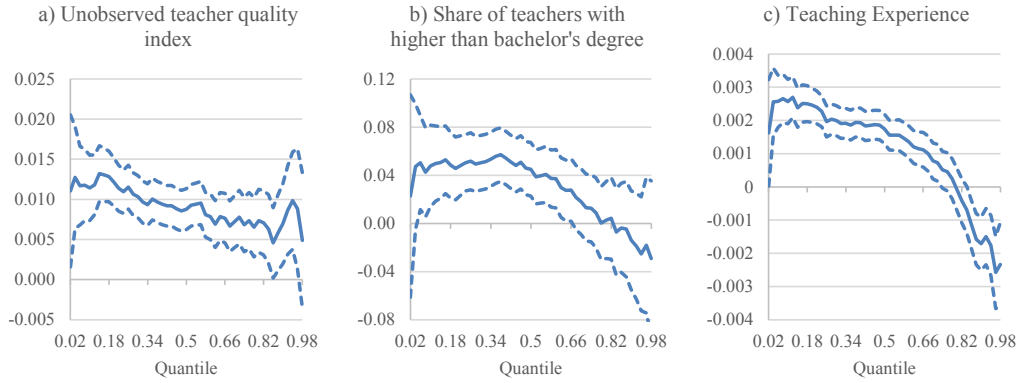
[3] Student achievement is measured by the Student Performance Index, which is a weighted index of mathematics and science scores in the 2010 Ordinary National Education Test (O-NET) exams for Grades 6, 9, and 12. The index is constructed as explained in detail in Section A5.3 in Technical Appendix to Annex A5.

[4] As described in the Annex section A4.3, the "unobserved teacher quality index" approximately captures variations arising from the discretionary wage component (such as performance pay), the average academic ranking of the teacher workforce, and other school average teacher characteristics unobserved by the researcher.

[5] Nevertheless, all is not lost as a rich body of research shows that effective teachers are the most important factor contributing to student learning (see for example Rivkin, Hanushek, and Kain (2005), Hanushek, Kain, and Rivkin (1998), and Nye, Konstantopoulos, and Hedges (2004)).

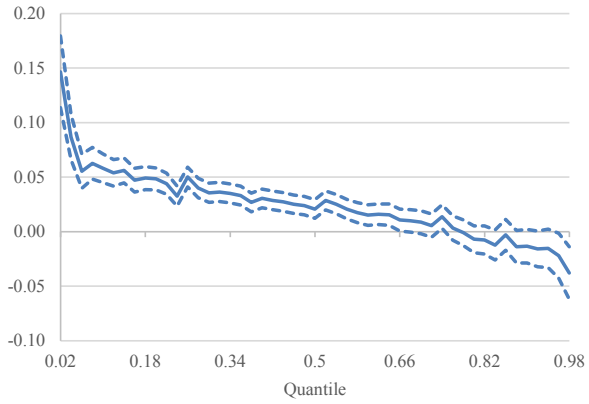
distribution. The three graphs in Figure A4.2 (reproduced from Technical Appendix to Annex A4) show the estimated marginal effects of the three teacher quality variables on the entire distribution of schools, ranked in accordance with their student performance outcome. The dotted lines in the graphs represent the 95 percent confidence band for the estimated effects. Consider low-performing schools that are ranked at the 10th percentile of the performance distribution. The study finds that 1) an increase in the unobserved teacher quality index of one standard deviation is expected to raise student performance by 1.14 percent (Figure A4.2a), 2) a 10 percentage point increase in the share of teachers with higher than bachelor's degree qualification is expected to increase student performance by 0.48 percent (Figure A4.2b), and 3) an increase of 10 years in the average experience of the teacher workforce is estimated to improve student performance outcome by 2.6 percent (Figure A4.2c). The estimated marginal effects of the teacher quality variables on schools ranked at the 10th percentile are therefore much larger than the estimated effects for the average school discussed in the previous paragraph. The marginal effects on other percentiles can analyzed analogously.

Figure A4.2. The Estimated Marginal Effects of Measured Teacher Quality Variables on Student Performance



The study also finds the greatest positive impacts on student learning for the lowest-performing schools from easing severe teacher shortages in their classrooms. Turning now to our measure of the adequacy of teacher quantity, we can see from Figure A4.3 that allocating one more teacher to each classroom is expected to raise performance for schools at the 2nd percentile of the performance distribution by as much as 15.8 percent. The effects are estimated to fall to within a range of 4.8-6.5 percent for schools ranked between the 6th and the 20th percentiles before falling off gradually thereafter. The large and positive effects for schools at the bottom end of the performance distribution should not come as a surprise, considering the fact that teacher shortages are very critical for these schools (see Technical Appendix to Annex A4 for more detailed discussion). The results shown in Figure A4.3 alone are strong evidence that staffing shortages in Thai classrooms are adversely affecting student learning, especially in small schools that primarily serve socioeconomically disadvantaged students.

Figure A4.3. The Estimated Marginal Effects of the Number of Teachers per Classroom on Student Performance



The results from our empirical study in this annex show that eliminating teacher shortages, both in terms of quality and quantity, would result in significant improvements in student achievement and the impacts would be greatest for lower-performing schools. The analyses of the effects of measured teacher quality and the number of teachers per classroom unambiguously suggest that allocating more and better teachers to small and low-performing schools would result in significant improvements in student learning. In light of these findings, we conclude that improving the quality of teachers and addressing the severe teacher shortages, especially for the vast number of small rural schools, should be at the center of Thailand's reform initiatives if the country is serious about tackling the widespread low quality education and the high disparity in educational achievements across socioeconomic groups.

Technical Appendix to Annex A4

A4.1. Using School Level Educational Production Function to Determine the Effects of Measured Teacher and School Characteristics on Student Performance

Our empirical analysis in Annex A4 uses school level data (see Annex A4.3) to estimate the educational production function for schools under the jurisdiction of the Office of the Basic Education Commission (OBEC). Specifically, we conceptualize schools as employing some production technology to combine various inputs into producing student learning. This analytical framework is particularly useful in helping us determine the relationships between measured teacher and school characteristics with student achievement, as indicated by the Student Performance Index in the 2010 O-NET exams.

Complications arise in the model estimation stage, however. Due to data limitations, we do not observe all potentially important family background characteristics of the student body that capture the quality of early education the students received or the home environments that are conducive to learning. These background characteristics are crucial in determining a child's cognitive ability. Furthermore, it is conceivable that these relevant family factors are related to both student