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ABSTRACT

This monograph summarizes the results of a World Bank research project that compared private and public secondary school costs and achievement in five developing countries--Columbia, the Dominican Republic, the Philippines, Tanzania, and Thailand. All the case studies address the question: Would a high school student, selected at random from the general student population, perform better in a public or private school? In the absence of experimental data, the studies compare students' performance on standardized tests in a cross-section of public and private schools. Student background, motivation, innate ability, and prior performance are controlled through the use of various statistical techniques. The report also compares the costs of public and private schools. The principal findings include: (1) although students in private schools come from more privileged families than those in public schools, on average, there is a significant overlap between the two groups; (2) with student background and selection bias held constant, students in private schools out-perform students in public schools on a variety of achievement tests; (3) unit costs of private schools are lower than those of public schools; and (4) private schools are organized for greater school-level decision making and emphasis on enhancing student achievement; this seems to affect the mix of inputs that private versus public schools choose. Implications for policy include: (1) over-restrictive regulations on private schools may be suppressing an efficient way to provide education; (2) in some cases, governments could encourage greater private sector participation in education; and (3) public schools could emulate at least some of the teaching and administrative practices of their private counterparts. Contains numerous tables throughout the document and 66 references. (EH)

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Public and Private Secondary Education in Developing Countries

A Comparative Study

Emmanuel Jimenez
and Marlaine E. Lockheed

with contributions by
Donald Cox, Eduardo Luna,
Vicente Paqueo, M. L. de Vera,
and Nongnuch Wattanawaha

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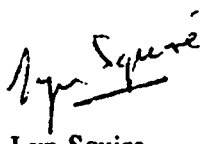
Foreword

There is now a firm consensus that investment in education has high payoffs in promoting both economic growth and equity. At the moment, governments are the primary provider and financier of such investments. But increasingly, governments have also encountered some key constraints in their abilities to mobilize resources to finance the investments and to manage ever-growing educational systems efficiently. One possible option is to let the private sector play a greater role.

While hardly anyone doubts that governments must play some role in financing education, there is more debate as to whether it necessarily must supply it all directly. Discussion of this issue has often suffered in this past from a dearth of hard evidence. The main contribution of this volume is to begin to fill this gap in our knowledge. While the study does not attempt to provide a definitive answer to the question of the relative public-private role in education, the authors do present rigorously derived evidence where none existed before. We, as co-sponsoring managers, feel this is a further step in what should be an ongoing debate on a very important topic.



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Abstract

Private and Public Secondary Education in Developing Countries: A Comparative Look

The debate over the relative roles of public and private schools is heated and volatile but often uniformed. What is the evidence regarding the relative performance of each type of school in boosting student achievement? Up until recently, almost all the evidence has been restricted to developed countries, primarily in the US. This monograph summarizes the results of a World Bank research project that rigorously compares private and public secondary school costs and achievement in five developing countries—Colombia, the Dominican Republic, the Philippines, Tanzania and Thailand.

All the case studies address the following question: Would a high school student, selected at random from the general student population, perform better in a public or private school? In the absence of experimental data, the studies compare students' performance on standardized tests in a cross-section of public and private schools. Student background, motivation, innate ability, and prior performance are controlled through the use of various statistical techniques. In addition, we compare the costs of public and private schools.

The principal findings are:

1. Although students in private schools come from more privileged families than those in public school, on average, there is a significant overlap between the two groups.

2. With student background and selection bias held constant, students in private schools outperform students in public schools on a variety of achievement tests.

3. Unit costs of private schools are lower than those of public schools.

4. Private schools are organized for greater school-level decision making and emphasis on enhancing student achievement; this seems to affect the mix of inputs that private versus public schools choose.

The findings cited in this book should not be interpreted as a call to abolish or privatize public schools. One immediate implication for policy is that over-restrictive regulations on private schools (including outright prohibition in some countries) may be suppressing an efficient way to provide education.

Another implication for policy is that, in some cases, governments could encourage greater private sector participation in education. It should be stressed, however, that the relative efficiency of private schools is highly dependent on the institutional regime and structure of the incentives under which they currently operate. A final implication for policy is that public schools could emulate at least some of the teaching and administrative practices of their private counterparts. The usual assumption in considering government policies toward private schools is that the quality of education they provide is not commensurate with what is being paid by the consumers, due to the asymmetry of information between consumers and providers. This widely held assumption is complemented by the view that bureaucrats have better information regarding the technology of education. The evidence, however, is that private schools, which are more autonomous and responsive to students and their parents, will deliver education in a cost-effective way.

Abbreviations and Acronyms

GLE	—	grade level equivalent
HSMS	—	Household and School Matching Survey
IEA	—	International Association for the Evaluation of Educational Achievement
NCEE	—	National College Entrance Examination
NESP	—	National Economic Survival Programme
OECD	—	Organization for Economic Cooperation and Development
OLS	—	ordinary least squares
PRODED	—	Program for Decentralized Educational Development
SES	—	socioeconomic status
SIMS	—	Second International Mathematics Study
SNP	—	Servicio Nacional de Pruebas
STR	—	Student-teacher ratio
UNESCO	—	United Nations Educational, Scientific and Cultural Organization

1

Introduction

Most developing countries provide public education free or at minimal cost to their citizens. Across the Third World, public schools enroll approximately 90 percent of all primary and 70 percent of all secondary students. But because of recent increasing fiscal constraints, many countries have limited free public education. In particular, this trend has created a serious problem for the poorest countries, where the demand for schooling is projected to increase dramatically during the next decades.

One way around this problem is to charge tuition fees for public education services, and many countries have adopted this policy. Another option is to rely on private schools to handle at least part of the expansion. Governments can encourage this development by relaxing restrictions on private schools, by providing loans to and information about them and by restricting the number of students enrolled in public schools. Some reports suggest that, if governments were to adopt such policies, more resources for education would be generated and standards of efficiency and quality would increase (World Bank 1986). Because private schools compete for students and are accountable to parents who pay the bills, they have an incentive to adopt teaching practices and to use staff and educational materials effectively and economically. If public schools were forced to compete with private schools for students, they too might become more efficient.

But what is the empirical evidence regarding the relative efficiency of private and public schools? In the United States, the provocative Coleman, Hoffer and Kilgore (1982) report concluded that attending private schools improved student performance as measured by standardized tests of verbal and mathematical skills. Although there are outstanding questions of selectivity bias and the magnitude of effect (see, for example, Murnane, 1985; Murnane, Newstead and Olsen, 1985), the conclusion that the average student performs better in private than in public schools is widespread (Hanushek, 1990).[1]

For developing countries, the evidence is even more recent. In this monograph, we summarize the results of a World Bank research project that rigorously compares private and public school costs and

[1] The magnitude of this advantage has been disputed. Levin (1987) claims that the estimated gain in student achievement, particularly in longitudinal data sets, would have very little effect on enhancing the chances for college admission in the United States or on wages.

achievement in five developing countries.[2] These case studies analyze data on secondary schools in countries that are educationally diverse—Colombia, the Dominican Republic, the Philippines, Tanzania and Thailand. We focus on secondary schools, the level at which private participation is most significant.

All the case studies address the following question: Would a high school student, selected at random from the general student population, perform better in a public or private school? In the absence of experimental data, the studies compare students' performance on standardized tests in a cross-section of public and private schools. Student background, motivation, innate ability and prior performance are controlled through the use of various statistical techniques. These techniques purge the influence of background factors from the achievement scores. They also ensure that there is enough overlap in the distribution of students' characteristics so that the subsamples are truly comparable. Other statistical techniques are then used to control for possible selection bias.

Because it is difficult to measure many nonschool or family background effects (for instance, innate ability), we supplement the cross-sectional studies with studies using panel data that compare the differences in the achievement of public and private school students over two time periods. Nonschool effects that do not change over that time are netted out. In the studies of the Dominican Republic and Thailand, changes in achievement across two time periods are used rather than the level of achievement in a given time period. As far as we know, this type of value-added analysis of private schools has previously only been done on a data set from a developed country (for data on U.S. high schools, see Coleman, Hoffer and Kilgore, 1982; Lee and Bryk, 1988; and Hanushek, 1986).

To examine the relative efficiency of public and private schools, we also compare differences in achievement with differences in costs. Although the results described in this book are unique because they combine both effectiveness and cost comparisons, the few studies that apply only parts of the methodology corroborate our results (Luna and Gonzalez, 1986; Psacharopoulos, 1987; and Tsang and Taoklam, 1990.)

Each of the studies used data that were collected for other purposes.[3] Despite their varied origins, the data sets contained similar core information. The main components were household and student characteristics and scores on standardized tests of verbal skills and/or mathematics. In the Dominican Republic and Thailand, extensive data were available on teaching practices and on school and teacher characteristics, and test scores were available for students for the beginning and end of the school year. In Colombia, the Philippines and Tanzania, the results were supplemented by data on mental ability. Table 1.1 summarizes the salient features of the data.

In the rest of this chapter, we briefly discuss the role of public and private schools and explain why such a discussion is important for policy. Thereby we set this book in its intellectual context—suggesting where it fits in the literature and what it might add.

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[2] Other recent studies, such as Roth (1987), James (1991) and Samoff (1987), examine the private sector's role in providing education in developing countries but do not compare costs or achievement in private and public schools. Also see Jimenez and Lockheed (1991) for studies that examine public and private schooling issues more broadly.

[3] The data on Colombia and Tanzania were generated as part of a World Bank study of diversified education (see Psacharopoulos and Loxley, 1985). The Philippines data were collected by the Philippine Ministry of Education as part of its Household and School Matching Survey. The Thailand data were obtained from the Second International Mathematics Study conducted by the International Association for the Evaluation of Education Achievement (IEA) (see Robitaille and Garden, 1989). The Dominican Republic data came from a survey modeled after the IEA (Luna and Gonzalez, 1986).

Table 1.1. Summary of Studies

	Year data collected	*Number of*		*Grade*	*Indicator of achievement*	*Data base*
		Students	*Schools*			
Colombia	1981	1,471	35	11	Average scores on math and verbal tests	Special survey
Dominican Republic	1982-83	2,472	76	8	Mathematics test	National school survey
Philippines	1983	446	..	7-10	Mathematics test English test Filipino test	National household survey
Tanzania	1981	1,025	13	11	Average scores on math and verbal tests	Special survey
Thailand	1981-82	4,030	99	8	Mathematics test	National school survey

Note: .. not available.

The remainder of the book is divided into three parts. Part I consists of four chapters on the basic cross-section case studies, explaining the methodology (Chapter 2) and the results for Colombia, Tanzania and the Philippines (Chapters 3, 4, and 5). Part II contains three chapters on the value-added case studies. In these chapters, we discuss how the basic methodology is adapted to take advantage of the richness of panel data (Chapter 6) before presenting the results for Thailand and the Dominican Republic (Chapters 7 and 8). In Part III, we present some cross-country findings (Chapter 9) and our conclusions (Chapter 10).

Some Facts and Figures on the Public-Private Role in Education

As pointed out by Roth (1987), "the concept of free compulsory education, for which the state should be responsible, originated in Europe and North America but was not widely promoted until the nineteenth century. It is thus of comparatively recent origin. Private education has had a much longer history...".

What is the situation today? Recently, UNESCO has resumed publishing data on the role of private schools in education. These data are largely self-reported by countries and reflect the huge variety in types and financing of private schools.[4] In particular, while most schools in the data base are considered

[4] Definition of "private education": "The International Classification of Education defines private education as that provided in institutions managed by private persons. This definition covers a wide variety of situations. Some private institutions are wholly funded by the State, others are state-aided to a wide variety of degrees while others again receive no state aid at all. In any one country, the situation may vary over time or according to level or type of education". (Organization of

to be private on the basis of ownership, the degree of government regulation and subsidization varies widely. Nevertheless, Table 1.2 offers some rough orders of magnitude on the breakdown of public versus private schools in the 1980s.

Table 1.2. Public Share of Primary and Secondary Education
(percent)

	Primary			*Secondary*		
	1965	*1975*	*1985*	*1965*	*1975*	*1980*
OECD	87	88	89	..	..	..
Asia	86	87	88	56	71	78
East Africa	47	57	80	64	55	52
West Africa	74	82	84	59	70	72
Middle East and North Africa	92	94	98	82	92	91
Latin America and Caribbean	86	87	88	61	67	75
Low-income Countries	75	81	95	..	..	..
Middle-income Countries	80	85	84	..	..	..

Notes: .. not available.
Figures for low-income and middle-income countries are incorporated from Table A-10 in Lockheed and Verspoor (1991). All other 1965 and 1975 primary education data and all secondary education figures are from Tan, as quoted in Roth (1987) Table 2-1. OECD data and 1985 data for Asia, East Africa, West Africa, the Middle East and North Africa and Latin America and the Caribbean are from the UNESCO data base official enrollment series. The figures do not reflect averages of constant cases.

There are several findings to highlight. First, primary and secondary enrollment is predominantly in the public domain. While the overall numbers obscure the data of individual countries, nearly all the (unweighted) regional averages for both primary and secondary education show a public sector share of more than 60 percent. Additionally, there is significant disparity across levels. The share of public education at the primary level is substantially higher than that at the secondary level. For example, in Asia in 1975, the average share of public enrollment was 16 percent higher in primary than in secondary education. Also, regional groupings vary widely, particularly at the secondary level.

At the primary level, the share of public education has remained at 80-90 percent for all regions other than Africa since 1965. At the secondary level, however, public education shares grew until 1980; more recent anecdotal evidence suggests they have subsequently declined.

The figures in Table 1.2 mask tremendous differences among schools across (and within) countries. In particular, to discern how the role of the private sector affects educational outcomes, it is important to have information about at least three critical characteristics: financing (the extent to which private schools are subsidized), regulation (how strict is the government's control over the way the schools are run) and ownership (whether the private schools are sectarian, religious or for-profit).

There is very little systematically gathered evidence on these characteristics. The most comprehensive is probably a recent review by James (1991) of the experiences of some 35 to 50 developing and developed countries. Her study indicates a large variance in experience among countries. In general,

Economic Cooperation and Development, 1990).

private schools are heavily subsidized (to the extent of 80 percent or more of costs) in those countries (mostly in Europe) where teacher salaries are paid by the state.[5] These schools are also the most heavily regulated. A wide variety of countries provides indirect incentives through tax breaks or partial subsidies (less than 25 percent of costs) to private schools, including Japan, the United States, the United Kingdom, Indonesia, Kenya and several Latin American countries. These governments tend to exercise only a moderate amount of control over individual schools. On the other hand, some governments offer neither indirect nor partial support, but they still attempt to regulate their private schools.

As the following section explains, the quality of private schools and the types of subjects they emphasize also vary depending on their relationship with the public sector.

Public and Private Schools: The Policy Debate

It is generally accepted that the family (or student) and the state share responsibility for the student's education. The role of the state is important for a number of reasons. First, when one individual's consumption of a good affects others (an externality), the individual must be induced to consider the social as well as the private costs and benefits of his behavior. It is often argued that this is relevant in many aspects of education, particularly at the primary level. Second, government intervention may be necessary because financial markets are too limited to allow students to borrow enough money to cover their current costs on the basis of their likely future earnings. Third, if making human resource investments is accepted as a principal strategy for alleviating poverty, government action is also required (World Bank, 1990).

These objectives provide an economic justification for the most common financing practice found in most countries: the reliance on general revenues to finance public education. But what is the role for private education in this setting?

First, private education must fill the inevitable gaps in public education. A lack of firm political support sometimes can limit the degree to which governments can assist public schools to develop (see James and Birdsall, 1991; Birdsall and James, 1993). Even when they are politically motivated to do so, as in many developing countries, governments are often under such severe financial constraints that they cannot afford to finance even a high return activity such as education (World Bank, 1986). The result is an excess demand for public enrollment. James characterizes two other motivations for the establishment of private schools: a differentiated demand arising from a deep-seated religious or linguistic diversity and an offer on the part of an entrepreneur or organization, often religious, to start the schools on a nonprofit basis. She hypothesizes that, in many developing countries, it is excess demand that prompts the development of private education, whereas it is differentiated demand that has the same effect in developed countries. This situation may change as countries develop and differentiated demand becomes a bigger motivator of private education (James, 1988, 1989a, 1986b, 1986).

The second role that private education can play is in fostering greater efficiency by requiring public schools to compete for students. Although there are many types of private schools, analysts have argued that they possess general characteristics that differentiate them from public schools. These characteristics

[5] Some developed countries, such as Lesotho, Togo, Chile and the state of Kerala in India, also support their private schools in this way.

include a greater flexibility in operation and in funding, a direct accountability to those who use their services and a greater tendency for those in charge of individual schools to make critical educational decisions (Coleman, Hoffer and Kilgore, 1982). It is often argued that these characteristics enable private schools to provide education more effectively, in other words, to provide the type and quality of education that students and their parents demand. Moreover, even when the quality of education is similar, private schools have the incentive to operate at a lower cost than their public school counterparts.

Third, private schools can serve as a laboratory for alternative models of school-level management, which, if effective, could be adopted by public schools. Theoretically, private schools are free of the bureaucratic constraints that encumber public schools and are able to control many more decisions at the school level. It is argued that, if public schools were given the degree of school-level autonomy that private schools enjoy, this would boost achievement levels in public schools. Not all analysts agree that public schools would be able to emulate private schools, because of the differences in their sources of support. They reason that private schools emphasize learning because parental funding makes private schools accountable to parents' demands for effective instruction. By comparison, public schools pay less attention to learning because they need to balance professional accountability to parents with fiscal accountability to the centralized funding source.

If correct, these theories have substantial policy implications for developing countries. At present, private schools play only a peripheral role as a conduit for educational expansion. Can this be changed? Should private schools be deregulated? Should they be subsidized? Some analysts have argued that these schools are only for the elite. Others have said that private schools should not be encouraged because they will provide low-quality education at high cost to gullible parents and students. Like all good theories, these arguments lead to the following testable hypotheses that will be the subject of the rest of this book:

- Private schools are relatively more effective than public schools.
- Private schools are relatively more efficient than public schools.
- The greater effectiveness and efficiency of private schools is due to differences in school-level management.

Earlier Work

Most of the recent intellectual debate regarding the efficiency of public and private schools has been precipitated by the seminal work of James Coleman and his colleagues (Coleman, Hoffer and Kilgore, 1982) on the U.S. system. Their results were generally favorable to the private sector; however, for data reasons, they restricted their analysis to the subset of private Catholic schools. There has also been a spirited methodological debate about the selection bias and the damage it caused to causal inferences (see Hanushek, 1990; and Murnane, 1985 for a review). A number of subsequent studies left the principal qualitative conclusion intact—that private Catholic schools were more effective than public schools. In a later study on the growth of achievement (Coleman and Hoffer, 1987), these findings were qualified somewhat in that Catholic schools were found to increase the average student's verbal and mathematical skills more significantly than did public schools, but not their science or civics skills. The magnitude of the difference was also pointed out to be absolutely small (Levin, 1987).

The U.S. experience is interesting but may not apply in developing countries where such studies are rare and the few that have been conducted were not very systematically undertaken. Yet the policy debate is raging in the Third World with perhaps even greater force than it did in the United States. Thus, this book begins to fill the empirical gap in the information that fuels the debate.

Part I

Cross-sector Case Studies

2

Methodology

All the case studies in this book address the following question: Would a high school student, randomly selected from the general student population, do better in a public or a private school? In the absence of experimental data, a reliable answer can be obtained from a cross-section comparison of the performance of public and private school students on standardized tests—provided that student background, motivation and innate ability are controlled through statistical techniques. In this chapter, we will review the basic empirical framework used to conduct the statistical analysis when the data are taken from only one point in time.

The Basic Approach

In order to show how statistical models have been used to measure the public-private school effect, we need to model the determinants of the accumulation of human capital, as measured by performance on standardized achievement tests. The basic model is that student achievement is determined by the child's learning environment, as measured by household background (H) and the type of school he or she attends. One way to express this is to assume separate relationships for each type of school (say, public or private).[6] In symbols, the "ith" private school student's achievement score (A) is a function of a vector of observed background variables (X), which are nonschool factors such as socioeconomic background and innate ability, and unobserved variables (e):

$$(2.1) \qquad A_{ip} = b_p X_{ip} + e_{ip},$$

where each component of b measures the marginal effect of a characteristic on achievement. The "jth" public (or government) school student's score can be similarly expressed by replacing the subscript "p" with "g"[7]:

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[6] Alternatively, equations 2.1 and 2.2 can be estimated as one equation, with a dummy variable for private and public types of schools. However, statistical (F) tests led us to reject the hypothesis that the coefficients of all the other variables are equivalent in both types of schools.

[7] Throughout, the subscripts p and g will be used for private and public (government) schools respectively.

(2.2) $A_j = b_{jg}X_{jb} + e_{jg}$

Measuring the school effect requires the estimation of b_p and b_g. This can be shown as follows: if the effects due to unobserved variables, e, are randomly and normally distributed, ordinary least squares (OLS) regression techniques can then be used to estimate the parameters of equations 2.1 and 2.2. Private-public comparisons can then be made using this information, since the expected value of achievement for 2.1 and 2.2 can be expressed as $E(A_{ip}) = \hat{b}_p X_{ip}$ and $E(A_{ig}) = \hat{b}_g X_{ig}$, where "^" denotes an unbiased estimator. For a student with the characteristics of the average public school student,[8] the difference in achievement score if he/she were to attend a private school can be obtained by subtracting the estimated form of 2.1 from 2.2. Then, add and subtract $\hat{b}_p X_g$ on the right hand side of the resulting equation. The resulting difference can be expressed as:

(2.3) Difference $= \hat{b}_p(X_p - X_g) + (\hat{b}_p - \hat{b}_g)X_g$,

where the first term is interpreted as the endowment effect (in other words, the difference in scores due to differences in characteristics). The second term shown in equation 2.4 below is the school effect:

(2.4) School Effect $= (\hat{b}_p - \hat{b}_g)X_g$.

The Empirical Framework for Selection

School effects are then compared with public-private cost differentials. The basic approach requires the statistical estimation of how background affects achievement. This complex issue requires some discussion that will develop into the book's empirical framework.

A selection problem arises in estimating equations 2.1 and 2.2 when the nonschool factors also affect school choices made by families, which, in turn, systematically affect performance. For example, if children from privileged backgrounds only attended private schools, it would be difficult to infer how they would do in public schools. A true experiment of the private school effect would ask one of the following questions. If we were to pick a student randomly from a population, would that student do better in a public or in a private school? Of if we were to place a private school student in a public school, what would his/her achievement score be?

However, if students were free to choose the option they preferred, these questions could not be adequately answered simply by holding observed student characteristics constant and comparing achievement in private and public schools from present samples. There are two possible reasons for this result. If students sort themselves into those institutions where they think they can perform the best, a variety of possible selection effects can occur, which are explored below, and students may be hierarchically (or meritocratically) sorted. If the best students are selected into public schools, there would be positive selection into public schools but negative selection into private schools. In either case, the analyst cannot observe the characteristics of private school students among the public school sample or vice versa. Because the subsamples are not a random draw from the student population, the assumptions of the basic linear model are violated, and estimates of the achievement effect could be biased. Statistically, the selection problem means that the error terms e are no longer normally distributed and that OLS should not be used to estimate the above equations.

[8] This analysis can also be conducted using the characteristics of the average private school student.

To correct for sample selection, we use statistical corrections based on the now standard two-step technique.[9] First, a probit model is employed to estimate the determinants of choice of school type. Second, the results of the first step are used to hold constant the probability of school choice in estimating achievement (equations 2.1 and 2.2). To show this step rigorously, we model the joint determination of schooling choice and school performance under the self-sorting and meritocratic regimes. (Readers who are uninterested in a technical discussion of the model may skip the rest of this section without sacrificing the continuity of the argument.)

Let us first generalize the estimating equations 2.1 and 2.2 to include student innate ability, I, as a determinant of achievements, so that:

$$(2.5) \quad A_{pi} = A_p(X_{pi}, I_i) + \epsilon_{2i},$$

and:

$$(2.6) \quad A_{gi} = A_g(X_{gi}, I_i) + \epsilon_{3i}.$$

We show how the endogenous choice of type of school (public or private) can affect the estimation of 2.8 and 2.9 by explicitly modeling this choice as resulting in either self-sorting or meritocratic sorting.

Self-sorting

Assume the parent chooses an education plan for his child that maximizes the child's value of human capital, net of tuition costs. The child's human capital is denoted by school achievement A. The per unit rental rate, which converts human capital to earnings, is assumed to be constant and is given by w. We refer to the product wA as the child's lifetime earnings. The parent's problem is to maximize:

$$(2.7) \quad -T + \frac{wA}{(1+r)}$$

where T denotes tuition costs and r is the rate of interest faced by the parent. To maximize net lifetime earnings, the parent chooses from an array of public and private schooling possibilities. Over the four to six year duration of an academic secondary program, we assume that switching from public to private (or vice versa) midway through the program is not feasible. Parents lock into either a private or public school.

Among the array of schooling possibilities, suppose parent i has narrowed the choices to two, one private and one public. The (undiscounted) lifetime earnings from the private school is wA_{pi} and those from the public school are wA_{gi}. Without losing anything essential, we normalize the value of w to one dollar. Let the latent variable determining school choice be t. The parent will choose the private school if:

$$(2.8) \quad t_i = (1+r_i)(T_g - T_p) + A_{pi} - A_{gi} > 0.$$

[9] Heckman (1979) and Maddala (1983).

If we assume that $T_p > T_g$ (private schools are more expensive), then $\partial t_i/\partial r_i < 0$. A lower discount rate raises the probability of choosing a private school.[10]

In the case where capital markets are "perfectly imperfect" (in other words, one cannot borrow or lend on any terms), the equation for t is very similar. The only modification is to replace dollar values (for example, $-T_p$) with utility values ($U(-T_p)$) and the market discount rate with the subjective rate of discount for utility. With capital market imperfections, tastes affect the schooling decision. Specifically, attitudes toward delayed gratification enter the picture. We can express the discount rate (either market or subjective) as a function of family background variables, X, so that:

$$(2.9) \quad r_i = r(X_i) + \epsilon_{1i}.$$

We substitute 2.5, 2.6 and 2.9 into 2.8, and linearize the deterministic components of these equations. Our expression for the latent variable then becomes:

$$(2.10) \quad t = \alpha_o + \alpha_1 X_i + \alpha_2 I_i - \mu_i,$$

where:

$$(2.11) \quad -\mu_i = d\epsilon_{1i} + \epsilon_{2i} - \epsilon_{3i}, \qquad d = T_g - T_p < 0.$$

Equation 2.10 is the probit equation for school choice that we will use in the empirical work below.[11] The vector of error terms ϵ is assumed to be normal with unrestricted covariance matrix Σ.

Human capital, A, is proxied by achievement test scores. The estimating equations for test scores are the empirical versions of equations 2.5 and 2.6:

$$(2.12) \quad E(A_{pi}|t_i > 0) = \beta_1 X_{pi} + \beta_2 I_{pi} + E(\epsilon_{2i}|t_i>0)$$

and:

$$(2.13) \quad E(A_{gi}|t_i \leq 0) = \beta_2 X_{gi} + \beta_2 I_{gi} + E(\epsilon_{3i}|t_i \leq 0).$$

The selection problem is that the expected values of A (achievement test scores) are conditional on sector choice. Therefore, we are looking at $E(\epsilon_{2i}|t_i > 0)$ and $E(\epsilon_{3i}|t_i \geq 0)$. These terms can be written as follows:

$$(2.14) \quad E(\epsilon_{2i}|t_i>0) = -\frac{\sigma_{\mu 2}}{\sigma_2}\frac{\phi(t_i)}{F(t_i)} = -\frac{\sigma_{\mu 2}}{\sigma_2}\lambda_{pi} = c_p\lambda_{pi}$$

and:

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[10] This model is a variant of the educational choice model used by Willis and Rosen (1979), which in turn is based on the seminal work of Roy (1951) on occupational choice. Other applications of the Roy model include Borjas' (1987) analysis of immigrant earnings and Lee's (1979) work on unionism and wage rates.

[11] Note that the school choice equation contains the student-specific family background and ability variables but not school characteristics. In some of the empirical work below, we do not know the characteristics of each school considered by parents and students, only the one chosen. In the Philippine case, we know the relative cost of each type of school. See Glewwe and Jacoby (1991) for a more detailed school-choice model.

$$(2.15) \qquad E(\epsilon_{3i} | t_i \leq 0) = \frac{\sigma_{\mu 3}}{\sigma_3} \frac{\phi(t_i)}{1 - F(t_i)} = \frac{\sigma_3}{\sigma_3} \lambda_{gi} = c_g \lambda_{gi}$$

The terms λ_{pi} and λ_{gi} are the inverse Mills ratios that will be estimated in the first stage of Heckman's (1979) generalized Tobit. The inverse Mills ratio term is the ratio of the ordinate of the standard normal density at (ϕ(t)) to the probability of being in the sample (F(t), 1-F(t)). The term $-\sigma_{\mu 2}$ is minus one times the covariance between the error terms in 2.10 and 2.8, and σ_2 is the standard error of ϵ_2. The ratio of the two is the coefficient λ_{pi}. The corresponding terms in 2.15 are defined similarly. The coefficients of the λ_{ji} terms are expressed more compactly as c_p and c_g. These, in turn, can be expressed as:

$$(2.16) \qquad c_p = \sigma_1 d \rho_{12} + \sigma_3 \left(\frac{\sigma_2}{\sigma_3} - \rho_{23} \right)$$

and:

$$(2.17) \qquad c_g = - \sigma_1 d \rho_{13} + \sigma_2 \left(\frac{\sigma_3}{\sigma_2} - \rho_{23} \right),$$

where the σ_k denote standard deviations of the ϵ_k, k = 1 to 3, and $\rho_{ik} = \text{corr}(\epsilon_k, \epsilon_1)$.

Formulations 2.16 and 2.17 are helpful in determining the sign hypotheses of the sample selection terms with self-sorting. First, consider the case in which private and public tuition costs are equal (d = 0). Positive selection will occur if the correlation between public and private human capital error terms, ρ_{23}, is low. Random selection will occur if $\rho_{23} = 1$ and $\sigma_2 = \sigma_3$, and mixed selection effects can occur if ρ_{23} is large and the error variances are unequal. Positive selection will occur for the high error variance sector, and negative selection will occur in the other.[12]

Now consider the case in which private school tuition exceeds that of public schools (d < 0), so that the first terms on the right-hand side of 2.16 and 2.17 are nonzero. Students from families that have low discount rates (either market interest rates or subjective rates of time preference) are probably apt to perform better academically. If this is the case, the term $\sigma_1 d \rho_{12}$ in 2.16 will be positive and $-\sigma_1 d \rho_{13}$ in 2.17 will be negative. This effect would impart positive selection effects to the private sector human capital equation and negative ones to the public sector equation.

Hierarchical Sorting

An alternative to self-sorting is a hierarchical sorting mechanism. For example, students might be allocated to schools on the basis of measured ability. For the sake of illustration, assume that $\{(1+r_i)(T_g - T_p) + K_{pi} - K_{gi}\} < 0$ - i, so that public schools dominate private ones as a human capital investment. Further assume that prices do not adjust to the excess demand for admission to public schools. Instead, the scarce slots are allocated by a test score, η_i. If η_i exceeds a threshold (say 0), the student gains

[12] The original source of these results is Roy (1951), as pointed out to us by an anonymous referee.

admission to public school.[13] Otherwise, he goes to a private school. In this "meritocratic" example, the selection rule 2.8 is replaced by:

$$(2.18)\quad t_i = -\eta_i.$$

If 2.18 is positive, the student attends a private school. Otherwise, he attends a public school. The selection terms 2.14 and 2.15 would be replaced by:

$$(2.19)\quad E(\epsilon_{2i}|t_i>0) = -\sigma_\eta \rho_{\eta 2} \lambda_{pi} = c_p \lambda_{pi}$$

and:

$$(2.20)\quad E(\epsilon_{3i}|t_i\leq 0) = \sigma_\eta \rho_{\eta 3} \lambda_{gi} = c_g \lambda_{gi}\ .$$

The terms $\rho_{\eta 2}$ and $\rho_{\eta 3}$ are the correlations between performance on the standardized test and academic performance, which, if positive, would imply $c_p < 0$, $c_g > 0$.

The values of the selection effects will depend on the institutional setup for secondary education. Freedom of school choice (subject to parental budget constraints) can produce a variety of configurations for selection effects. For example, selection effects would be positive for each sector when: (a) the conditional error variances are similar; (b) the correlation between performance is not perfect; and (c) small disparities exist between the discount rates of private versus public school families. A meritocratic system, however, would produce positive selection effects for the "elite" sector but negative ones for the "nonelite" sector.

Looking into the Private School Effect

Estimating school effects in equation 2.4 with parameters estimated from 2.5, 2.6 and 2.10 allows us to attribute differences in achievement only to the type of school. But what is it about each school type that accounts for this difference? In particular, two important questions arise:

- If we could hold constant for observed school characteristics, would private schools effects persist? If not, then if the effects are positive, public schools could copy the observed characteristics.

- Can some of the private schools effects be attributed to peer group rather than school characteristics? To address these questions, we modify the basic model in equations 2.5 and 2.8 by including school attributes and peer group effects where the data allow.

[13] Our notation, which suggests that the admissions test score is unobserved, is intentional. The data set we use below does not have information for pre-secondary performance and hence cannot model school admission behavior in terms of observed variables.

3

Colombia

In this chapter, we will first review the evolving role of public and private education in Colombia. We then discuss the data and review the results of the statistical comparison of public and private schools and their relative effectiveness.

Private and Public Education: Relative Sizes and Shifting Roles[14]

Since Colombia gained its independence from Spain in 1819, the Roman Catholic Church has played a significant role in the affairs of the state. Nowhere is this influence more obvious than in the realm of education. During colonial rule, religious communities supported by the Government of Spain provided secondary education only to boys from wealthy families. A close relationship, known as "Regio Patronato," existed between the state and the Catholic Church. Accordingly, the state declared itself the defender and protector of the Church and provided for all the Church's material needs.

As institutions of secular education began to emerge early in the Republic, the stage was set for years of dispute between the priests and the secularists for the control of education. This conflict has even been reflected in the Republic's Constitution. In 1843, a conservative government amended it to state unequivocally that: "The Roman Apostolic Catholic Religion is the only one whose practice is supported and maintained by the Republic." Ecclesiastical authorities claimed that this clause gave them the right to direct and control education at all levels. However, in 1853, a liberal government added the clause: "The Republic guarantees all citizens [the right] to give or receive whatever instruction they see fit, provided it is not funded by public funds."

1819 to 1886

In the early days of the Republic, the great majority of schools in Colombia were rudimentary and ill-equipped due to the shortage of trained teachers and the poverty of the country following the war of independence. Although most schools were run by the Church, the influence of the Church on education weakened slightly for two reasons. First, many of the top clergy had been sympathetic to the Spanish, and they left the country after the war. As a consequence, some customs were relaxed a little in several

[14] This section draws from Losada and Rodriguez (1990).

communities. Second, between 1830 and 1850, there were various attempts to develop a network of educational establishments run directly by the government to teach the natural sciences, a subject scorned by the Catholic schools. This emphasis on science stemmed from the influence of rationalist ideas on several of the early presidents of the Republic. Meanwhile, the first private secondary schools unconnected to any religious community were established, but this phenomenon failed to become popular.

In the middle of the 19th century, the government abandoned the Patronato and acquired greater control over education at all levels, though lack of funds still severely limited its ability to make any major improvements. However, in 1870, a significant attempt was made to modernize primary education. Despite strong opposition from the Church, this reform increased the number of students attending primary schools from an annual average of 25,000 between 1836 and 1873 to about 80,000 in 1886. Although no hard data exist, the increase in primary students is likely to have caused a concomitant increase in the numbers of students attending secondary schools.

1886 to 1930

In the mid-1880s, after a civil war, the conservatives came to power in Colombia and wrote a new centralist constitution. In the area of education, the new constitution made publicly funded primary school free of charge and noncompulsory. It solidly supported private education at all levels and stated that: "Public education shall be organized and managed in concordance with the Catholic Religion." This was reinforced by the Concordat of 1887 signed by Colombia and the Vatican. Thus, this period saw a marked proliferation of secondary schools organized by religious communities. These schools charged tuition, and they were targeted mainly at the upper and middle classes in the most developed areas of the country.

In the first half of this century, four types of private secondary schools existed: (1) Catholic, clergy-run schools (by far the largest category); (2) Catholic schools run by the laity; (3) liberal, anti-Church schools; and (4) foreign nonreligious schools. Together they accounted for about 70 percent of secondary school students. The remaining 30 percent of students attended so-called "public" schools whose actual nature tended to be ambiguous. They were owned and partly funded by the government, but they were fully administered by religious communities. In most cases, both public and private schools were small, the quality of their teaching was poor and they did not offer the complete range of grades. "Complete" secondary schools were usually located in the major cities, and the best schools tended to be run by the religious orders.

Under the Church's influence, there had been a bias toward the humanities in the curriculum of most schools. However, during the 1920s, a number of private initiatives were taken to set up more commercial schools that were not subject to inspection by the ministry and were not under the Church's control. In 1927, the government decided that secondary education should be privatized, an extreme point in the drastic fluctuations in education policy that ensued over the next 30 years.

1930 to 1957

During this time, there were no fewer than 12 education reforms, most of which took place during the liberal government of 1934 to 1938. Three of these were of particular significance.

First, in 1935, the Ministry of National Education imposed on public and private schools, a common

curriculum that was attacked by the Church for its secular character and its emphasis on the natural sciences. Second, the constitutional reform of 1936 deleted all reference to the state's responsibility for protecting and respecting Catholicism. Third, a few "colegios nacionales" (national schools) were founded, which were to be totally supported and administered by the state, and a number of private schools were nationalized. The aim of these changes was to provide better access to education for lower-income students in urban areas.

Meanwhile, the Church started a counteroffensive, establishing new religious schools and warning parents against the pernicious effects of the secondary education provided by the state. Then, in the early 1950s, the political pendulum swung back to the conservatives who repealed some of the laws passed during the previous decade and returned the control of certain nationalized schools to the Church.

Despite the political turmoil, between 1930 and 1957, there was a fivefold expansion in the number of students enrolled in Colombia. At the secondary level, the private sector grew more rapidly than the public sector. Between 1950 and 1957, 264 new private schools were founded to reach a total of 989. This total constituted 67 percent of the entire secondary school sector. (In 1940, religious schools made up 56 percent of private schools; by 1963, this had dropped to 40 percent.) The irony was that private schools were receiving higher government subsidies than public secondary schools.

1957 to 1990

From the late 1950s onwards, the education system expanded significantly at all levels. The public secondary school system grew gradually until it matched the private sector in numbers of schools, teachers and students. By the late 1980s, only 40 percent of all secondary school students (compared to 63 percent of students in both primary and secondary) were enrolled in private schools, which today are concentrated in urban areas. However, most of the schools with good academic reputations still tend to be in the private sector.

During this time, the Ministry of Education expanded its mechanisms for controlling private education, particularly by imposing stricter conditions on granting operating permits and by first freezing and then monitoring annual increases in school fees. At the end of the 1960s, the government instituted formal state examinations in order to certify that students possessed the requisite level of education necessary for university entrance. Initially, these exams were optional, but during the 1980s they became compulsory for anyone wishing to enter university. The academic performance of secondary schools is evaluated (as high, average or low) by means of the scores their students achieve on the Servicio Nacional de Pruebas (SNP) scale. Comparing the national results for 1981 and for 1987 shows a general improvement in the overall quality of education provided, with a 24.3 percent increase in the number of schools achieving a high performance rating. While private school students generally achieve higher averages than do their public school counterparts, these gross averages are not strictly comparable because they do not take into account students' background. This comparison is the subject of the rest of this chapter.

Summary of the Present Situation

Secondary education in Colombia has exhibited sustained growth in both the private and the public sectors during the 170 years of the Republic. State participation in the education system was minimal until early this century, but it increased in the 1930s. By the 1980s, it had overtaken the private sector in terms of both numbers of schools and numbers of students.

In both sectors, the best schools tend to be located in the large urban centers, particularly in Bogota. Private schools are perceived to be overrepresented among high-quality schools because of their demanding selection criteria for both students and teachers. While private education enjoys greater social acceptance, certain public schools have gained increasing acceptance over the last three decades, and students at these schools are also given a certain amount of social prestige because of their high level of academic achievement. But, once student selection is taken into account, does this advantage persist? The rest of the chapter addresses this question.[15]

Data and Specification

Sample

The data for Colombia come from a 1981 World Bank international study of diversified (in other words, academic plus vocational) schools (Psacharopoulos and Loxley, 1985). The diversified schools study sample included students from 16 diversified schools and 113 comparison schools chosen on the basis of their similarity to the diversified schools in terms of the subjects they offered and their geographic proximity. Data for the present study came from the 1,471 students enrolled in the 35 academic comparison schools. This chapter uses data on the 1,004 students for whom both aptitude and achievement test scores were available.

Student Achievement

Locally developed academic achievement tests measured skills taught in biology, chemistry, mathematics and social sciences. The measure used in this chapter is an aggregate, standardized to a mean of 50 and a standard deviation of 10.

Student Aptitude

Aptitude tests previously administered to students in secondary schools were extracted from student records and matched with students in the sample. These tests of verbal and quantitative aptitude were believed to be unrelated to any particular curriculum in order to serve as a measure of innate ability.

Student Background Characteristics

Background information about each student includes gender, urban or rural place of birth, number of siblings, primary- and secondary-level grade repetition, paternal occupational status, maternal and paternal educational attainment, paternal income, family ownership of automobile, family ownership of business, number of books in the household and the size of city in which the school is located. All but the number of siblings and paternal income are categorical variables.

School Characteristics

Two school characteristics are included: the average salary of teachers in the sample schools and the student-teacher ratio. They are proxies for school resources spent on students, which hence may be

[15] The rest of this chapter is taken from Cox and Jimenez (1991).

considered measures of the quality of school inputs. Most research (for example, Hanushek, 1986) finds little relationship between these particular school characteristics and student achievement.

Basic Results

Means and standard deviations of the above variables, for each school type (private and public), are shown in Tables 3.1 and 3.2. Private school students have better family backgrounds than public students. Fathers of private school students have incomes that are almost twice those of public school students. Parents of private school students have more education than those of public school students. A greater proportion of private school families live in a large city and own a car. Average aptitude scores are similar, but private students have a 2.4 point advantage in average achievement test scores. With respect to school characteristics, mean teacher salaries in public schools are much higher than those in private schools (among non-missing values), and a greater proportion of private schools do not report mean teacher salary. Student-teacher ratios are lower in private schools.

Selection into Private Schools

The first task is to specify the vector of variables that will enter the probit equation for school choice. The choice of variables fits the ideas discussed above. The probit contains a vector of family background variables and an ability proxy (whether the student repeated a primary grade).[16]

The next task is to specify the achievement test score equation—the empirical version of equations 2.5 and 2.6. Achievement test scores are a function of student ability (verbal and quantitative aptitude) and school characteristics. Student ability is measured by aptitude test scores (mathematical and verbal) and whether the student repeated a secondary-level grade. Indicators of school "quality" are the average salary of the teachers and student-teacher ratio.

As with most two-stage selection models, identifying equations 2.5 and 2.6 is a possible issue. We initially achieve identification by including vectors of family background and income variables in the

[16] Ideally, a pre-secondary IQ-type ability variable would be desirable, such as the aptitude test scores from secondary school. If aptitude is time invariant, this variable would be acceptable for the probit equation. Because performance on the test could be influenced by the quality of the secondary school, however, we take the conservative approach and use only the primary repeat variable as a proxy for pre-secondary ability.

Table 3.1. Student Background and Achievement in Private and Public Schools, Colombia, 1981[a]

Variable definition	*Private*	*Public*
Student achievement score (points)	50.80	48.40
	(8.54)	(10.67)
Resident in large city	52.9	30.3
Urban residence	89.5	82.0
Male	42.6	41.0
Number of siblings	4.8	5.2
	(2.9)	(2.8)
Repeated primary grade	20.3	16.6
Repeated secondary grade	36.9	34.1
Verbal aptitude (points)	51.1	50.5
	(9.6)	(10.0)
Quantitative aptitude (points)	50.8	51.2
	(9.4)	(10.4)
Mother's education		
Less than primary or missing data	25.5	40.3
Completed primary	19.9	28.9
Some secondary	27.3	17.1
Completed secondary	22.7	9.0
Some tertiary	1.9	1.9
Completed tertiary	2.7	2.8
Father's education		
Less than primary or missing data	24.7	36.4
Completed primary	16.3	27.0
Some secondary	24.9	19.4
Completed secondary	16.8	8.5
Some college	4.6	3.5
Completed college	12.7	5.2
Father's occupation		
Agriculture	17.2	14.5
Laborer	5.3	16.4
Employee	35.2	32.7
Self-employed	25.9	25.8
Owner	13.4	8.5
Father's income (in pesos) [b]	34,114.0	17,610.0
	(47,898.0)	(19,959.0)
Father's income missing	26.6	23.7

Table 3.1 (continued). Student Background and Achievement in Private and Public Schools, Colombia, 1981

Variable definition	*Private*	*Public*
Family owns car	43.3	22.5
Family owns business	23.5	17.1
Number of books in household[d]		
More than 100	37.1	28.2
50 to 100 books	23.0	20.6
25 to 40 books	35.2	43.1
10 to 24 books	4.6	8.1
0 to 9 books	..	..
λ	0.56	0.77
	(0.29)	(0.38)
Number of observations	582	422

Note: .. not applicable.

[a] All means are percentages unless otherwise indicated. Numbers in parenthesis are standard deviations for continuous variables.

[b] Computed for nonmissing values.

[d] Computed from probit equation in Table 3.3.

Source: Cox and Jimenez (1991).

Table 3.2. Characteristics of Private and Public Schools, Colombia, 1981[a]

Variable definition	*Private*	*Public*
Average teacher salary in pesos[b]	10,752	20,659
	(15,667)	(15,053)
Teacher salary		
Greater than median salary (16,130 pesos)	3.4	55.9
Less than or equal to median salary	39.5	17.5
Missing	57.0	27.0
Student-teacher ratio (students)[b]	19.9	23.3
	(5.2)	(5.7)
Student-teacher ratio (STR)		
STR > 26	10.0	28.4
21 < STR ≤ 26	10.1	13.3
18 < STR ≤ 21	11.1	23.0
STR ≤ 18	23.5	19.1
Missing	45.2	16.1

[a] All means are percentages unless otherwise indicated. Numbers in parenthesis are standard deviations for continuous variables.

[b] Computed for nonmissing values.

choice equation but not in the achievement equations. However, it is also possible that background characteristics indirectly affect achievement as, for example, better educated parents might give higher quality help to their children. To account for this possibility, we test the robustness of the model by changing the specification of the achievement equations. Background variables from the probit equation are entered in the achievement equation to test for any significant changes in the signs and magnitudes of the coefficients and in the private school effect. The probit analysis is presented in Table 3.3. If the father is a laborer, the probability of choosing a private school is reduced from the sample mean of 58 percent to 29 percent. A 10,000-peso increase in the father's income increases the probability of choosing a private school by five percent. The student ability measure, having repeated a primary grade, is positive and marginally significant, suggesting that being a less able student increases the probability of going to a private school.

Student Achievement in Private and Public Schools

The estimates that interest us most are the achievement test score equations shown in Table 3.4. First, the coefficients of the selectivity terms indicate positive and statistically significant selection bias for both private and public school students. For private school students, the selection bias is equal to 1.33 achievement test points.[17] For public school students, the selection bias is larger—3.14 achievement test points. Net selection bias, therefore, favors public school students.

Performance on the verbal aptitude test is a strong determinant of achievement test scores. Quantitative aptitude is a weaker variable. Males score significantly better than females in private schools but not in public schools. Mean teacher salaries are strong determinants of achievement test scores. Above-median teacher salaries raise public school achievement test scores by almost five points; median or lower teacher salaries reduce private school achievement test scores by 3.2 points (the reference category is teacher salary missing). Student-teacher ratios also affect achievement test performance. For public school students, being in large classes clearly hurts test performance; these students have an achievement test average that is 6.5 points lower than students in schools in the reference category (student-teacher ratio missing). The student-teacher ratio pattern is non-monotonic for both private and public school students, but the general pattern reveals that private students tend to perform better in larger classrooms while public students tend to perform better in smaller ones.

Achievement Differences

Do private schools offer an achievement advantage? To answer this question, we must use the estimates from Table 3.4 to calculate standardized private/public achievement test differences. By way of preview, the answer is yes; a large private school achievement advantage exists.

[17] Coefficient of lambda times mean value of lambda for each subsample. Note that, in each generalized Tobit estimate, a generalized least square procedure is used to adjust standard errors for possible heteroscedasticity associated with using Heckman's (1979) two-stage technique.

Table 3.3. Choice of Private or Public Schools: Probit Equations, Colombia, 1981 (private = 1)

Variable	*Coefficient*	*Asymptotic t-statistics*
Constant	-0.64	-2.62
Resident of large city	0.65	7.27
Urban residence	0.07	0.53
Male	0.07	0.89
Number of siblings	-0.02	-0.95
Repeated primary grade	0.19	1.72
Mother's education		
Complete primary	0.07	0.56
Some secondary	0.33	2.34
Completed secondary	0.44	2.55
Some tertiary	-0.45	-1.40
Completed tertiary	-0.48	-1.69
Father's education		
Complete primary	-0.05	-0.35
Some secondary	0.17	1.24
Completed secondary	0.33	1.88
Some tertiary	-0.03	-0.14
Completed tertiary	0.38	1.77
Fathers's occupation		
Agriculture	-0.01	-0.07
Laborer	-0.76	-3.88
Employee	-0.27	-1.74
Self-employed	-0.32	-2.06
Father's income missing	0.40	3.20
Father's income	0.13×10^{-4}	4.14
Family owns car	0.37	3.43
Family owns business	-0.06	-0.49
Number of books in household[a]		
51-100 books	0.12	1.01
11-50 books	0.12	1.09
1-10 books	0.17	0.85
Log likelihood	-574.09	
Number of observations	1004	

Source: Cox and Jimenez (1991).

Table 3.4. Achievement Functions for Private and Public Schools, Colombia, 1981

Explanatory variable	*Private*		*Public*	
	Adjusted (1)	*Unadjusted (2)*	*Adjusted (3)*	*Unadjusted (4)*
Constant	28.28	29.66	16.25	19.29
	(12.39)	(6.46)	(6.46)	(7.86)
Verbal aptitude	0.35	0.35	0.47	0.49
	(9.53)	(9.93)	(10.88)	(10.89)
Quantitative aptitude	0.05	0.05	0.07	0.06
	(1.30)	(1.34)	(1.69)	(1.49)
Male	1.79	1.73	-0.325	-0.31
	(3.11)	(2.98)	(-0.42)	(-0.39)
Repeated secondary grade	-0.20	-0.33	0.61	0.46
	(-0.29)	(-0.48)	(0.80)	(0.58)
Teacher salary more than 16,130 pesos	0.98	0.14	4.79	6.93
	(0.40)	(0.06)	(3.21)	(4.89)
Teacher salary 0 - 16,130 pesos	-3.18	-3.35	-0.19	1.02
	(-2.46)	(-2.56)	(-0.12)	(0.67)
Teacher-student ratio > 26	2.09	2.64	-6.51	8.76
	(1.14)	(1.43)	(-3.57)	(-4.94)
21 < Student-teacher ratio ≤ 26	7.64	7.37	2.46	0.52
	(4.50)	(4.31)	(1.49)	(0.32)
18 < Student-teacher ratio ≤ 21	0.02	0.40	-1.37	-4.01
	(0.01)	(0.24)	(-0.72)	(-2.19)
Student-teacher ratio ≤ 18	1.86	1.62	3.36	2.71
	(1.74)	(1.50)	(2.25)	(1.79)
λ	2.38	..	4.07	..
	(2.12)	..	(3.85)	..
R^2	0.23	0.22	0.55	0.53
F	15.09	16.07	45.57	47.19
N	582	582	422	422

Notes:
.. not applicable
Numbers are regression coefficients with t-statistics in parentheses.

To calculate the standardized private public achievement test differences, first consider the predicted achievement test scores from Table 3.4:

$$(3.1) \quad \textit{PRIVHAT} = \hat{b}_p \bar{x}_p + \hat{c}_p \hat{\lambda}_p$$

$$(3.2) \quad \textit{PUBHAT} = \hat{b}_g \bar{X}_g + \hat{c}_g \hat{\lambda}_g.$$

PRIVHAT denotes the predicted value of the achievement test evaluated at private sample means. Let subscript j = p,g. The $\hat{b}_j$ denote estimated coefficient vectors (including constant terms but not selectivity terms), and the $\hat{c}_j$ denote the coefficients on the selectivity terms. The $\bar{X}_j$ are vectors of mean values of the explanatory variables, and the $\bar{\lambda}_j$ are the average values of the inverse Mills ratio terms.

Now consider the difference, PRIVHAT - PUBHAT = Δ :

$$\Delta = \hat{b}_p \bar{X}_p + \hat{c}_p \bar{\lambda}_p - \hat{b}_g \bar{X}_g - \hat{c}_g \bar{\lambda}_g.$$

It is convenient to rewrite Δ as:

$$(3.3) \quad \Delta = [\hat{b}_p(\bar{X}_p - \bar{X}_g) + \hat{c}_p(\bar{\lambda}_p - \bar{\lambda}_g)] + [(\hat{b}_p - \hat{b}_g)\bar{X}_g + (\hat{c}_p - \hat{c}_g)\bar{\lambda}_g].$$

The first bracketed term in equation 3.3 is the portion of the private-public difference explained by differences in endowments. The second bracketed term is the standardized private-public difference, taking sample selection into account. This is the main term of interest. Having set aptitude and school characteristics equal to public school means, it shows the private school effect on achievement test scores.

First, we focus on the term $(\hat{b}_p - \hat{b}_g)\bar{X}_g$. This term represents the unconditional private school effect. Consider a sample of both private and public school students. Now, focus on the subset of those with the average characteristics of public school students, in other words, standardize according to public school means. Pick at random an individual from this subset and predict a private-public difference for him. Based on the estimates in Table 3.4, the estimated value of $(\hat{b}_p - \hat{b}_g)\bar{X}_g$ is 5.820. This is the unconditional private school effect on achievement test scores.

Now, consider a different experiment. Start with the same subset of individuals (both private and public) with the mean characteristics of public school students. Now, delete the private school students and consider only the public school students. This is a conditional experiment where the private school effect is calculated for an individual chosen at random who has already opted for public school. Based on the estimates in Table 3.4, the estimated value of this conditional private school effect, $(\hat{b}_p - \hat{b}_g)\bar{X}_g + (\hat{c}_p - \hat{c}_g)\hat{\lambda}_g = 4.512$. The conditional private school advantage is less than the unconditional one because, though positive self-selection exists in each sector, it is larger for public school students.[18]

[18] We also estimated the generalized Tobits for different subsamples in Colombia. Suppose we consider all students, including those who did not take the aptitude tests. The sample size is 1,471. When the missing values of the aptitude tests are set to zero, two interesting results arise. First, the achievement scores for those who did not take the aptitude test are 2.75 points lower than the average for private students. In contrast, the achievement scores are 1.75 points higher than average for public school students who did not take the aptitude tests. Further, when nontakers of the aptitude tests are added to the public sample, the coefficient of the selectivity variable shrinks dramatically.

Next, we analyze the standardized private school advantage by school characteristics. These estimates, conditional on self-selection, are presented in Table 3.5 for different values of teacher salary and student-teacher ratio.

The way to read the table is as follows. Suppose we have a sample of students who chose public school and whose characteristics are equal to public school means, except that they are attending school where the teacher salaries are above the sample median and the student-teacher ratio is greater than 26. The first entry in the Table 8.78 is the estimated conditional private school advantage for this group.

The higher student-teacher ratios are and the lower mean teacher salaries are the larger the private school advantage will be. In a nutshell, private schools exhibit a stronger advantage under what seem to be adverse conditions. The estimated private school advantage is highest (12.59) when student-teacher ratios are greater than 26 and teacher salary data are missing and is lowest (1.47) when student-teacher ratios are less than 19 and teacher salaries are above the median.

Next, we turn to the simple OLS estimates in Table 3.4 (columns 2 and 4). The OLS estimates roughly mirror the patterns found in the adjusted equations, but some numerically important estimation differences arise (for example, the teacher salary and student-teacher ratio coefficients for public school students). The estimated private school effect from the OLS equations (standardizing by public school means) is 3.78. This number has no behavioral interpretation, however, because sample-selection effects are not taken into account.

Table 3.5. Private School Advantage by School Characteristics

	Teacher salary		
	Above median	*At or below median*	*Missing*
Student-teacher ratio (STR)			
STR > 26	8.78	9.59	12.59
21 < STR ≤ 26	5.35	6.17	9.16
18 < STR ≤ 21	1.58	2.39	5.39
STR ≤ 18	-1.47	-0.50	2.48
STR missing	0.18	1.00	3.99

Finally, let us consider an index number issue. If we repeat the entire private-public difference calculation above but standardize by private school means, the estimated private school advantage is larger. The estimated unconditional private school advantage is 8.38 and the conditional private school advantage is 7.43. The estimated private school effect depends on the index chosen.

We then enter teacher salary and student-teacher ratio linearly rather than as dummies (Table 3.6, columns 1 and 3). Missing values are set to sample means and flagged by "teacher salary missing" and

Table 3.6. Achievement Functions for Private and Public Schools, Colombia, 1981

	Private		Public	
	(1)	*(2)*	*(3)*	*(4)*
Constant	25.97 (9.45)	30.10 (14.01)	24.94 (7.81)	10.04 (4.34)
Verbal aptitude	0.34 (9.04)	0.34 (9.12)	0.49 (10.96)	0.58 (12.47)
Quantitative aptitude	0.04 (0.99)	0.04 (1.09)	0.07 (1.70)	0.09 (2.06)
Male	1.72 (3.01)	1.64 (3.09)	-0.94 (-1.20)	-0.90 (-1.10)
Repeated secondary	-0.54 (-0.78)	..	0.71 (0.89)	..
Teacher salary	-0.99×10^{-4} (-1.11)	..	0.40×10^{-3} (4.34)	..
Teacher salary missing	2.97 (2.61)	..	1.57 (1.12)	..
Student-teacher ratio	0.26 (2.69)	..	-0.55 (-7.26)	..
Student-teacher ratio missing	-2.33 (-2.10)	..	-2.58 (-1.77)	..
λ	0.65 (0.59)	0.95 (0.87)	2.04 (1.62)	6.28 (6.19)
R^2	0.19	0.17	0.52	0.44
F	14.61	29.95	49.98	81.98
N	582	582	422	422

Notes:
Alternative specifications of school characteristics; teacher salary and student-teacher ratio entered as continuous variables.
Numbers are regression coefficients with t-statistics in parentheses.

"student-teacher ratio missing." This specification makes it easier to gauge the effects of teacher salary and student-teacher ratio, though it is less preferable because we know the effects of student-teacher ratio are nonlinear. Notice that student-teacher ratio has opposing effects on achievement test scores: positive for private schools and negative for public schools. In addition, teacher salary is slightly negative for private schools. Also, note that, in this specification, the inverse Mills ratio terms are positive but are not statistically significant. The probit from Table 3.3 was used to generate the selectivity terms.

The final specification is presented in Table 3.6, columns 2 and 4. In this specification, the school characteristics, teacher salary and student-teacher ratio, are deleted. Only aptitude test scores, the gender dummy, and the selectivity variables are included. The rationale for this specification is to calculate the private school effect but not to condition the effect on school attributes. In other words, here we view the private school effect as a "black box." The effect may come from differences in measured school attributes, like student-teacher ratio, or it may come from unobserved attributes, such as differences in disciplinary policy.

Repeating the calculation based on equation 3.3 yields the following results. First, the specification gives an estimated unconditional private school effect of 7.84. The comparable figure based on the original specification (Table 3.4) is 5.86. Leaving out school attributes raises the unconditional differential. The estimated net selectivity effect in this specification is larger as well, indicating that the selectivity terms are picking up some of the effects of those school attributes that have been omitted. The part of the achievement differential that reflects selection bias is 5.40 points in favor of public school students. The conditional private-public effect, therefore, is 2.44. The comparable figure from Table 3.4 is 4.55. In sum, deleting school characteristics from the achievement test equations raises the estimated unconditional private school advantage but lowers the conditional one.

The Relative Costs of Public and Private Education

For a more complete picture of the relative efficiency of public and private schools, it is important to examine their relative costs. Although the original data base did not obtain cost data from the schools, we rely on a recent study (Gomez, 1988) of a sample of secondary schools that proportionally represented the types of schools found in the public and private sectors.

The results are summarized in Table 3.7. They indicate that the average cost per student in the public sector is about 10 percent higher than in the private sector. The difference is due mostly to the payments for teachers and direct supervisors, rather than for administration and other expenditures (including maintenance). In public schools, the student-teacher ratio is lower, the ratio of teachers to supervisors is lower and the average level of formal training is higher.

Table 3.7. Costs and Characteristics of Public and Private Schools, Colombia, 1987
(thousands of pesos)

Variable definition	*Private*	*Public*
Average cost per student	58.8	65.1
Average costs for teachers and director supervisors (e.g. principals)	49.3	72.1
Average costs for administration and other expenses	50.7	27.9
Student/full-time teacher ratio	30.3	26.7
Teachers/supervisors ratio	29	14
Percentage of teachers at or above level 10[a]	8	83.2
Number of observations	15	11

[a] Levels for teachers run from 0 to 14; higher levels reflect higher levels of formal training.
Source: Gomez (1988).

Annex: Sensitivity Analysis

In addition to the choice of school type, the choice of academic emphasis may also affect achievement. We test for this possibility by estimating a two-choice selection model using a method similar to that in Catsiapis and Robinson (1982). In addition to the probit equation for choice of school type, we also estimate a probit equation for the choice of academic stream using the full sample of 4,033 academic and nonacademic students. Thus, two selectivity variables, corresponding to each of the choice equations, are generated and entered as explanatory variables in the achievement equations. To conserve space, we do not present the estimated equations, which are available upon request. This multiple sample selection model produces results that are very similar to the original ones. The selection terms are positive, significant and of the same order of magnitude as before. The private school effect, evaluated at the public school mean, is also positive and significant, although somewhat smaller than before. We conclude that our results are insensitive to the selection effects associated with choice of academic emphasis in Colombia.

We further test the robustness of these results in terms of the specification of the probit and achievement test equations. As mentioned earlier, it is possible that some background variables in the probit equation may also affect the achievement equations, possibly leading to identification problems. To test for this, we include groups of variables from the probit equation as explanatory variables in the achievement equation. We incorporate the variables in three groups. First, variables related to parental income and occupation are included, second, variables related to parental education and ownership of books are included and third, both groups of variables are included.

Our results for Colombia are relatively insensitive to such changes in specification. (The results are available from the authors.) The magnitude and direction of the selectivity variables do not vary substantially, and the private-public achievement differentials are also relatively stable. Evaluated at the mean characteristics of both private and public school students, the private school advantage persists across all specifications. The magnitude is stable, except when all background variables are included in both the probit and achievement equations (see Cox and Jimenez, 1991 for details).

4

Tanzania

The Tanzanian case stands in marked contrast to Colombia with respect to the role of public schools. At the secondary level, these schools are very selective. However, as will be shown below, the results regarding relative efficiency are roughly similar.

Private and Public Education: Evolving Sizes and Roles[19]

The earliest education available in the part of East Africa that is now Tanzania seems to have been introduced by the Arabs as early as the 12th century. Koranic schools were attached to mosques and were designed to promote Islamic religious education for boys. However, the first formal education in Tanzania—defined by a curriculum that included a core of secular subjects and by the use of the Roman script—was introduced in the mid-19th century by Christian missionaries. The first school in the country was established on the east coast at Bagamoyo by the French Roman Catholic missionaries of the Holy Ghost Order in 1862. Thereafter, the development of schools was defined by the country's colonial history.

The German Colonial Period (1885 to 1919)

By the time German rule was declared over Tanganyika after the Berlin Conference of 1884-85, five Christian missionary societies operated in the country. There are no reliable figures available to establish the number of schools and enrolled pupils at this time, but it is known that the first pupils taken on by at least three of the missionary societies were freed slaves.

In 1892, the German administration opened a state school, the first of its kind, at Tanga. The syllabus was dictated by the technical skills that were valuable to the state, which was in need of clerks, interpreters, tax collectors and customs officials. Meanwhile, the government's district officers were encouraged to begin building local schools to educate the sons of local headmen so that they could then be sent to Tanga School to be trained. They would then be able to put their new skills to good use back in their home districts.

[19] This section draws heavily from Ishumi (1990).

By 1903, the government had formalized its aims and objectives for education in the territory. These included, among others: (1) to train competent and loyal junior personnel to enable the natives to work in the government administration; (2) "to inculcate in the native a liking for order, cleanliness, diligency and dutifulness, and a social knowledge of German customs and patriotism" plus the value and respect for manual labor and punctuality; (3) to introduce the African territory into a cash economy linked to the German industrial market economy, partly by imparting essential basic skills, particularly literacy and numeracy skills such as woodwork, tailoring, shoe-making, metalwork, welding and printing; and (4) to encourage independent thinking, originality and innovativeness, and the ability to collect and present data in a logical and comprehensive manner (Cameron and Dodd, 1970).

While the German administration was setting out these goals for the state education sector, the various missionary societies continued to operate their schools independently of the state. The mission school systems tended to be decentralized, and, despite their diversity, their educational philosophies shared certain basic principles of Christian character and moral and temporal obligations.

There was a considerable degree of complementarity between the principles of state schools and mission schools. By 1914, both government and mission schools had a more or less common curriculum that featured vocational and industrial education. By this time, the state school system had grown to educate a total of 6,200 pupils (in 60 primary schools, nine central schools and the Tanga School) from a total of 1,550 in 1903 (in just 20 primary schools). In the mission schools, enrollment had increased from about 50,000 pupils in 1903 to between 110,000 and 150,000 in 1914.

The British Mandated Territory Period (1920 to 1960)

German rule over Tanganyika formally ended with the conclusion of the First World War in 1919. Due to the military campaigns that had been fought over wide areas of the territory, the system of government-provided education had collapsed. The new British administration had to start almost completely from scratch.

To the first director of education, appointed in 1920, fell the task of establishing an education system across the territory that would train Africans to fill the vacant junior positions in the civil service as well as to supply artisans for the economy. As part of the strategy to achieve this goal, the government cooperated closely with the missions during the early years of the British period. In particular, the government made grants-in-aid to mission schools in return for which the government was given the authority to inspect and supervise them. Meanwhile, in accordance with the government's philosophy of "indirect rule," a number of local native authorities were created. These authorities were encouraged to build schools, whose operating costs were met partly by local government taxation and partly by the authorities' own fundraising.

By 1934, there were more schools teaching more students than there had been in 1914—84 public schools with a total enrollment of 7,979. The state ran just over half of these schools, and local authorities ran the rest. At the same time, there were 4,473 missionary schools (the majority of which were village schools) with a total enrollment of 195,150 pupils.

The Second World War reversed some of the achievement of the previous 20 years. A number of schools closed, and, as a result of recession, the level of education financing dwindled. But after the War, in

1947, a Ten Year Plan for the Development of African Education was unveiled, marking the beginning of an integrated and coherent policy on education in the territory.

The Plan's most notable innovation was the establishment of trade schools. They were designed as a formal branch of vocational and technical education that would produce the craftsmen required by industry (mostly engineers and builders) and would turn out people who could work with "their brain as well as their hands." A technical institute was subsequently opened in Dar es Salaam as an intermediate link between these trade schools and the highest level of technical training, which was provided at the Royal College in Nairobi.

Independence (1961 to Present)

After Tanzania gained its independence in 1961, the state tried to exert more control over the education system. The government's objectives for secondary education were much influenced by the socialist slant of President Julius Nyerere. The government hoped to provide public secondary schools that would reduce elitism and prepare children for life in a classless, socialist Tanzania. Academic criteria were used to decide whether a student could enter into secondary education, though this process was somewhat tempered by a regional quota system. All fees for government secondary schools were waived, and private schools offering education only to those who could afford it were discouraged.

Between 1963 and 1980, secondary enrollment in Tanzania grew by 8 percent a year—from 17,000 to 67,000. However, enrollment in government schools increased by only 20,000 during that time and leveled off completely during the late 1970s. Budget constraints became particularly tight after the decision in 1974 to move rapidly to universal primary education. However, the main reason for slowed enrollment was the government decision to control the rate of expansion of the post-primary sector so that it produced exactly the right number of educated workers to meet the nation's manpower requirements. Therefore, the sector was not geared to meet demand, and, as a result, Tanzania now has one of the smallest public secondary school sectors in the world.

Because enrollment in public secondary schools was limited by government policy, some important nongovernment initiatives developed. First, a number of private trust schools were set up by successful business enterprises (such as trading houses, commercial farm estates and plantations) as a form of personal philanthropy. Most of the private trust fund schools were "nationalized" in 1971, which brought them under the control, financing and supervision of the central government. But it was the notion of an education trust fund that inspired a few native cooperative unions and the pan-territorial parents' association in the 1960s and 1970s to set aside money from their official activities specifically for building and running secondary schools.

The second initiative dates from the time of the severe economic problems of the 1970s and 1980s. During this time, a movement began to gather momentum throughout Tanzania that stressed mass involvement and self-help in order to improve communities. As a result, local development associations were formed that constructed and financed a number of community secondary schools. Some of these development associations have been set up with the exclusive objective of providing and expanding secondary school enrollment, while others have a number of additional socioeconomic objectives.

At first, the government tried to restrict the development of these schools because they were not compatible with the strictly planned government education system. But in 1981, in response to the

economic crisis, the government adopted a National Economic Survival Programme (NESP) that reversed many of its spending priorities in the hope of achieving renewed economic growth and a more sustainable external balance of payments. This plan meant that the government assumed a more tolerant attitude to private education initiatives. However, in the interests of coordination and comparability, the Ministry of Education has established common conditions and procedures that all nongovernment schools must follow.

Summary of the Present Situation

Since 1980, private education initiatives have increased in the secondary sector, both in the number of schools founded and of the number of school places available to qualified pupils. At that time, there were 83 public schools with 38,800 pupils and 71 private schools with 28,500 pupils. By 1989 (the latest available figures), there were 195 private schools educating 75,000 pupils, while the 124 public schools educated 57,500.

Three related factors influenced this shift: the economic decline of the early 1980s; the more open-minded attitude of the government to private initiatives; and the growth of community participation in education at the grassroots level. The goals, management style and operational standards of a number of private secondary schools have changed considerably in recent years. Nonprofit religious and community schools rather than private profitmaking enterprises now dominate the sector. This shift has led to higher overall standards and to better remuneration of teachers in the private sector.

In order to examine the relative merits of this shift, the rest of this chapter will measure the relative effectiveness of public and private schools. It will discuss the data and the results of comparing relative performance in achievement tests. It has been difficult to obtain information on relative costs, but some qualitative evidence is reviewed.

Data and Specification

As with Colombia, the data set used in this paper was generated from a World Bank study of diversified education (Psacharopoulos and Loxley, 1985).

Sample

A stratified random sample of one-third of all secondary schools and approximately 25 percent of all Form IV (11th grade) students in Tanzania was chosen; stratification was based on the dominant curriculum of the school and their public or private status. In each school, all Form IV students, up to 125 per school, were surveyed and tested in 1981 for a total sample of 4,181 students in 57 schools. Samples of students were polled a year later to collect information on their post-graduation activities. Head teachers in each school were also surveyed regarding the characteristics of their school. In this chapter, data from 1,025 students in academic tracks in 13 schools are analyzed.

The structure of the Tanzanian data set is very similar to that of Colombia. Here we note two main differences. First, aptitude test scores are available for all Tanzanian students. Second, we do not have information on whether Tanzanian students repeated primary or secondary grades.

Academic Achievement

Student scores on the Form IV examination in English, Kiswahili, mathematics and science were combined into a single measure of achievement, normalized to a mean of 50 and standard deviation of 10. This is the dependent variable in the analyses that follow.

Student Background

Student background measures include academic ability, family and community characteristics. Academic ability (verbal and quantitative) was measured by tests developed for the diversified schools study (Psacharopoulos and Loxley, 1985). Other background variables that will enter the probit equation for school choice are gender, urban residence, number of siblings, paternal and maternal education, paternal occupation, paternal income and number of books in the household. All are entered as dummy variables, with the exception of the number of siblings and the father's income.

School Characteristics

As in the Colombia case, two "school quality" variables are included: average teacher salary and the school-level student-teacher ratio.

Basic Results

For Tanzania, variable means for private and public school students are presented in Table 4.1. Private school students on average have more privileged family backgrounds than public school students. Parental education is a year greater for private school students. A higher proportion of private school fathers have a professional occupation, and their incomes are a 1,000 shillings higher than public school fathers. The number of books in the household is higher for private school students.

Although public school students come from poorer backgrounds, their average aptitude test scores (verbal aptitude and quantitative aptitude) exceed the private school average. This trend is true for achievement test scores as well, but the difference is much less pronounced. Both the average and the dispersion (standard deviation) in teacher salaries are higher for private schools (Table 4.2). The student-teacher ratio is slightly higher as well.

Selection into Private Schools

The first task is to estimate the determinants of school choice. The selection process for secondary schools works differently in Tanzania than in Colombia. In Colombia, students can freely choose between private or public schooling. The sorting model presented in the theoretical section above is most appropriate for Colombian students. However, school choice is severely limited in Tanzania's planned economy, and public sector secondary slots are controlled to prevent an oversupply of secondary

Table 4.1. Student Background and Achievement in Private and Public Schools, Tanzania, 1981[a]

Variable definition	*Private*	*Public*
Student achievement score (points)	50.60	51.80
	(10.70)	(8.50)
Urban residence	14.1	16.0
Male	66.2	61.6
Number of siblings	6.0	5.8
	(2.9)	(3.0)
Verbal aptitude (points)	48.3	51.7
	(10.50)	(10.50)
Quantitative aptitude (points)	47.0	51.3
	(10.3)	(9.4)
Father's education		
0 years	5.8	11.8
3 years	16.7	24.5
4 years	8.4	9.4
7 years	22.8	15.0
8 years	31.8	26.6
11 years	14.5	12.6
Mother's education		
0 years	9.3	22.6
3 years	29.2	28.8
4 years	15.1	14.4
7 years	23.5	15.1
8 years	18.7	15.3
11 years	4.2	3.8
Father's occupation		
Farmer	44.3	45.2
Craftsman	10.3	10.8
Teacher	7.7	6.6
Sales	14.8	8.7
Professional	13.2	8.3
Other	9.6	20.5
Father's income in shillings[b]	6121	5116
	(10427)	(10556)
Number of books in household		
More than 100	21.2	12.9
50 to 100 books	43.7	25.9
25 to 49 books	2.6	10.8
10 to 24 books	26.4	38.7
0 to 9 books	6.1	11.8
λ[c]	1.04	0.97
	(0.30)	(0.22)
Number of observations	311	713

Notes:

[a] Sample: Academic students who took college-related aptitude tests. All means are percentages unless otherwise indicated. Numbers in parenthesis are standard deviations for continuous variables.

[b] Computed for nonmissing values.

[c] Computed from probit equation in Table 4.3.

Table 4.2. Characteristics of Private and Public Schools, Tanzania, 1981[a]

Variable definition	*Private*	*Public*
Average teacher salary in shillings[b]	1316	1143
	(2291)	(596)
Teacher salary		
Greater than median salary (1,300)	12.90	48.10
Less than or equal to median salary	30.90	36.50
Missing	56.20	15.40
Student-teacher ratio (students)[b]	25.40	23.70
	(11.20)	(9.20)
Student teacher ratio (STR)		
STR $\geq$ 30	15.80	15.00
24 < STR < 30	55.60	10.70
20 < STR $\leq$ 24	6.40	24.10
STR $\leq$ 20	21.50	21.30
Missing	0.01	28.90

[a] All means are percentages unless otherwise indicated. Numbers in parenthesis are standard deviations for continuous variables.
[b] Computed for nonmissing values.

graduates.[20] Entrance into public schools is heavily determined by an examination given during the final year in primary school and by government-imposed regional quotas. Public schools are, therefore, generally perceived to be of a higher quality than are private schools. In sum, the Tanzanian selection system for public secondary schools is meritocratic, and the public sector is considered elite.

No fees are charged in public schools. Private schools are viewed as an expensive alternative for students who were not accepted to public schools and whose parents have a high demand for secondary education.

The probit equation for school type is given in Table 4.3. The probit analysis for Tanzania indicates that being male increases the probability of attending a private school. Having a mother with some education increases the probability of attending a private school, but father's education seems not to matter. Father's income is positively related to private school attendance, but the statistical significance of the coefficient is weak. Father's occupation is a strong determinant, although the effect is not linear. Students from farm, sales and professional backgrounds are more likely to attend private school than students from other backgrounds. The educational environment in the home, measured by the number

[20] For a detailed description of Tanzania's education system, see Psacharopoulos and Loxley (1985), Chapter 6. The discussion that follows is drawn from this source.

of books in the household, affects private school attendance; the higher the number of books, the larger the probability of private school attendance.

Table 4.3. Choice of Private or Public Schools: Probit Equations for Tanzania, 1981 **(private = 1)**

Variable	*Coefficient*	*Asymptotic t-statistic*
Male	0.22	2.40
Urban residence	-0.19	-1.47
Number of siblings	-0.004	-0.26
Father's education		
3 years	-0.11	-0.53
4 years	-0.04	-0.15
7 years	0.20	0.94
8 years	-0.08	-0.38
11 years	-0.23	-0.92
Mother's education		
3 years	0.54	3.41
4 years	0.38	2.08
7 years	0.66	3.56
8 years	0.57	2.95
11 years	0.64	2.26
Fathers's occupation		
Farmer	0.36	2.58
Craftsman	0.35	1.95
Teacher	0.20	0.96
Sales	0.51	2.88
Professional	0.53	2.76
Father's income	0.55×10^{-5}	1.31
Number of books in households		
More than 50	0.62	3.23
26 to 50	0.61	3.55
11 to 25	-0.42	-1.70
0 to 10	0.09	0.54
Constant	-1.70	-6.48
Log likelihood	-568.69	
Number of observations	1,024	

If public schools are indeed elite schools, the probit results suggest that the Tanzanian system for allocating students is meritocratic. Public school students tend to come from poorer, less education-oriented backgrounds.

Student Achievement in Private and Public Schools

The next task is to specify the achievement test score equation—the empirical version of equations 2.8 and 2.9. Achievement is a function of student ability and school characteristics. Student ability is measured by aptitude test scores (quantitative and verbal); school characteristics are measured by mean teacher salary and by student-teacher ratio. As with Colombia, we test the robustness of the model by changing the specification of the achievement equations. Background variables from the probit equation are entered in the achievement equation to test for any significant changes in the signs and magnitudes of the coefficients and in the private school effect.

The first and third columns in Table 4.4 show the achievement test equations adjusted for sample selection. The pattern for the selectivity terms is different for Tanzania. Recall that, in the Colombian

Table 4.4. Achievement Functions for Private and Public Schools in Tanzania, 1981

	Private		*Public*	
Explanatory variable	*Adjusted*	*Unadjusted*	*Adjusted*	*Unadjusted*
Constant	19.75	16.93	19.84	20.12
	(3.88)	(3.35)	(10.94	(11.25)
Verbal aptitude	0.24	0.24	0.23	0.23
	(5.45)	(5.51)	(8.14)	(8.11)
Quantitative Aptitude	0.36	0.35	0.35	0.35
	(8.36)	(7.96)	(11.16)	(11.11)
Male	1.75	2.12	2.50	2.52
	(2.11)	(2.51)	(2.93)	(2.94)
Teacher salary greater	12.39	11.75	1.64	1.72
than median (1,300)	(6.61)	(6.14)	(2.10)	(2.20)
Teacher salary less than	4.03	3.94	2.51	2.55
or equal to median salary	(4.00)	(3.80)	(2.05)	(2.08)
Student-teacher	2.26	1.37	-1.94	-1.99
ratio $\geq$ 30	(0.51)	(0.30)	(-2.11)	(-2.15)
24 < student-teacher	0.12	-0.54	-0.85	-0.95
ratio < 30	(0.03)	(-0.11)	(-0.95)	(-1.07)
Student-teacher	2.94	2.92	-3.07	-3.10
ratio $\leq$ 20	(1.60)	(1.56)	(-4.35)	(-4.37)
λ	-3.36	..	0.86	..
	(-2.83)	..	(0.75)	..
R^2	0.67	0.66	0.42	0.42
F	67.87	73.77	57.36	64.50
Number of observations	311	311	713	713

Note: Numbers are regression coefficients with t-statistics in parentheses.

case, we found positive self-selection for both private and public schools. Here, we find negative selectivity effects for private school students and positive selectivity effects for public school students. For private school students, the estimated selection bias is equal to -3.49 achievement test points (one-third of a standard deviation). For public school students, the comparable figure is 0.39 achievement test points. This hierarchical pattern for sample-selection effects squares with the institutional setting of the Tanzanian education system, where the public sector is an elite enclave. The pattern for sample selection in Tanzania differs from that in Colombia, where students can choose freely in which sectors to study. Recall, however, that mixed selection effects can occur with self-sorting as well.

As in the Colombian case, aptitude test scores are strong determinants of achievement test scores. Males perform better in both private and public schools in Tanzania. Teacher salaries are positively and strongly associated with achievement test scores in private schools but inversely related to scores in public schools. The variable STR is divided into half-tiles for private students and quartiles for public students. Private students tend to perform better in larger classrooms while public students perform best in intermediate size classrooms (student-teacher ratio between 20 and 24).

Our results for Tanzania, as for Colombia, are relatively insensitive to such changes in specification. The magnitudes and direction of the selectivity variables do not vary substantially. As shown in the annex, the private-public achievement differentials are also relatively stable. Evaluated at the mean characteristics of both private and public school students, the private school advantage persists across all specifications. The magnitude is stable, except when all background variables are included in both the probit and achievement equations.

Achievement Test Differentials

We use the estimates from Table 4.4 to calculate standardized private-public differences in achievement test scores. We follow the same methodology as in the Colombian case, standardizing by public school means. As in the Colombian case, private schools in Tanzania have an achievement advantage.

The unconditional private school advantage is 8.25 achievement test points or nearly one standard deviation. This is the expected private-public achievement test score difference for a student chosen at random from a group having mean public school student characteristics. The conditional private school advantage is smaller—6.34 achievement test points or 0.75 standard deviations. The reason for the smaller difference is that sample selection bias is positive for public school students but negative for private school students.

One possible reason why private students might outperform their public school counterparts is that the chances of desirable government employment or university attendance are greatly enhanced by public school credentials (Psacharopoulos and Loxley, 1985). Therefore, the marginal benefits of scholastic effort for private school students are likely to be higher than for public school students, because the latter have already been tracked onto a successful career path. This incentive would explain why an achievement score advantage exists for private schools despite their lower quality.

The coefficient of teacher salary greater than median is much larger for private than for the public students, indicating that the private school advantage is highest among schools that have the most highly paid teachers. High teachers' salaries clearly improve student performance in Tanzanian private schools.

The unadjusted OLS estimates are presented in the second and fourth columns of Table 4.4. The patterns of the estimated coefficients are similar to their generalized Tobit counterparts, but coefficient values do differ between the adjusted and unadjusted equations, particularly for the private institutions. For example, the coefficient on gender in the adjusted private sector equation (1.75) is 17 percent lower than that in the unadjusted equation 2.12. The private-public achievement test difference implied by the OLS estimates is 4.74 or about one-half a standard deviation. As before, this number has no behavioral significance because it is calculated from coefficients obtained without adjusting for selection bias.

Finally, once again note the index number problem. If we repeat the exercise above but standardize by private means, the estimated private-public difference is 6.81 or .75 standard deviations (unconditional) and 2.43 or about .25 standard deviations (conditional).

For a substantial proportion of the sample, values for teacher salary or student-teacher ratio are missing. Table 4.5 shows the achievement test regressions for samples with nonmissing values only. As in Table 4.4, the sample selection bias favors public school students. Here, the estimated sample selection bias is positive and marginally significant for public school students and negative (but insignificant) for private school students.

To illustrate more clearly the effects of teacher salary and teacher-student ratio on achievement, the two are entered as continuous variables in Table 4.5, column 1. This specification, estimated for the full sample, shows the powerful effect of teacher salary on achievement test scores for private schools. A 2,000 shilling increase in teacher salary (about one standard deviation) raises achievement test scores by about 11 points (about one standard deviation) in private schools. On the other hand, teacher salary has a negligible effect on achievement test scores in public schools. The regression also shows the positive relationship between student-teacher ratio and achievement test scores in private schools.

The final specification for Tanzania is given in Table 4.5, columns 2 and 4, with school characteristics, teacher salary and student-teacher ratio deleted. This is the same "black-box" specification used above. The black-box specification implies a much smaller standardized private-public achievement advantage. The unconditional private school advantage is 2.04 achievement test points. The conditional private school advantage is 0.68 achievement test points.

Relative Costs of Education in Tanzania

The latest figures (1987) for Tanzanian public schools indicate that the unit recurrent expenditure for secondary education was about 17,410 shillings (Tsh). It is very difficult to obtain comparable figures for private schools, and it is not possible to make any definitive statements about the relative costs of the two sectors. However, some rough indications can be obtained from small sample observations of private schools. The Kanyigo community, a group of villages in the Kagera region, formed the Kanyigo Development Association that established a school plus a few other projects. Four years after its inception in 1985, recurrent unit costs in the school were 17,360 Tsh. While Kagera is a predominantly rural area and is not representative, it does indicate that Tanzanian private education does not cost exorbitantly more than public education. Moreover, family costs (other than tuition and school fees) are roughly the same for both public and private day schools (in fact, uniform fees are higher for public schools on average). The overall picture for relative costs, however, remains the subject of additional research.

Table 4.5. Achievement Functions for Private and Public Schools, Tanzania, 1981

	Private		Public	
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*
Constant	17.91	12.12	18.91	20.22
	(4.85)	(4.66)	(7.48)	(12.94)
Verbal aptitude	0.24	0.37	0.24	0.22
	(5.51)	(7.75)	(8.33)	(8.03)
Quantitative aptitude	0.35	0.45	0.35	0.36
	(8.23)	(9.31)	(11.35)	(11.49)
Male	1.71	2.26	2.18	1.94
	(2.06)	(2.42)	(3.43)	(3.52)
Teacher salary (shillings)	0.01	..	-0.42×10^{-3}	..
	(5.67)		(-0.36)	
Teacher salary missing	0.51	..	-2.53	..
	(0.35)		(-1.32)	
Student-teacher ratio	0.15	..	0.05	..
	(2.29)		(1.17)	
Student-teacher ratio missing	1.47	..	2.76	..
	(0.31)		(2.55)	
λ	-3.32	-1.71	1.12	1.31
	(-2.78)	(-1.24)	(0.97)	(1.15)
R^2	0.67	0.54	0.41	0.41
F	75.50	91.40	62.08	121.37
Number of observations	311	311	713	713

Notes:
Alternative specifications of school characteristics; teacher salary and student-teacher ratio entered as continuous variables. Numbers are regression coefficients with t-statistics in parentheses.

Annex: Sensitivity Analysis

As we did with Colombia, we investigate the robustness of the model with respect to possible selection effects in the choice of academic stream. We implement a multiple selection model in which two selectivity terms are generated from probit equations on the choices of school type and academic stream. For the latter estimation, the full sample of 4,181 academic and nonacademic students is used. The signs and magnitudes of the selection terms do not change. Calculated at the mean public school characteristic, the unconditional private school advantage is 11.7 points with the dual selection correction, which is close to the 8.2 point advantage for the single lambda correction. The detailed results are available upon request.

In addition, we also subject the Tanzania sample to different specifications of the achievement equations by including groups of background variables used in the probit equation. Our results for private-public achievement score differentials do not change markedly. The private school advantage in test scores is relatively insensitive to such changes in specification. When father's income and occupation are added to the regressors in Table 4.4, the selection terms follow the same pattern as those reported above. When we add parent's education and number of books in the household to the regressors in Table 4.5, however, each selection term is negative. These results are available on request from the authors (see Cox and Jimenez, 1991 for details).

5

Philippines

The Philippines is our third case study involving cross-section comparisons of student achievement. The analysis roughly follows that of Colombia and Tanzania, with some important differences regarding the data base. Because the data come from different sources—a household and school matching survey—the analysis allows us to differentiate better between the equation describing the choice of school and that describing achievement. As in the other chapters, we first describe the institutional context of Philippine private education.

The Role of Private Education

When the Americans arrived in the Philippines in 1898 after overthrowing some 300 years of Spanish colonial rule, they found about 40 schools in existence. They catered exclusively to the children of the elite, who were resident Spaniards and rich Filipinos, and to children who wanted to join a religious order. These schools had been established as a result of the liberal movement of the 1860s. The schools were administered and often taught by parish priests as a part of their missionary work. They seem to have been mostly one-class schools with no structured curriculum, where pupils merely learned to read at best. By the turn of the century, schools enrolled no more than a few thousand students out of a school-age population of about 1 million.

The American Colonial Period (1898-1940)

Many of the key features of the present-day education system in the Philippines were introduced by the American colonial government of 1898 to 1940. The military government imported to the Philippines an essentially American elementary and secondary educational system, including curricula. About 700 teachers were shipped in from the United States to organize schools and to train teachers as well as to teach students. Each municipality was given an elementary school, and every province had a secondary school, though these were difficult to establish given the embryonic nature of the elementary system at that time. Consequently the secondary schools tended to provide an education equivalent to intermediate grades five to seven. Even as late as 1925, not all high schools were offering a complete secondary education.

Nevertheless, by 1923, there were 85 public high schools in operation, and enrollment had grown tremendously to 47,419 pupils (from 405 pupils in 1903 and 4,753 in 1913). When private high school

students (20,000) were included, the Philippines had a secondary school enrollment rate of 8 percent in 1923, considerably higher than that of either Britain or France.

Despite the dramatic rise in public education, the private system was also growing rapidly at the secondary level. The expansion in the public elementary system led to a large unmet demand for education from primary school graduates. The public secondary school system was unable to expand to meet this demand because of the 30 Million Peso Law, passed in 1919, which had decreed that this amount should be made regularly available to expand public elementary schools. Thus, the limited public resources available for education were concentrated on one area, leaving little room for spending on secondary or tertiary levels or on quality improvements. In the early 1920s, private education was financed by tuition and other fees, while public education was financed about 50 percent by the national budget, 30 percent by local government and 20 percent by contributions such as tuition fees and contributions in kind (for example, land or materials for school construction). But because elementary education was given priority in public funding, public high schools came to rely increasingly on their fee income until, by the 1940s, they had become largely funded by tuition fees.

There was no policy or regulatory body governing private educational institutions until 1913 when the division of private schools was established. The division granted or withheld approval to schools that applied to it for recognition, but it did not seem to use any clear quality standard. While some Catholic and Protestant-run secondary schools were of the highest standard, a majority of private schools had unsuitable buildings, large classes, poor teachers and antiquated textbooks.

Despite its rapid expansion, the public and private school system as a whole suffered from four basic flaws, which were highlighted in the Monroe Commission of the Board of Education Survey of 1925. First, the quality of education across the board was low. In achievement tests, the average English reading standard of senior high school students was only as high as that of grade five students in the United States, while their standards in history, science and the social sciences reached only the equivalent of grade seven. The teachers' scores were no higher than those of the senior students. Second, the high school curriculum was unduly biased toward academic rather than vocational subjects, due to the popularity of the white-collar jobs that the new bureaucracy had created and the negative attitude that the population had to farming and farm life. Third, the curricula for elementary and high schools were essentially transplanted directly from the American school system. There was minimal adaptation to encompass the Philippine culture and environment. In addition, faced with 43 distinct language groups and 87 dialects in use throughout the Philippines, the colonial government promoted English as the common language for official communications and for use in schools. Although this was a practical solution, the difficulty of learning through the medium of a foreign language led to a high failure rate at every high school level. Students tended not to complete their schooling until about age 21. Fourth, there was wide variation across provinces in a number of key indicators such as the enrollment rate, the socioeconomic background of students, the average performance of public school students, class size and per student cost.

Post-Independence (1946 to Present)

Public and private high schools continued to grow rapidly in the first three decades of the post-independence period. The number of public high schools grew by 3.8 times the 1923 figure, while enrollment grew 5.2 times. Private high schools expanded even faster, with corresponding rates of 6.6 and 12.6.

One reason for this growth was the creation of a national bureaucracy. Many white collar jobs became available for college graduates during the immediate post-independence period. Meanwhile, the necessary qualification for becoming a high school teacher was gradually raised to the level of a bachelor's degree. These employment opportunities were a big incentive for pupils to complete secondary education in order to be able to go on to college. However, this employment boom did not last, and, toward the end of the 1960s, high unemployment rates for college graduates concerned many policymakers. As a result, in 1970, the Presidential Commission to Survey Philippine Education was set up, the first major assessment of the system to be undertaken since Monroe. The conclusions of this commission led to two important policy changes.

First, admissions to college were restricted to those passing the National College Entrance Examination (NCEE), whose Board was given the authority to set an annual cut-off level of examinees to be admitted to degree programs.[21] The second policy change was that a 15 percent ceiling was set on tuition increases in all private schools, although subsequently this was amended to allow exceptions to be considered on a case-by-case basis. The result of this policy has been to make it extremely hard for private schools to maintain their facilities and to pay their staff competitive salaries, especially given the high inflation rates of the last decade.

In recent years, the government has also made changes in the way public schools are financed. The Free High School Law of 1987 has added the responsibility of providing free public secondary education to all qualified citizens to the 1919 commitment to provide free elementary schooling. Students who cannot be accommodated in public schools receive tuition grants so that they can enroll in private high schools. This policy, of course, has already put a considerable burden on the exchequer, and, as before, the government is defining its task in quantitative rather than qualitative terms. In the first two years, a large part of the extra appropriations went toward standardizing private teachers' salaries, which had often been lower than those of their public elementary school counterparts.

Summary of the Present Situation

The Philippines has a relatively large and very varied secondary school system. Total secondary school enrollment in 1988-89 (in 5,496 high schools) was 3.74 million students, of whom 63 percent were in the public sector. Enrollment is running at about 18 percent, which is high for a country with an annual per capita income of less than US$800. In terms of quantity, the Philippines has the most extensive schooling system of all less developed countries, and both the public and the private sectors have contributed to this. Secondary education in the Philippines is geared mainly toward providing students with general academic education for college preparation, as well as with vocational and technical training. The secondary education system provides four years of high school after six years of elementary school. Students are generally 3 to 16 years old.

[21] The cut-off fraction has tended to be quite large, ranging from 25 to 40 percent, but the law has left a big loophole. Those not admitted are still allowed to enroll in college in programs not classified as four-year or higher, and meanwhile the student can retake the NCEE an unlimited number of times. So, college enrollment rates continued to grow more or less unchecked until about 1975 when the rate began to decelerate. However, this happened not as a result of the NCEE examinations but of market forces such as the high unemployment rate, the economic crisis of 1983 to 1985 and the gradual narrowing of the differential between the wages of college educated and noncollege-educated personnel. As college enrollment started to slow, the enrollment figures for secondary schools soon followed suit.

The various secondary schools in the system can be categorized in terms of funding as follows:

- Public national high schools funded by the national government. They include those administered by the Department of Education, Culture and Sports, those attached to state colleges and universities and specialized schools.
- Public local schools funded by local government units. They include the city, municipal, provincial and barangay (village) schools.
- Private schools, which are further classified into sectarian and nonsectarian institutions.

In the school year 1983, the year our data were gathered, there were about 5,190 secondary schools nationwide. Of these, 62 percent were public and 38 percent private.

The public secondary school system derives support from two main types of sources. First, some funds are generated from within the school (6 to 19 percent), such as tuition/school fees, plus income from business-type activities, grants, loans and fundraising activities. Second, national and local governments provide aid, by way of the general tax fund and other receipts. For private schools, the financing process is relatively simple and direct. They retain all income earned—mainly from student fees, business-type activities and grants—and plow it back to the school.

The overall quality of the instruction is very low. As was the case right from the earliest days of the Philippine education system, education policy has emphasized quantitative expansion regardless of its allocative implications. Quality standards and planning and management organization have been sacrificed for this goal.

Private schools are generally perceived to be of better quality than those in the public sector, but many private schools are of the same low standard as the average provincial or municipal public school. As in earlier times, many private religious schools compare favorably to good high schools in developed countries. On the other hand, the public sector also includes some high quality special schools, such as the three science high schools and the teacher training high schools of the University of the Philippines. However, the majority of public high schools merely provide the equivalent of intermediate elementary instruction.

The generally poor quality of secondary education can be crudely measured by looking at the performance of senior high school students in the NCEE. Their scores vary widely, from 740 out of 1,000 to 406, but a large majority of students perform poorly, scoring fewer than 500 points. Among private schools, the best scores usually come from religious schools, while the nonreligious schools produce scores that are more evenly distributed. Public schools, with the exception of the three science high schools, generally tend to produce scores that are low in the distribution.

Table 5.1. Public and Private Secondary Schools and Enrollments, Philippines, 1910-1989, Selected Years

Year	Number of schools		Enrollments	
	Public	*Private*	*Public*	*Private*
1913	..	30	4,753	2,585
1923	86	142	47,419	19,406
1936	118[a]	..	58,000[a]	30,000[a]
1946	151	..	155,000[a]	132,000[a]
1955	356	1,246	187,373	372,495
1965	521	1,541	318,498	643,061
1975	2,825	2,019	975,356	1,136,820
1985	3,399	2,076	1,957,444	1,365,619
1989	3,347	2,149	2,354,620	1,382,484

Note: .. not available.
[a] World Bank (1988).
Source: Tan (1991) unless otherwise indicated.

In the rest of this chapter, we will conduct an analysis to see whether such comparisons of gross averages still hold up when background and selection are taken into account.[22]

Data and Sample

The data used in our regression analysis were obtained from the Household and School Matching Survey (HSMS). These data were collected to provide integrated baseline information for policy analysis and for the impact evaluation of the Program for Decentralized Educational Development (PRODED). They include socioeconomic, demographic and education-related information at the level of the community, school, household and individual.

Sample

The data were collected nationwide between May 1982 and December 1983 from 260 barangays (villages) and 4,990 households, which were chosen on the basis of a two-stage stratified random sampling of households within barangays. At the first stage, a random sample of 20 barangays was drawn from each

[22] The rest of this chapter is taken from Jimenez, Paqueo and de Vera (1988).

households within barangays. At the first stage, a random sample of 20 barangays was drawn from each region, stratified according to urban and rural and affected and unaffected by PRODED. At the second stage, a random sample of the households was drawn from the sampled barangays. One consequence of this sampling strategy is that urban areas are somewhat overrepresented in the sample. The sample children for the study were identified from the lists of the members of each sample household. After deleting from the sample children who were not in high school and those who had incomplete information, we were left with a sample of 446 students for the analysis.

Achievement Test

About 62 percent of the children completed an educational achievement test during the last quarter of the school year 1982-83. The other children were not examined because they moved their place of residence, because they refused or because they could not be located. The test employed to measure educational achievement was the Philippine Educational Placement Test, a timed battery of subtests developed by the National Educational Testing Center of the Ministry of Education for its annual Accreditation and Equivalency Program. It is designed to measure the grade (or year) level of learning performance of early school-leavers. Subtests include mathematics, English and Filipino, each of which consists of items that broadly cover the hierarchy of learning objectives as defined in the learning continuum from grade one to fourth-year high school examinees are allowed 90 minutes per subtest and are directed to answer as many items as they can.

Student Background

Data from the household survey included information about the student's age, gender, birth order, mental ability, year in high school and exposure to media. It also included information about the household including assets, income, parental education, distance of home to school and availability of electricity. Some community information was also included, for example, its rural or urban location.

Basic Results

Of the 446 sample secondary students, 302 (68 percent) attended public schools and 144 (32 percent) attended private schools. Among the public school students, 57 percent lived in urban communities and 43 percent in rural communities. Of the private students, 63 percent came from urban communities and 37 percent from rural communities.

The mean characteristics of our sample secondary students, by school type, are presented in Table 5.2. The table shows that the average grade equivalency for private school students, compared to public school students, is higher for mathematics and English and lower for Filipino. The differences are substantial: 0.64 standard deviations, 0.81 standard deviations and 1.06 standard deviations respectively. However, these differences cannot immediately be taken as conclusive evidence that one school type is more or less effective than the other for a number of reasons. First, the students attending private schools attained more years of education than students attending public schools. As shown in the same table, almost a quarter of the private school students were already in their third or fourth year, compared to only about a tenth of the public school students. With respect to performance on mental ability tests, the mean score for private students is higher than for public school students by 0.37 standard deviations.

Table 5.2. Student Background and Achievement in Private and Public Schools, Philippines, 1981

Variable definition	*Private*	*Public*
Achievement test score		
Mathematics	5.99	4.58
	(2.23)	(2.19)
English	5.52	3.90
	(2.30)	(2.01)
Filipino	2.38	4.72
	(1.66)	(2.21)
Student background		
Household assets (thousands of pesos)	90.12	47.60
	(161.01)	(111.79)
Gross household income (thousands of pesos)	34.78	16.78
	(61.60)	(40.87)
Mother's education (years)	10.50	8.52
	(4.07)	(3.74)
Exposure to media (1=frequent; 0=other)	.64	.51
Age (years)	13.30	12.85
	(.79)	(.85)
Male (1=male; 0=female)	.45	0.46
Birth order	3.27	3.48
	(2.22)	(2.24)
Mental ability test score	57.10	51.63
	14.27	14.84
Use of English (1=frequent; 0=other)	.45	.36
Use of Filipino (1=frequent; 0=other)	.74	.58
Rural community (1=yes; 0=no)	.37	.43
Electricity available (1=yes;0=no)	.96	.83
Year in high school:		
First or second	.76	.89
Third or fourth	.24	.11
Distance to school (kms.)		
Private	1.92	9.53
	(3.16)	(28.66)
Public	1.80	2.42
	(2.32)	(3.53)
Relative (private-public)	.12	7.11
	(2.77)	(28.93)
λ	.98	-.47
	0.28	0.26
Number of observations	144	302

Note: Numbers in parenthesis are standard deviations for continuous variables.

In terms of socioeconomic standing, the private school students on the whole come from more advantaged backgrounds. Private school students come from households with income and assets almost double those of the public school students' households. The mothers of private school students also have, on average, more years of schooling than do the mothers of public school students. A lower percentage of private school students live in rural communities. Private school students have slightly more exposure to the media than do public school students. A higher percentage of them live in communities where electricity is available, an amenity that can influence student achievement. Private school students live closer to both private and public schools, probably because more schools of both types are situated in metropolitan areas. The proximity of private school students to both school types is about the same, although they have slightly greater access to public schools. On the other hand, the difference in the proximity of public school students to private and public schools is more pronounced, with private schools being considerably less accessible to them than public schools.

With respect to personal and other household characteristics of the students, on average, private school students are slightly older than public school students. Both groups of students have about the same sex distribution, with females being in the majority. As to birth order, private school students tend to be slightly lower in the order of their siblings than do public school students. There is, finally, a notable difference between the two groups of students in terms of the language spoken at home. A greater percentage of private school students use both English and Filipino at home than public school students. This is significant because either English or Filipino is the language used for instruction in all secondary schools.

Because the private and public subsamples are not necessarily randomly drawn from the student population, the assumptions of the basic linear model could lead to biased estimates of the achievement effect. As noted earlier, the way to correct this is to use the two-step technique: (1) estimate what determines the choice of school type and (2) estimate the achievement functions while holding constant the probability of being in one type of school versus another.

What Determines the Choice of School Type?

The first step in the estimation technique is to regress private school choice with variables that measure socioeconomic characteristics. In specifying the regression equation, each household is assumed to maximize utility. Hence, it is expected that the gains and losses will balance out in the decision about whether to send a child to private rather than public school. In this regard, although the private school charges higher fees, it may provide better and more educational services that parents expect will benefit their child.

The relative cost of public and private schools and the ability to pay are thus of paramount importance. The tuition costs of private and public schools were not available to us. In any case, such costs are not appropriate explanatory variables of school choice because they may reflect school quality and would thus be endogenous variables. Instead, we use a measure of the other costs of schooling. For example, if a household is located closer to a public school than a private school, this distance is likely to reduce the net gain to the family of choosing private education and, hence, the probability of sending the child to private school. This choice is confirmed by the results presented in Table 5.3. The coefficient of the relative distance variable has the expected sign and is highly significant. At the mean values of the explanatory variables, an increase in the differential distance of private and public schools of one

Table 5.3. Choice of Private or Public Schools: Probit Equations, Philippines, 1981
(private=1)

Variable	*Coefficient*	*t-statistic*
Constant	-0.90	-3.36
Relative distance to school	-0.07	-4.23
Household assets	0.00	2.27
Gross household income	0.00	2.17
Mother's education	0.06	3.24
Exposure to media	-0.20	-0.97
Age	0.05	0.33
Gender (male)	-0.06	-0.43
Birth order	-0.02	-0.52
Log-likelihood	-248.05	
Number of observations	446	

kilometer (in other words, if private schools are one kilometer farther away than public schools) will decrease the probability of being in private schools by 2.5 percent.[23]

In as much as the value or willingness to pay by parents for the extra services (quality or quantity) offered by private schools depends on the household's ability to pay, the probability of choosing private education should also be positively related to income and household assets. The data support this relationship. An increase in gross household income of one peso will increase the probability of choosing private school by one-tenth of a percentage point. Likewise, the higher the level of parental education, the higher the probability of private school choice. Educated parents presumably place more value on the extra quality of educational services offered by private schools.

Other relevant variables include media exposure and the age, gender and birth order of the child. These conditions have no effect on the choice of school type. It is possible that, for some variables, conflicting effects cancel each other out. For example, given the same total household resources, it is also plausible that children at the end of the sibling range may be at a disadvantage. It is also possible, however, that children born later may be going to school at the time when their parents are older and have more income and when older siblings are already contributing to household income. If these hypotheses are true, there may be no linear effect.

The parameters of the probit equation in Table 5.3 are used to estimate the term that will be used to correct for the selection bias. The average values of this term, which are called the λ's and which are used as explanatory variables in the achievement function equations, are shown in the penultimate row of Table 5.2.

How Does Socioeconomic Background Affect School Achievement?

The second step in the estimation is to use OLS to estimate the impact of background on achievement. The variables that are used to explain achievement, as measured by grade equivalency, in the Philippines

[23] For the j^{th} variable, this is computed from the formula $k_j \phi(\hat{\gamma} y_j)$ where $\hat{\gamma}$ denotes the estimated probit coefficient and $\phi(.)$ refers to the standard normal density function.

(in other words, the vector X) include many of the same variables that are used in Table 5.3. They include assets, income, mother's education, media exposure, age, gender and birth order. However, there are other variables that we had expected to affect achievement but not the choice of school type. They include mental ability, the language used at home, community variables and the present year of schooling. Most importantly, there is one variable that is included in the public-private choice equation but not in the achievement equation—the relative distance of the student's home from private as opposed to public schools. This distance becomes our identifying restriction.[24] Finally, the achievement equation includes a term that holds constant for the selection bias, in other words, for the probability that a given student will be in a private school. This term is derived from parameters in the choice equation, as described earlier. The estimated achievement equations are presented in Table 5.4 for private and public school students. These equations can be used to estimate whether or not an achievement advantage exists in either the public or the private sector after holding constant for student background and selection.

As expected, the mental ability test score is significantly and positively correlated with the grade level equivalent (GLE) test score for all subjects. Another variable that consistently has statistically significant coefficients for all regression equations is gender. Girls outperform boys on the GLE achievement by about 0.63 to 0.95 of a grade equivalent. This finding as it relates to mathematics is an interesting cultural phenomenon. It contrasts noticeably with the U.S. experience. In a recent literature review of sex and ethnic differences in mathematics achievement, Lockheed *et al.* (1985) concluded that sex differences were not statistically significant during the middle school years, but that gender differences in mathematics typically favor boys at the upper secondary level.

The asset and income variables, which perform extremely well in the probit equation, do not have statistically significant coefficients except in public schools for mathematics and English. In the latter case, the coefficient has a negative sign. Mother's education, which in the Philippines is very highly correlated with father's education, is statistically significant at customary levels only for English in private schools and for mathematics in public schools. Exposure to the mass media has a significant positive effect on English scores but a negative impact on mathematics. Not surprisingly, children from Tagalog-speaking families perform better in Filipino, which is essentially a Tagalog-based national language. Interestingly also, children from households that use English frequently at home perform worse in Filipino but do not score higher in the English test.

With regard to the effect of the community variables, the presence of electricity in the village has a very important effect on the child's achievement in mathematics and in Filipino. Children from communities that have electricity seem to score higher in these subjects by as much as 0.86 to 1.5 of GLE. On the other hand, holding other variables constant, living in a rural area has a negative and significant effect only in the achievement scores of children in English in public schools.

The coefficient of lambda times its mean can be interpreted as the selection term. Suppose that students are free to chose the type of school they prefer. One result occurs if students sort themselves into those institutions where they think they can perform the best. There would be positive selection in both the private and the public school samples. Another result would occur if students are hierarchically sorted.

[24] Without this restriction, the school choice and achievement equations may not be identified. Only the functional form would distinguish them. In many other studies, such a restriction has not been available.

Table 5.4. Achievement Functions for Private and Public Schools, Philippines, 1981

Explanatory variable	Mathematics		English		Filipino	
	Private	Public	Private	Public	Private	Public
Constant	-1.99	1.66	-2.21	1.69	-1.92	0.61
Household assets	0.00	0.00	0.00	-0.00	-0.00	-0.00
	(0.32)	(2.33)	(0.61)	(-0.12)	(-0.66)	(-1.03)
Household income	-0.00	0.00	-0.00	-0.01	0.00	-0.00
	(-0.63)	(1.37)	(-0.47)	(-2.37)	(1.35)	(-1.23)
Mother's education	0.05	0.06	0.17	-0.04	-0.03	-0.01
	(0.80)	(1.65)	(2.72)	(-1.16)	(-0.52)	(-0.25)
Exposure to media	-0.64	-0.19	-0.34	0.36	0.16	0.28
	(-2.11)	(-0.92)	(-1.09)	(1.77)	(0.51)	(1.22)
Age	0.10	-0.13	0.10	-0.10	0.07	0.01
	(0.43)	(-0.93)	(0.42)	(-0.78)	(0.29)	(0.05)
Male	-0.75	-0.71	-0.96	-0.63	-0.86	-0.82
	(-2.53)	(-3.46)	(-3.11)	(-3.21)	(-2.82)	(-3.73)
Birth order	-0.02	-0.04	0.01	0.03	-0.08	0.02
	(-0.29)	(-0.91)	(0.08)	(0.75)	(-1.13)	(0.39)
Mental ability	0.10	0.08	0.08	0.06	0.11	0.06
	(8.90)	(11.42)	(7.27)	(9.06)	(9.15)	(8.42)
Use of English	-0.41	-0.39	-0.11	0.03	-0.04	-0.71
	(-1.17)	(-1.58)	(-0.30)	(0.12)	(-0.10)	(-2.67)
Use of Filipino	0.14	0.14	-0.11	-0.04	0.50	0.65
	(0.39)	(0.56)	(-0.29)	(-0.17)	(1.39)	(2.48)
Rural community	0.09	0.22	-0.44	-0.44	-0.16	-0.09
	(0.29)	(0.96)	(-1.36)	(-1.99)	(-0.49)	(-.36)
Electricity available	0.99	0.57	-0.43	0.25	1.50	0.86
	(1.36)	(1.99)	(-0.58)	(0.88)	(1.98)	(2.81)
Third/fourth year dummy	0.33	0.67	0.09	0.38	0.41	0.18
	(1.59)	(1.85)	(0.51)	(1.12)	(1.92)	(0.48)
λ	0.38	0.65	1.09	-1.69	0.11	-0.50
	(0.35)	(1.16)	(0.99)	(-3.01)	(0.10)	(-0.82)
R^2	.49	.35	.47	.28	0.51	.30
F	8.13	11.63	7.68	8.91	8.91	8.01
Number of observations	144					

Note: Numbers are regression coefficients with t-statistics in parentheses.

For example, if there is an excess demand for places into the public schools and the best students are selected, there will be positive selection into public schools but negative selection into private ones. In either case, the analyst cannot observe the characteristics of private school students among the public school sample or vice versa.

The results show that, in math and Filipino achievement, the selection term is not significantly different from zero. However, in English language achievement, the selection term is positive for both groups and significant for public school students. This result is an indication (albeit a weak one) that students sort

themselves according to comparative advantage in the choice of school type, at least when it comes to language achievement.

With Background Held Constant, Is There a Private School Effect?

The estimated differential between public and private students' achievement scores can be computed from the parameters presented in Table 5.4 to hold constant for the effect of background. Because private and public school achievement equations differ in terms of intercept and slope, the estimated differential could vary depending on the value of the independent variables. Hence, we estimate the private-public differential using alternative sets of assumptions about the value of the independent variables.

The first row in Table 5.5 presents the unconditional private school effects calculated at the average characteristics of the overall sample of public and private students. The estimates show that students in private schools perform better in English and Filipino. The private school effect is over one-half a grade level equivalent for both subjects, with substantial effect sizes. In mathematics, on the other hand, private school students have a slightly lower performance average, with an effect size of 0.09, which is not meaningful.

Table 5.5. Private School Effects after Holding Constant for Background Characteristics, Philippines, 1981

Characteristics of the randomly chosen student set at:	*Differential*			*Effect size*		
	Math	*English*	*Filipino*	*Math*	*English*	*Filipino*
Overall sample means	-0.20	0.66	0.54	-0.09	0.33	0.25
Low socioeconomic status[a]	-0.11	0.13	0.55	-0.05	0.06	0.25
High socioeconomic status[b]	-0.29	1.19	0.54	-0.13	0.59	0.24
First or second year of high school (third/fourth year dummy set at 0)	0.03	0.73	0.73	0.01	0.39	0.33
Third or fourth year of high school (third/fourth dummy set at 1)	-0.31	0.48	0.97	-0.14	0.24	0.44

Notes:

[a] Status includes assets, household income and mother's education set 25 percent lower than overall sample mean.

[b] Status includes assets, household income and mother's education set 25 percent higher than sample mean.

To examine the sensitivity of the private-public differentials to socioeconomic status (SES), we compare the above results with those for low and high SES students. These results are shown in the second and third rows of Table 5.5 respectively. The private school advantage in English and Filipino persists for all the groups, but its magnitude varies. The advantage of the private school increases with SES for achievement in English, with high SES students gaining over one year (grade equivalent) in private schools as compared with public schools. The development of English-language skills is emphasized in

many Philippine private schools. Children from higher status backgrounds may benefit more from these schools because they tend to come from environments where English is used often and where they have better access to English language media. For Filipino, there is no relationship between SES and the strength of the private school effect; in mathematics, the private school effect diminishes with SES.

Our measure of academic performance reflects the cumulative achievement of students in the sample. The private-public differential may be sensitive to the number of years of secondary education completed. A comparison of the figures in the fourth and fifth rows of Table 5.5 reveals that the private school effects for English and Filipino were positive for both first and second year students as well as for third and fourth year students. In mathematics, however, a non-significant positive effect for first and second year students became negative for third and fourth year students. The estimates also show that, while the private school advantage decreased in English, it increased in Filipino. This shift may reflect the relative emphasis of public schools on the quality of teaching in upper years relative to lower years.

In sum, the overall direction of the private school effect is the same for various socioeconomic groups and for different years of high schools. However, the magnitude varies, depending on the measure of educational output, whether math or language skills.

The Relative Costs of Public and Private Schools

A recent study (Laya, 1987) of secondary school expenditures shows that, over all types of schools, unit costs come to about P666 (Philippine pesos) per student (see Table 5.6). The schools appear to be highly differentiated in their costs. The average private school is considerably cheaper (by about half) than the average public school. However, there is also a large difference between the two main types of public schools. Unit costs of local public schools are similar to (in fact, slightly lower than) those of private schools. However, national schools are three times more expensive than private schools.

Table 5.6. The Size and Costs of Philippine Secondary Education, 1985

	Public Schools			*Private*	*All*
	National	*Local*	*Overall*	*Schools*	*Schools*
Enrollment Thousands	712	1,273	1,985	1,415	3,400
Percent of total	21	37	58	42	100
Cost per student (pesos)	1,570	400	820	450	666
Source of revenue (percent):					
Student fees/miscellaneous	6	19	..	100	..
General fund	94	81	..	0	..
Total	100	100	..	100	..

Note: .. not applicable.
Source: Laya (1987).

Part II

Value-added Case Studies

6

Methodology[25]

The data bases for our next two cases studies on Thailand and the Dominican Republic allow us to take our analysis a step further in mitigating the selection effect. The data, taken from the International Association for the Evaluation of Educational Achievement (IEA) Second International Mathematics Study (SIMS), allow us to compare the results of tests from two periods, the beginning and the end of the eighth grade school year. This comparison can dampen the impact of any pre-school effects. This chapter briefly outlines the conceptual framework for the value-added analysis.

Chapter 2 showed how factors that affect student achievement can be quantified by using statistical inference. We now adapt that chapter's achievement model (equations 2.5 and 2.6) to incorporate the fact that we observed achievement twice for each student. In each type of school (we drop the "p" and "g" subscripts to simplify the notation), the ith pupil's score on the eighth grade mathematics achievement test is characterized by the following equation:

$$(6.1) \quad A_{i8} = a_0 + a_8'X_{i8} + a_7'X_{i7} + \ldots + a_1'X_{i1} + c_8'Z_i + d_8I_i + u_{i8},$$

and the ith pupil's score on the seventh grade test can be similarly expressed as follows:

$$(6.2) \quad A_{i7} = b_0 + b_7'X_{i7} + b_6'X_{i6} + \ldots + b_i'X_{i1} + c_7'Z_i + d_7I_i + u_{i7}.$$

The terms in equation 6.1 and 6.2 are defined as follows. A_{it} is the achievement score of the ith child at the end of school year t (that is, seven or eight). X_{it} is a vector of variables describing the ith child's learning environment during school year t (for example, out-of-school tutoring, parental encouragement, availability of study materials at home, characteristics of teachers and other school-related characteristics specific to year t). The vector describing the learning environment can be partitioned into a school-related vector (S) and a child- or household-related vector (H), or $X_{it} = [X_{itS}\ X_{itH}]$. Z_i is a vector of variables affecting achievement that are invariant over time, such as the quality of the home environment, education, the student's educational expectation and the student's sex and age. I_i is a vector of variables describing unobserved influences (for example, innate ability on preschool care). The term u_{it} is a random disturbance term with a zero mean and a variance v^2. The term a_i' is a vector of coefficients describing the effect on achievement at the end of the eighth grade of a unit change in the child's environment in school year t (for example, a_7 is the marginal effect on eighth grade achievement of environmental characteristics during the seventh grade). The term b_i' is similar to a_i', but describes the effect on achievement at the end of the seventh grade. The term c_i' is a vector of coefficients of the

[25] The material from this chapter and the next is largely taken from Jimenez, Lockheed and Wattanawaha (1988).

effect on eighth grade achievement of a unit change in one of the Z variables. The term d_t is the effect on achievement of a unit change in the unobserved component. The prime symbol (') is an indication of the transposition of a column vector to a row vector.

It is not feasible to estimate equations 6.1 and 6.2 because researchers rarely have much information on past characteristics, such as class size or parental tutoring four or five years earlier. An alternative is to estimate equations 6.1 and 6.2 as value-added equations by subtracting equation 6.2 from equation 6.1 (see Hanushek, 1986 for a more thorough review of the arguments). The resulting equation could greatly simplify the specification if some of the terms are canceled out. However, for this to happen, additional assumptions are necessary. Boardman and Murnane (1979) have demonstrated the importance of deriving the empirical form of the value-added equations carefully because each specification imposes behavioral restrictions.

The specifications in equations 6.1 and 6.2 imply that school and student characteristics in previous years also affect current achievement. For example, the size of a student's class in the seventh grade on down to the first grade affects his/her eighth grade achievement. A reasonable expectation is that the effect of past characteristics on current achievement diminishes geometrically, in which case a simple value-added equation can be derived from equations 6.1 and 6.2.

Let the unsubscripted variables, a, c and d represent the "true" current period effect on school achievement of a unit change in a component of X, Z and I respectively. For example, a is the effect on eighth grade achievement of an increase in one unit of class size during the eight grade, or $a_8 = a$. Let f be the amount by which the effect of seventh grade characteristics on eighth grade achievement diminishes relative to a, or $a_7 = (f)a$.[26] The critical assumption is that the effect of previous years diminishes geometrically thereafter, or $a_6 = (f^2)a,\ldots,a_1 = (f^7)a$, for $f < 1$. By similar reasoning, the impact of previous years' characteristics on seventh grade achievement is $b_7 = a$, $b_6 = (f)a,\ldots,b_1 = (f^6)a$. These definitions can then be substituted into equations 6.1 and 6.2. Then, if equation 6.2 is multiplied by f before it is subtracted from equation 6.2 and the terms are canceled out, the following simple specification is obtained:

$$(6.3) \quad A_{i8} = g_o + g_1 A_{i7} + g_2' X_{i8} + g_3' Z_i + e_{i8}$$

where $g_o = (a_o - fb_o) = f$, and $e_{i8} = d'(1-f)I_i = (U_{i8} - fu_{i7})$. This estimating equation is intuitively appealing because the terms describing previous environments (X_k, $t = 1, \ldots, 7$) are deleted and the (unrestricted) coefficient of A_{i7} can be easily interpreted as f.

In this study, we use equation 6.3 as the final form to estimate achievement in each type of school. However, several econometric issues require further discussion. First, it is important to distinguish between variables that change during the eighth grade (and thus belong to the X vector) and those that are invariant over the child's schooling career (and thus belong to the Z vector). The coefficient of a Z-type variable (such as student sex) cannot be interpreted as the marginal effect on eighth grade achievement less its effect on achievement in the seventh grade.

[26] We would expect $f < 1$. However, this is not a restriction because f is a parameter to be estimated. In the unlikely event that the estimated $f > 1$, we conclude that past characteristics have greater importance than current-period characteristics in explaining current achievement.

Second, the use of the lagged dependent variable in equation 6.3 could introduce technical problems, as A_{17} has a random component and it may be correlated with the error term. We can invoke additional restrictions regarding the error structure to address these problems.[27] Moreover, we argue that, regardless of these restrictions, any remaining technical biases would not change our main results regarding the differential achievement of private and public schools because both types of schools would be equally affected.

Third, the use of value-added analysis does not necessarily make the problem of omitting unobserved variables disappear, although we would expect the problem to be mitigated. This problem is important if variables such as ability and motivation are correlated with the X and Z terms (for example, if more able children are given more attention at school and at home). The coefficient of the measured variable would be biased upward or downward, depending on its correlation with the unmeasured I variable. Because we are focusing on one particular environmental effect—the public versus private dimension—the problem can be couched in terms of selection bias. If students are systematically selected (or self-selected) into public or private schools on the basis of some unobserved criterion (such as ability), the estimates of achievement within each school type would be contaminated by this selection effect. This problem is corrected using recently developed statistical techniques, as already elaborated in Chapter 2.

[27] We assume that this year's persistent error will be some fraction of last year's persistent error (that observations with large positive or negative errors this year will be likely next year to have errors closer to zero--smaller in absolute value, or $U_{i8} = uU_{i7}$, where $u < 1$). If $u = f$, then that part of the error term in equation 6.3 that contains the persistent effects collapses to a random variable with zero mean, and the autocorrelation problem is solved. In any event, the bias associated with the autocorrelation of the persistent effects ought to be empirically quite small and should be dominated by the random component and our large sample (see Theil, 1971, Chapter 8).

7

Thailand

This chapter reviews the evolution of private education in Thailand, describes the data used in the value-added analysis and discusses the results.

Private and Public Institutions: Relative Sizes and Roles

Private schools were operating in Thailand as far back as the 13th and 14th centuries. In the 17th century, Roman Catholic missionaries taught Latin, Christian studies and Thai literacy in Catholic institutions in Thailand. Then, in 1828, American missionaries opened schools that specialized in such diverse fields as medicine, science, education and journalism. After 1852, Protestant missionary groups established schools in Thailand for boys, for girls, and for both sexes. The school for girls, established in 1870, was the first of the "private" church-related institutions to charge tuition and boarding fees.

The Pre-democracy Period (1887 to 1932)

At the beginning of this period, King Chulalongkorn V opened a school for the children of government officials. The students were instructed in the Thai language, Thai culture and arithmetic. Free tuition, lunch and uniforms were provided. In 1885, the government established public schools in the temples, which the King encouraged by donating some of his own land for school buildings and by paying the salaries of qualified teachers. By 1887, there were 35 such schools, four of which (all located in Bangkok) were "higher level" schools. These institutions may be regarded as the first public secondary schools in Thailand. In 1887, the Thai Department of Education was established, becoming a ministry two years later. The ministry exercised tight control over public schools, and, by introducing a nationwide system of examinations, it also exercised effective control over the numerous private and missionary schools. At this point, the laissez-faire period, during which schooling was entrusted to the wisdom and enterprise of private individuals and organizations, effectively came to an end.

In 1911, the Thai government made primary education compulsory for all children ages 8 to 14 living in Bangkok, and the 1921 Compulsory Education Act extended that provision to all Thai children. Enrollment, particularly in private schools, increased sharply. However, a majority of Thai children still did not attend school because their parents could not afford to send them.

The Post-democracy Period (1932 to mid-1960s)

At the beginning of this period, there were 1,307 private schools in Thailand, providing education from kindergarten to secondary level. There were two main types: large, influential schools run by religious groups, such as the Roman Catholic Church or Protestant missionary societies, and small schools run by individual entrepreneurs. The latter tended to concentrate on providing literacy, numeracy and basic social accomplishments, whereas the larger schools sought to provide a solid grounding in the basic secondary school subjects. These schools were regarded as elite educational establishments, catering for the needs and aspirations of the middle and upper classes in Thai society.

In fact, it became increasingly difficult for parents to enroll their children in these schools. Competitive entrance examinations began to be used as screening devices. The parents not only had to pay fees for tuition and for expensive school uniforms, but they were also expected to contribute to the upkeep of such facilities as the schools' libraries and science laboratories.

The People's Party, which assumed power in 1932, made the expansion of the education system a high priority. It abolished fees for public primary schools, causing the percentage of children attending school to jump to over 50 percent. In 1938, it launched the first nationwide compulsory literacy program and built large numbers of public schools throughout the 1930s to accommodate the growing demand.

The first two National Education Plans of the post-democracy era (1932 and 1936) recognized that the existence of private schools operated by individuals and organizations helped to reduce the government's expenditure on education. With this rationale in mind, the Thai government sometimes assisted private schools by providing financial grants, staff and material support during this period.

The Second World War interrupted the Thai government's educational expansion program, but the 1950s witnessed a sharp rise in the overall number of children attending schools. This increase was due to the fact that the population was growing rapidly and to the government's renewed commitment to increasing educational opportunities. The National Education Plan of 1951 specifically linked expanding the education system to improving the economic condition of the nation. The private sector still provided the majority of school places. In 1952, 292,218 students (77 percent) were enrolled in 1,565 private schools, whereas only 87,727 students (23 percent) were enrolled in 293 government schools.

In the years immediately following the introduction of compulsory education, public schools were funded by a head tax levied especially for education. However, this practice proved to be neither effective nor equitable, and it was abandoned in the 1930s. Later, in 1953 and again in 1962, a special levy was charged on contract stamps as an experiment. Part of the revenue from these stamps was earmarked for education and health. As the majority of people signing contracts had directly benefitted from secondary and/or tertiary education, this experiment attempted to make students repay to society some of the costs of their education. Unfortunately, the scheme was never adapted to the increasing complexity of the economy, so it was abandoned just as the education system was about to expand rapidly.

1960 to 1990

The most dramatic development over the last 30 years in the Thai education system has been the change in the relative sizes of the public and private sectors. In 1961, 190,960 students attended 400 government schools (19.5 percent), whereas 787,136 students attended 2,841 private schools (80.5 percent).

However, by 1980, this state of affairs had been completely reversed, with 88 percent of enrollments being in government schools and only 12 percent in private schools. The main reason for this shift was the massive commitment the Thai government made in the early 1980s to expanding secondary education. The Fifth Educational Development Plan (1982 to 1986) aimed to increase the enrollment in lower and upper secondary schools of each respective age group to 48.3 and 30.9 percent respectively. While this commitment was not exclusively confined to the public sector, in reality, the majority of Thai families can no longer afford private school fees.

The latest figures available (1988) make it clear that enrollments in the upper secondary classes of government schools have more than doubled since 1980 while the equivalent statistics for private schools have increased only modestly. At the junior secondary level, the number of students enrolled in private schools has dropped by almost 50 percent while the government school numbers have remained constant.

If this trend continues, many existing private secondary schools may not remain viable. However, even though the percentage of private secondary schools in Thailand is declining, the good reputation of the elite secondary private schools has persisted.

Summary of the Present Situation

The present education system in Thailand includes six years of primary school followed by three years of lower secondary education and three years of upper secondary education. Government guidelines on curricula and syllabi are followed in all schools, both public and private, although foreign language instruction is more widely available in private schools than in public ones. All secondary schools, whether public or private, have their own entrance exams in addition to the examinations that students must take at the end of grade six.

All private schools are strictly supervised by the government through the Office of the Private Education Commission. This principle was formalized in the 1977 Plan in which it was recognized that the government needed: (1) to ensure that private schools operated in ways that were consistent with the Plan; and (2) to restrain private schools from making exceptionally high profits from their operations.

The 1977 Plan also made it possible for the government to provide technical assistance to high quality private schools. These subsidies can constitute up to 40 percent of a school's operating costs, with the rest being funded by tuition fees, private donations, and fundraising. If a school accepts a subsidy from the public purse, it must be prepared to tolerate even greater government control over its affairs. Consequently, the number of elite private schools accepting a subsidy has declined from more than 90 percent in 1979 to 60 percent in 1984.

Public schools are subject to even tighter government controls than private schools. Because the public school system is extremely centralized, all important decisions about curriculum, budget and personnel, for example, are taken in Bangkok, allowing for little variation at lower levels. This arrangement severely limits local initiatives to improve public schools.

Public education in Thailand is funded primarily from public revenue and accounts for about 18 to 19 percent of the total government budget. However, other than at primary school level, individual students are supposed to bear at least part of the cost of their education by paying tuition fees. The amount charged by most public schools is very small and varies according to the size of the school.

Public and private schools differ not only in terms of financing and government controls but also in student achievement levels and student, peer group, class, teacher and school characteristics. Using samples drawn from the IEA SIMS study, the following sections explore the differences and similarities between public and private schools in Thailand.[28]

Data and Specification

Sample

The IEA SIMS study sampled 99 mathematics teachers and their 4,030 eighth grade students and was derived from a two-stage stratified random sample of classrooms. The primary sampling units were the 12 national educational regions of Thailand plus Bangkok. Within each region, a random sample of lower secondary schools was selected, along with replacements. At the second stage, a random sample of one class per school was selected from a list of all eighth grade mathematics classes within the school. The resulting sample represented 1 percent of eighth grade mathematics classrooms within each region. This chapter reports data on the 3,265 students for whom complete data were available.

A mathematics test covering five curriculum content areas (arithmetic, algebra, geometry, statistics and measurement) was administered to students at both the beginning (pre-test) and end (post-test) of the school year. Students also completed a short background questionnaire at the time of the pre-test and a longer one at the time of the post-test. Teachers completed several survey instruments at the post-test, including questionnaires on their background, teaching practices and the characteristics of their randomly selected "target" class. Data about the school were provided by a school administrator and were supplemented with information provided by the Ministry of Education.

Mathematics Achievement

The IEA developed five mathematics tests for use in SIMS. One test was a 40-item instrument called the core test. The remaining four tests were 35-item instruments called rotated forms. These five test instruments contain roughly equal proportions of items from each of the five curriculum content areas, except that the core test contains no statistics items (Wattanawaha, 1986). For the purposes of this analysis, we regard the instruments as parallel forms with respect to their mathematics content.

The IEA longitudinal design called for Thai students to be pre-tested with both the core test and one of the four rotated form tests. At the post-test, students again took the core test and a rotated form test different from that taken at the pre-test. Approximately the same numbers of students took each of the rotated form tests in both test administrations.

One goal of our analysis was to predict post-test achievement as a function of pre-test performance plus other determinants. Because students took the core form twice, the core form post-test scores reflect, to some degree, familiarity with the core test items. Thus, we analyzed scores from the rotated forms after they were equated to adjust for differences in test length and difficulty. In this analysis, we used equated rotated form formula scores for both pre-test and post-test measures of student mathematics

[28] The rest of this chapter is taken from Jimenez, Lockheed and Wattanawaha (1988).

achievement. A complete description of the equating procedure is provided in Lockheed, Vail and Fuller (1986).

Student Background Characteristics

To conform with the value-added model outlined above, student characteristics are divided into two categories: time invariant or fixed (Z_i) and variable or eighth-grade specific (X_{i8H}). Fixed background information about each student includes sex, age, enrollment in a coeducational or single-sex school, number of older siblings, maternal educational status, paternal occupational status,[29] educational expectations and correspondence between home language and language of instrumentation.

Student characteristics thought to vary over the course of the school year include amount of out-of-school tutoring, perceived parental encouragement and home use of a four-function calculator (a proxy for family educational resources). Parental encouragement is measured by an index combining four items of the type "My mother thinks that learning mathematics is very important for me," with a five point Likert-type response alternative ranging from 1 = "exactly like" to 5 = "not at all like." On this index, a low score represents high parental encouragement. Definitions and basic statistics for student background variables are provided in Table 7.1.

Peer Group, Class, Teacher and School Characteristics

We use three measures of a student's peer group characteristics: average pretest score, the proportion of classmates whose mothers have more than a primary school education and the proportion of classmates whose fathers have professional occupations. Class characteristics include class size, "enriched" or "nonenriched" curriculum and single-sex or coeducational mathematics class (as opposed to the school). Teacher background characteristics include sex and participation in in-service training. Teacher classroom practices include using workbooks, maintaining discipline and administering tests and quizzes. School characteristics include regional per capita income, school size, public or private status, single-sex or coeducational status and the proportion of teachers certified to teach mathematics. Definitions and categories for these variables are provided in the discussion of the nature of the public-private school differential.

To control for student or household characteristics (such as socioeconomic status and ability) when comparing achievement test scores, we use the value-added achievement model developed earlier.

The Effect of Background on Achievement in Public and Private Schools

A critical policy issue is whether a student randomly chosen from the general population would do better in a public or a private school. According to Table 7.1, the average test score is 0.27 standard deviations higher at the beginning of the eighth grade and 0.15 standard deviations higher at the end of the eighth grade for students in private schools than for students in public schools. The achievement of students

[29] Because the correlations between paternal and maternal occupational status (r = 0.39) and paternal and maternal educational attainment (r = 0.58) were high, we analyzed the effects of paternal occupational status and maternal educational attainment only. There were also fewer missing cases for these variables.

Table 7.1. Student Background and Achievement in Private and Public Schools, Thailand, 1981-82

Variable description	*Private*	*Public*
Student post-test score (A_{i8})	13.64	12.53
	(10.42)	(8.96)
Student pre-test score (A_{i7})	10.87	8.84
	(9.25)	(7.47)
Time-invariant background (Z_i)		
Student's age in months	169.57	171.16
	(10.45)	(8.37)
Female	0.52	0.48
Eldest child	0.21	0.22
Mother's education		
None	0.23	0.26
Primary	0.53	0.59
Secondary	0.13	0.09
University	0.11	0.06
Father's occupation		
Unskilled	0.15	0.15
Skilled	0.24	0.48
Clerical	0.43	0.23
Professional	0.19	0.15
Educational expectations		
Less than 2 more years	0.05	0.80
2-5 more years	0.29	0.30
5-8 more years	0.38	0.41
More than 8 more years	0.28	0.21
Language of instruction also used at home	0.65	0.44
Child in single-sex school	0.42	0.15
Gender by school type interactions		
Female in single-sex school/grade	0.22	0.08
Female in coed school/grade	0.30	0.39
Male in single-sex school/grade	0.14	0.10
Male in coed school/grade	0.35	0.42
Gender by classroom type interactions		
Female in single-sex class	0.29	0.13
Female in coed school/grade	0.23	0.35
Male in single-sex grade/grade	0.27	0.15
Male in coed class	0.21	0.47
Background during eighth grade (X_{i8})		
Hours of extra tutoring	1.69	1.65
	(2.69)	(2.93)
Index of parental encouragement (1=high; 5=low)	2.13	2.09
	(0.90)	(0.94)
Home use of four-function calculator	0.41	0.27
Lambda	1.37	-0.26
Number of observations	527.00	2,738.00

Note: Numbers in parentheses are standard deviations for continuous variables.

in private schools increases by 0.3 standard deviations, while that of students in public schools increases by 0.46 standard deviations over the school year. These magnitudes imply that the gross measure of value-added during eighth grade (post-test less pre-test scores) is higher for public schools. However, because students in public and private schools are different, these gross figures should not be used to conclude that one school type is more or less effective than the other.

What Determines the Choice of School Type?

The first step in the estimation technique is to perform a regression analysis of private school choice with variables that measure the socioeconomic characteristics of the student and the coeducational/single-sex school type. The results are presented in Table 7.2. The most significant variables in determining private school choice are home language and school type (that is, single-sex or coeducational) by sex of student. One strong effect on the choice of private schools is a correspondence between the home language and the language of instruction. Another strong effect is related to the interaction between a student's sex and a student's decision to attend a single-sex or coeducational school. Girls who select single-sex school are more likely to choose private schools, whereas girls who select coeducational schools tend to choose public schools. Whether the school is single-sex or coeducational appears to have little effect on male choice of private or public schools, however. When student sex and single-sex/coeducational school type are held constant, few other background characteristics have an effect on choice. Paternal occupational status is inconsistently related to school choice; for example, in comparison with students whose fathers are employed in unskilled occupations, students with fathers in white-collar clerical occupations are more likely to choose private schools, whereas those with fathers in skilled blue-collar occupations are less likely to do so. Maternal education has no effect on private school choice. Thus, the relationship between parental status and choice of school is not strictly monotonic, and groups with low socioeconomic status are well represented in private schools. There is likely to be a great variance in the quality of private institutions, a point that is discussed further in the next section. Finally, first-born children tend to be enrolled in public schools, as are older students, suggesting that repetition rates may be higher in public schools.

The parameters of the probit equation presented in Table 7.2 can now be used to estimate the term that will be used to correct for the selection bias.

How Does Socioeconomic Background Affect School Achievement?

The variables used to explain achievement scores in Thailand (that is, the vectors X_{i8H} and Z_i) include many of the same variables used in Table 7.2 to explain choice of private or public schools. However, the variable represented by X_{i8H} should affect achievement scores only, because the choice of a private or public school was made well before the student started eighth grade. The X_{i8H} set includes variables that measure parental encouragement of mathematics, out-of-school tutoring during eighth grade and the availability at home of instructional aids such as calculators.

Although very few classes in this sample are from single-sex schools or grade levels (five private schools and 13 public schools), a considerable number of mathematics classes are single-sex (eight in private schools and 22 in public schools). After holding student sex and single-sex/coeducational school type constant, we expect to find systematic differences in test scores between boys and girls in single-sex and coeducational classes. We expect that girls will profit from single-sex classes, whereas boys will profit from coeducational classes, all other things being equal. This expectation is based on previous research

Table 7.2. Choice of Private or Public Schools: Probit Equations, Thailand, 1981-82 **(private = 1)**

Variable	*Coefficient*	*t-statistic*
Constant	20.21	4.56
Father's occupation		
Skilled	-0.28	-3.28
Clerical	0.25	2.97
Professional	-0.02	-0.23
Mother's education		
Primary	-0.56	-0.83
Secondary	0.02	0.15
University	0.01	0.07
Educational expectations		
5-8 more years	-0.07	-1.02
> 8 more years	0.03	0.33
Age	-0.25	4.81
Age squared	0.00	4.79
Eldest child	-0.13	-1.91
Language of instruction also used at home	0.41	7.06
Male in single-sex school/grade	0.15	1.56
Female in single-sex school/grade	0.59	6.50
Female in coed school/grade	-0.13	-2.03
Log likelihood		3,265
Number of observations		-1,307.9

documenting sex differences in teacher-student and peer interaction in coeducational mathematics classes (Lockheed *et al.* 1985). Thus, coeducational status in the classroom (and its interaction with student sex) is included in the list of explanatory variables of achievement.

Finally, the achievement equation includes a term that holds constant for the selection bias, that is, for the probability that a given student will be in a private school. This term is derived from the parameters in the choice equations, as described above.

The estimated achievement equations 8.1a and 8.2b are presented in Table 7.3 for private and public school students respectively. These equations can be used to estimate whether a school achievement advantage exists in the public or private sector, after holding constant for student background and private or public school selection.

As explained earlier, the interpretation of the coefficients of the stock variables (Z_i) differs from that of the flow variables, which are nonmarginal. They represent the cumulative effects on past achievement

as well: c(1-f) where f is the lagged effect of previous inputs on current year achievements. The estimate of f is 0.073 for private schools and 0.78 for public schools.

Students whose fathers were in skilled jobs tended to perform better than students whose fathers were in unskilled occupations. However, those with fathers in professional or clerical jobs did not score significantly higher. These trends hold for both public and private school students. Mother's educational attainment (reference category: no education) and student's educational expectation (reference category: less than five more years of school) are both insignificant for the private school subsample but are significant and generally exhibit the expected positive sign for the public school subsample. One explanation for this difference is that private school students are relatively homogenous—once they have chosen private schools, their home environment does not affect their achievement. They may also be more highly motivated that public school students, and a "marginal increment" in motivation will not significantly affect achievement. Older students outperform younger students in both public and private schools, but being the eldest child in the family has no effect on achievement. Speaking the language of instruction at home is negatively related to achievement for both groups. (One possible explanation is that Chinese-speaking students do better in school than Thai-speaking students, although we had no data on ethnicity to test this hypothesis.) Boys in coeducational classes do better in mathematics than either boys or girls do in single-sex classes; the differences are particularly pronounced in private institutions. However, within private coeducational institutions, boys do not outperform girls, and within public coeducational institutions, boys only slightly outperform girls. Thus, the male advantage in mathematics performance is sensitive to classroom setting.

Table 7.3 also presents regression results for three flow variables: out-of-school tutoring, parental encouragement and home use of a four-function calculator. None of these variables has a significant effect on achievement.

The selection term (coefficient of lambda times its mean) is negative for private schools and positive for public schools. This difference indicates that, if any school system "skims the cream," it is the public school. Whereas private school students tend to come from a slightly more elevated social status (clerical workers), the effect of parental occupational status is apparently offset by other variables, principally educational aspirations.

With Background Held Constant, Is There a Private School Effect?

The estimated differential in the achievement scores of public and private school students can be computed from the parameters presented in Table 7.3 to hold constant for the effect of background. Because private and public school achievement equations differ in terms of intercept and slope, the comparison would be affected by the values of the other explanatory variables, as well as by the coefficients in these equations. To clarify this relationship, we compute the following unconditional private school effect. From the entire sample of private and public students, consider a randomly chosen pupil with the average characteristics of a public school student (that is, standardized according to the public school means). The unconditional effect measures the increment (or decrement) in the student's

Table 7.3. Achievement Functions for Private and Public Schools, Thailand, 1981-82

	Private		*Public*	
Explanatory variable	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Constant	-99.81	-1.69	-79.71	-2.42
Past achievement	0.73	19.98	0.78	45.29
Time invariant background (Z_i)				
Father's occupation				
Skilled	1.91	1.72	0.93	2.30
Clerical	-1.99	-1.95	-0.91	-1.97
Professional	-0.12	-0.11	0.54	1.15
Mother's education				
Primary	.43	0.60	0.80	2.72
Secondary	-1.26	-1.89	0.83	1.69
University	0.11	0.08	0.16	0.27
Educational expectations				
5-8 more years	1.11	1.57	1.19	4.15
> 8 more years	1.17	1.47	1.64	4.64
Age	1.47	2.07	1.01	2.71
Age squared	-0.00	-2.17	-0.00	-2.89
Eldest child	0.38	0.52	0.03	0.09
Language of instruction also used at home	-2.65	-2.72	-0.81	-2.21
Male in single-sex class	-3.30	-3.69	-1.51	-3.97
Female in single-sex class	-2.83	-2.42	-1.14	-2.30
Female in coed class	0.44	0.50	-0.60	-1.93
Background during eighth grade (X_{8H})				
Tutoring	-0.15	-1.36	-0.06	-1.54
Parental encouragement	0.18	0.55	0.07	0.53
Home calculator	0.34	0.54	0.23	0.83
Lambda	-9.10	-3.81	-7.34	-3.68
R^2	0.61		0.49	
F	39.16		129.49	
Number of observations	527		2,738	

Table 7.4. Private School Effects on Eighth Grade Mathematics Achievement after Holding Constant for Background Characteristics, Thailand, 1981-82

Effect	*Predicted scores of student with characteristics of average private school pupil if that student were in*		*Private/public differential*	
	Private school	*Public school*	*Raw difference*	*Effect size*[a]
Total unconditional effect	26.22	11.09	15.13	1.69
Effect by student type				
Male in single-sex class	24.53	10.45	14.07	1.57
Female in single-sex class	24.99	10.83	14.17	1.58
Female in coed class	28.27	11.36	16.91	1.89
Male in coed class	27.83	11.96	15.86	1.77
	Predicted scores of student with characteristics of average public school pupil if that student were in			
	Private school	*Public school*		
Total unconditional effect	27.15	10.31	16.83	1.88
Effect by student type				
Male in single-sex class	24.57	9.39	15.17	1.69
Female in single-sex class	25.03	9.76	15.27	1.70
Female in coed class	28.31	10.30	18.01	2.01
Male in coed class	27.87	10.90	16.97	1.89

Note: Calculated from Tables 7.1 and 7.3.
[a] Units of public school standard deviation.

test score had the student gone to a private school.[30] The same calculations can be performed standardizing the private school means. The question then is, how would a pupil with the average characteristics of a private school student have done had he/she gone to public school? There is no theoretical reason to perform one method of standardization over another. However, there is no guarantee that the results will be consistent. The results are summarized in Table 7.4.

The results presented in the top panel of Table 7.4 indicate that, after holding constant for past achievement and socioeconomic background, eighth grade students in private schools have an unconditional advantage on mathematics tests of about 15 points or 1.69 standard deviations. This implies that a Thai eighth grade student with the background of an average private school student, chosen

[30] This unconditional effect nets out the selection term from both the public and private school equations in calculating school effects. In contrast, the conditional private school effect retains the selection term in calculating school effects.

randomly from the population, would more than double his or her score on a mathematics achievement test if that student attended a private school instead of a public one, scoring higher than approximately 95 percent of students attending public school. The private school advantage is slightly more pronounced for students in coeducational institutions than in single-sex schools, nearly two standard deviations. To check the robustness of this result, we calculated the private school effect for a randomly chosen student with the average public school characteristics. The results, shown in the lower panel of Table 7.4, are not substantially different.

The Nature of the Public-Private Differential

The previous section showed that private school students in Thailand score higher on mathematics achievement tests at the end of the eighth grade than do their public school counterparts, after controlling for previous achievement, socioeconomic background and systematic selection by school type. For policymakers, the remaining question is, what accounts for this achievement differential?

Is it possible to identify those characteristics of private schools that contribute most to the private school effect? What do administrators and teachers do that is different? What is the influence of a student's peers on relative achievement? Can any lessons regarding the input mix be applied to public schools?

This section attempts to answer some of these questions for Thailand. The method is to redo the estimates of the previous section. This time, however, the full achievement equation (equation 6.3), including school characteristics, is estimated; that is, both components of $X_{i8} = [X_{i8h}\ X_{i8S}]$, in addition to Z_i, are included in the equation. We then discuss how the school specific components in these vectors of explanatory variables affect achievement in the public and private sectors.

Differences in Peer Group and School Attributes

Table 7.5 presents, for private and public schools, the mean values of the school, classroom, teacher and peer group attributes that are used in the estimation procedure. They indicate some bias differences between private and public schools in teaching methods and administration. Also, private schools appear to be advantaged in two respects and disadvantaged in a third. On the one hand, private schools are, on average, half the size of public schools—suggesting that they have more scope to individualize their teaching programs—and they are located in regions with per capita incomes 30 percent higher than those in which public schools are located—suggesting that they have greater access to resources. On the other hand, fewer than 10 percent of the teachers in private schools, compared with 61 percent of the teachers in public schools, are certified to teach mathematics. The characteristics of teachers and their teaching practices differ between public and private schools. A higher proportion of students in private schools have older and, therefore, possibly more experienced teachers. The proportion of students with female teachers is higher in private than in public schools. A higher proportion of students in the private subsample have teachers who have undergone some in-service training. Unfortunately, the data do not contain a great deal of additional information regarding the individual teachers of the sample students.

There is a fair amount of information regarding teaching practices. Teachers of students in private schools spend 25 percent more time maintaining order in the classroom and 50 percent more time giving tests and quizzes. Students in public schools tend to rely a little less on commercially produced teaching materials such as workbooks. The mathematics classes included in the sample differ for public and

Table 7.5. School and Peer Group Characteristics, in Thailand, 1981-82 **(mean and standard deviation)**

Variable description	*Private*	*Public*
School-level characteristics		
Average district per capita income (in baht)	16,589.00	12,602.00
	(4,318.40)	(4,520.00)
School enrollment	747.80	1,576.60
	(493.90)	(1,073.20)
Proportion of teachers certified to teach mathematics	0.10	0.61
Teacher and class characteristics		
Teacher's age in years	34.60	29.00
	(11.00)	(6.60)
Proportion of male teachers	0.26	0.36
Proportion having in-service training	0.23	0.10
Proportion teaching enriched mathematics class	0.31	0.20
Proportion using workbook often	0.26	0.24
Proportion spending more than 15 minutes a week maintaining order	0.60	0.48
Minutes a week spent on quizzes and tests	44.35	30.51
	(62.43)	(24.98)
Number of students in target class	44.10	41.90
	(6.80)	(10.70)
Peer group characteristics		
Average of average pre-test scores	10.87	8.84
Average proportion of mothers with more than a primary education	0.24	0.15
Average proportion of fathers with a professional occupation	0.19	0.15

Note: Numbers in parentheses are standard deviations.

private schools. A higher proportion of private students are in enriched mathematics classes, and the average size of mathematics classes is slightly larger in private schools. The rough picture provided by this comparison of means is that teachers in private schools have fewer credentials, on average, than their public school counterparts. However, their students are more heavily exposed to in-class work and exercises. Private school students also have an advantage over public school students in terms of the learning environment provided by their peer groups. In the next two subsections, we investigate how these differences in characteristics and teaching practices translate into differences in achievement gain.

Peer Group Effects

Because students interact with each other in school, the ability and socioeconomic status of fellow students could affect individual achievement. To account for this possibility, we reran the achievement equations with the addition of three classroom-level variables: average pre-test score, the proportion of mothers

with greater than a primary school education and the proportion of fathers in professional occupations. The results of this regression, displayed in the first four columns of Table 7.6, show that average schoolmate pre-test score is highly correlated with the individual's post-test score but that the social class background of peers is unrelated to achievement.

In order to determine the extent to which peer groups affect the private-public differential, we compute the unconditional private school effect for a randomly chosen student with the average background and the average peer group characteristics of private school students. A comparison of the first panel of Table 7.7 with that of Table 7.4 reveals that private-public differentials decline to about five points after peer group characteristics are taken into account. This result is robust with respect to a public or private reference group. We conclude that peer groups can account for a substantial part (but not all) of the difference between public and private school achievement.

School Practices and Achievement Gain

The reestimation of the student achievement functions includes the additional variables listed in Table 7.5. As before, private and public school functions are estimated separately. Aside from statistical reasons for not assuming homogeneity of slope and intercept coefficients, separate estimations reflect the fact that unmeasured management practices and "school culture" could differ between public and private schools. Teachers and administrators in public and private schools probably face entirely different sets of incentives. Thus, we expect the coefficients of each of the school- or teacher-related variables to differ for public and private school students.

The coefficients are presented in Table 7.6; they demonstrate considerably different effects for public and private students. After holding individual student characteristics constant, district-level per capita income is positively correlated with achievement in public schools only. This relationship may be due to local contributions to school maintenance, or the variable may reflect the availability of ancillary public services that may influence achievement, such as electricity or running water. In any case, public school students who go to school in richer communities do better, whereas community wealth has no effect on the private school student achievement.

Students in small private schools do better than those in large ones, but school size has no effect on the achievement of public school students. Not surprisingly, the effect of class size is insignificant because the average class size (over 40 students) for both public and private schools is well outside the range of class size associated with improved student achievement (Glass, McGaw and Smith, 1981). Also, teaching staff qualifications are not significantly related to achievement in either sector.

Private school students with female teachers outperform those with male teachers; this result may reflect a disproportionate utilization of male teachers in the low performing, all-male private schools. Students in enriched mathematics classes outperform students in regular or remedial classes, but the effects are significant for public school students only. Finally, more teacher time devoted to maintaining order is positively related to achievement in private schools but negatively related in public schools, possibly because public school classes in which teachers have to spend a large amount of time maintaining order are "problem" classes. In-service teacher training is unrelated to student achievement. Is there still a private school effect, even after differences in teaching practices and school characteristics are held constant? The answer is yes, according to the second panel of Table 7.7, which measures achievement

Table 7.6. Achievement Functions with Peer Group and School Characteristics included for Private and Public Schools, Thailand, 1981-82

	Regression including peer group characteristics				*Regression including school characteristics*			
	Private		*Public*		*Private*		*Public*	
	Coeff.	*t-stats*	*Coeff.*	*t-stats*	*Coeff.*	*t-stats*	*Coeff.*	*t-stats*
Constant	-18.06	-0.32	-10.83	-0.31	4.09	0.36	-33.32	-0.92
Past achievement	0.57	13.32	0.65	32.59	0.58	13.66	0.76	42.53
Time-invariant background (Z_i)								
Father's occupation								
Skilled	0.76	0.68	0.45	1.12	-0.30	-0.15	0.84	2.02
Clerical	-1.00	-0.10	-0.42	-0.90	0.09	0.05	-0.49	-1.01
Professional	0.31	0.26	0.39	0.81	0.51	0.48	0.64	1.34
Mother's education								
Primary	0.00	0.00	0.69	2.42	0.28	0.36	0.67	2.29
Secondary	-1.68	-1.64	0.64	1.30	-1.24	-1.21	0.69	1.38
University	-1.22	-0.93	-0.18	-0.30	-0.57	-0.45	0.02	0.03
Educational expectations								
5-8 more years	0.83	1.22	0.88	3.15	0.70	0.93	1.07	3.77
> 8 more years	0.80	1.02	1.35	3.38	0.74	0.92	1.55	4.39
Age	0.41	0.60	0.21	0.53	-0.43	-0.29	0.49	1.19
Age squared	-0.00	-0.73	-0.00	-0.70	0.00	0.23	-0.00	-1.35
Eldest child	-0.08	-0.10	-0.26	-0.86	-0.35	-0.33	-0.10	-0.34
Language of instruction also used at home	-1.75	-1.78	-0.17	-0.46	-0.22	-0.09	-0.16	-0.41
Male in single-sex class	-1.88	-2.03	-1.51	-3.97	0.16	0.05	-1.04	-2.51
Female in single-sex class	-2.00	-1.49	-0.89	-1.83	3.38	0.85	-0.46	0.89
Female in coed class	-1.08	-1.16	-1.12	-3.66	-1.70	-1.37	-0.85	-2.73
Background during eighth grade (X_{i8H})								
Tutoring	-0.12	-1.09	-0.04	-0.87	-0.11	-1.03	-0.07	-1.62
Parental encouragement	0.36	1.13	0.07	0.57	0.42	1.33	0.03	0.25
Home calculator	0.16	0.26	-0.17	-0.61	0.14	0.21	0.11	-0.40
Peer group during eight grade (X_{i8S})								
Average pretest score	0.44	5.75	0.47	11.96				
Proportion of mothers with more than primary education	2.41	0.84	-1.24	-0.72				
Proportion of fathers with professional occupation	-4.00	-1.12	0.14	0.01				
Grade 8 school characteristics (X_{i8S})								
District-level per capita					0.00	0.44	0.00	2.27
School enrollment					-0.01	-4.14	0.00	0.13
Teacher's math qualifications					7.46	0.97	0.48	1.06
Class size					0.32	1.03	-0.00	-0.08
Teacher's age					-0.01	-0.13	-0.01	-0.46
Male teacher					-3.15	-1.73	-0.34	-1.20
Teacher in-service training					-3.03	-0.58	0.15	0.34
Enriched math class					2.65	0.54	0.92	2.75
Workbook used often					-3.17	-0.94	-0.14	-0.47
Maintaining order					4.03	2.90	-1.44	-5.32
Minutes spent taking tests					-0.01	-0.68	-0.01	-1.42
Lambda	-3.96	-1.58	-1.97	-0.90	0.55	0.07	-3.56	-1.56

Table 7.7. Private School Effects after Holding Constant for Peer Group and School Characteristics, Thailand, 1981-82

Effect	*Predicted scores of students with average background and peer group characteristic if that student were still in:*		*Private/public differential*	
	Private school	*Public school*	*Raw difference*	*Effect size*[a]
Total unconditional effect	19.06	13.58	5.48	.45
Effect by student type				
Male in single-sex class	18.51	12.99	5.52	.45
Female in single-sex class	18.38	13.61	4.77	.39
Female in coed class	19.31	13.38	5.93	.48
Male in coed class	20.39	14.50	5.89	.48
	Predicted scores of students with average background of private school student and private school characteristics if that student were still in:		*Private/public differential*	
	Private school	*Public school*	*Raw difference*	*Effect size*[a]
Total unconditional effect	12.89	12.42	0.47	.04
Effect by student type				
Male in single-sex class	12.43	11.99	0.44	.04
Female in single-sex class	15.65	12.57	3.08	.25
Female in coed class	10.57	12.18	-1.61	-.13
Male in coed class	12.27	13.03	-0.76	-.06

Note: Calculated from Tables 7.5 and 7.6.

gain by the same method as in the previous section. Although the achievement advantage of private schools is lessened with the addition of these variables, there is still a residual effect of half a point on average. This effect is substantial (over three points and one-quarter of a standard deviation) for students in female single-sex schools, who benefit most from private schooling. This remaining private-public school differential indicates that there are unmeasured differences (such as employee incentives) between private and public schools that influence achievement. These findings need to be qualified, however, because the calculation is sensitive to the choice of the public or private reference point.

Unit Costs of Public and Private Schools

The previous sections show that private schools are more effective than public schools, even after holding constant for the characteristics of students as well as their peers. The bulk of the effect is attributable to measured differences in input mixes (including teaching practices). A critical question is whether more effective schools are necessarily costlier. Cost data imply that the answer is an emphatic no.

It was not possible to obtain actual expenditure data for the schools in the IEA SIMS sample. We did, however, obtain data on school-level income. Under the assumption that schools spend all of their income, income data can be used to estimate total costs per school. Data on the following categories of income were provided for the same academic year in which the tests were administered: support from the government, fees, material donations, cash donations and student scholarships. From the school-level data, we computed unit costs (see Table 7.8), which were substantially lower for private schools (1,762 baht) than for public schools (4,492 baht). This result holds for single sex and coeducational institutions. We conclude that private schools are more cost-effective than public schools.

The cost estimates are obviously rough. On the one hand, some schools (particularly private ones) might save a portion of their budget. If so, costs would be overestimated, and this situation would strengthen our conclusion about the cost effectiveness of private schools. On the other hand, private Catholic schools' budgets may not reflect their actual costs. For example, Catholic schools often rely heavily on teaching clergy, whose salaries substantially understate their market value, and their facilities may be subsidized by the church (Levin, 1987). If so, private school costs would be underestimated. Moreover, it was not possible to ascertain whether some of the income categories were earmarked for one-time expenditures (such as contributions to a building fund). If there are systematic differences in the categorization of public and private schools, the cost estimates could change—but probably not enough to overturn the relative cost effectiveness of the results.[31]

For two reasons, the impact of background on achievement gain can reinforce or counteract the private-public differential as measured by gross value-added. First, it is not unambiguously clear that students from one type of school (public or private) have characteristics that would give them an advantage in mathematics achievement gain (as opposed to achievement level) over students in the other type of school. Several indicators from our sample do point to a slight background advantage for students in private schools, which charge higher fees. Approximately 48 percent of public school students have fathers with blue-collar, semiskilled occupations, and 23 percent have fathers with white-collar clerical occupations, compared with 24 percent and 42 percent respectively for private school students. Also a greater proportion of private school students than public school students have mothers with a secondary school education or above (25 percent versus 15 percent) and have higher expectations regarding further education (28 percent of them expected to attend eight more years of schooling, that is, finish college, as opposed to 21 percent for public school students). These differences are reflected in the private school students' access to extra-school inputs such as more home use of calculators and out-of-school tutoring.

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[31] A careful and comprehensive comparison of the costs of 301 Thai primary schools (of which 7 percent were private) was recently documented by Tsang and Taoklam (1990). They conclude that the ratio of per unit total cost of private schools to all government schools is 0.78. The same ratio comparing private schools to public schools in Bangkok (where most private schools are) is 0.37. While we cannot use these primary-level estimates directly in our secondary-level comparison, they show that, when all aspects of costs are taken into account (including uniforms and privately borne costs), the qualitative results in Table 7.8 are corroborated by other evidence.

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However, private school students perceive receiving less parental encouragement for mathematics. *A priori*, therefore, we cannot be certain how background affects achievement gain.

Second, even if private school students come from more advantaged backgrounds, such characteristics could still reverse the uncorrected advantage of public schools in achievement gain (as opposed to achievement level). If the impact of background on achievement diminishes at higher grades, the achievement gain of the school type attended by advantaged students may be understated. For example, suppose that private school students enjoyed an unambiguous background advantage relative to public school students. Holding constant for background will increase private school achievement gain relative to that in public schools.

Table 7.8. Unit Cost of Private and Public Secondary Schools, Thailand, 1981-82
(in baht)

School type	*Private*	*Public*
All	1,762.03 (289.17)	4,491.90 (6,470.22)
Single-sex, grade 8, male	1,780.68 (77.26)	3,992.59 (1,387.31)
Single-sex, grade 8, female	(2,159.70 (138.32)	3,988.67 (764.20)
Coed, grade 8	1,615.76 (229.95)	4,646.92 (7,109.48)
Single-sex class, male	1,634.66 (176.97)	3,379.48 (11,476.21)
Single-sex class, female	2,171.66 (115.45)	3,992.80 (1,113.66)
Coed class	1,567.56 (111.39)	4,856.70 (7,557.12)

Note: Numbers in parentheses are standard deviations.

8

Dominican Republic

Unlike the four cases above, the data base for the Dominican Republic allows differentiation among types of private schools. This chapter reviews the history of secondary education in the Dominican Republic, analyzes available secondary education data using a modified version of earlier models that take into account the three different types of schools (public and two types of private) and discusses the findings.

Private and Public Education: Relative Sizes and Roles

The Dominican Republic has a history of strongly supporting public education. However, in recent years, public schools standards have dropped, and a growing number of private schools have been established to meet the demand.

Independence to 1930

When the Dominican Republic achieved independence from Haitian rule in 1844, its first constitution stated: "Public instruction will be provided for all citizens; it will be free in all branches of primary school instruction and the schools will be distributed according to territorial divisions and population." In that year, evidence suggests that there were seven schools in the country, two of which were private. In 1852, Presidential Decree No. 271 guaranteed the freedom to establish private schools.

The Republic was once more annexed by the Spanish in 1861, but four years later, the Spaniards were expelled in what was known as *la Restauración* (the Restoration) after a war with a nationalist army. By 1867, 14 schools existed, with 721 students enrolled in the public sector and 601 in the private sector.

After the Restoration, there was a period of constant struggle between the revolutionaries and the conservative bosses, some of whom had run the country under the Spanish (the *caudillos*). Then, in 1874, the process of modernizing the Republic's economy began as sugar mills were set up by exiled Cubans and the first national bank was established. The foreign debt process began as loans were taken on to finance public works. This was the era of Dollar Diplomacy. A period of political unrest followed the death in 1899 of Ulises Heaureaux, the country's leader, and, as the Republic's debt situation became increasingly complicated, the U.S. military stepped in to run the country in 1916. The period of U.S. intervention lasted eight years, during which the groundwork was laid for many of the Republic's present-

day social services, including the education system. At the same time, the U.S. administration disarmed the population and created a strong national guard.

1930 to Present

In 1930, six years after the Americans had left the Republic, the chief of the National Guard, Rafael Leonidas Trujillo, seized power and ruled the Republic for 30 years. The Trujillo government expanded education significantly as part of an overall attempt by the dictator to modernize the Republic. In 1930, total student enrollment at all levels barely exceeded 50,000 students, but by the end of the dictatorship in 1961, enrollment had increased more than tenfold. Although these statistics were probably somewhat inflated, this increase was nevertheless a considerable achievement. The government rigidly reinforced the law that made it obligatory for parents to send their children to grade school and made schools adhere to strict regulations. As a result of this expansion, the country's illiteracy rate dropped considerably. However, public schools tended to serve as centers of indoctrination in favor of the dictatorship, and critical thinking was not encouraged.

During and immediately after the Trujillo regime, the number of students attending private school was insignificant. Very few private schools existed, and most of those were primary schools. For example, in 1961-62, there were 21,424 students enrolled in grades seven to twelve in the public sector compared to only 6,661 in the private sector. Public secondary schools were the best at that time in spite the doctrinaire quality of their teaching. Even families with higher incomes sent their children to public schools.

However, after Trujillo was overthrown, private education boomed for a number of related reasons. In general, public schools lost a lot of their students due to political unrest, which drove many middle- and upper-class families to migrate from the downtown area of Santo Domingo to the suburbs. Public schools in these areas thus became overcrowded, and new private schools soon appeared to meet the excess demand. Because the income of middle- and upper-class families grew throughout the 1970s, they were increasingly able to afford the fees that the private schools charged. Also, during the 1970s, there was a growing demand for highly skilled workers, and the private sector responded by creating vocational schools to train students to meet the demand.

Most of these private schools were established by individuals, many of them teachers who wanted to make more money than they could earn in public sector. However, sometimes religious organizations would also establish private schools, either because they wished to promote their religion or because of their concern with social issues.

The period of greatest expansion in private education was from 1971 to 1980, due to the government's neglect of education and to falling public school standards. However, the primary sector grew more rapidly than the secondary sector, due to greater demand. It was calculated in 1976 that, for every 1,000 students who entered the first grade, only 160 completed the six years of primary school in six years. Of those 160, only 120 proceeded to the intermediate level, and of those 120, only 30 would complete high school.

Summary of the Present Situation

Despite the rapid growth of private secondary schools over the last 25 years, more students are still educated by the state (342,430) than privately (116,445) according to 1985-86 estimated[32] figures. Yet the number of secondary schools in each sector are about the same—378 public and 340 private[33]—indicating that average class size is much smaller in private schools than in public schools.

Public schools are financed by the state, but the funds provided often only cover the salaries of teachers, administrators and service personnel. Therefore, in order to meet minimum requirements for maintenance and instructional materials, directors of public schools sometimes charge students a small fee at the beginning of the year. Private schools are usually financed by monthly payments made by parents, often over a 10-month period; the government does not subsidize private schools. In some cases, it does provide money, but this is usually earmarked to pay scholarships, it is often less than the necessary amount and it is paid late. Furthermore, even though private schools have recently increased their registration and tuition fees considerably due to inflation and the devaluation of the peso, the government has not increased its "subsidy" to match.

In 1951, the "Ley Orgánica de Educación" (Educational Code) was passed into law. It specified that: "Private education is free; any person, corporation, society or group can find teaching institutions and in them teach any branch of knowledge without needing a license. Nor are they subject to any regulations, programs, methods or official text. However, primary education is an exception ... and will be subject to state supervision." In 1975, the Ministry of Education set up its Private School Department to supervise private schools, and 10 years later, the department published a set of minimum standards governing both teaching and facilities that all private primary schools must meet.

In accordance with the Ley Orgánica, private secondary schools are not regulated by the ministry. However, only those that meet the standards set by the Ministry of Education on September 1975 (Ordenanza Numero 7'75) are authorized to give examinations. These schools are known as "Escuelas Con Facultad" (we will call them F-type schools). To all other private secondary schools (we call them O-type schools), the ministry sends teachers from public schools to write and adjudicate examinations. F-type schools are generally regarded as higher status schools and tend to be more expensive. Also, a majority of them (77 percent) have an explicit religious affiliation, while this is the case for only 31 percent of O-type schools.

Only a small percentage of the population enjoys the privilege of eight years of school. But research suggests that, for the majority of students completing the eighth grade, the levels of instruction provided are extremely low. Nevertheless, the same research was able to identify an "instructed elite" within the eighth grade catchment sample. Almost all of these students attended high-quality private schools, and came from families with a high socioeconomic status. However, no significant differences in levels of achievement were discernible between the students attending low-quality public schools and those attending low-quality private schools.

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[32] Estimaciones y proyecciones, Dept. Estadística de La SEEBAC as cited in Luna and Gonzalez (1986).

[33] Departamento De Colegios Privados, SEEBAC, as cited in Luna and Gonzalez (1986).

The average teacher in the Dominican Republic has insufficient academic training and a very heavy teaching load. Research data collected in the 1982-83 school year show that only 24 percent of the teachers have received the training officially required to teach mathematics at the eighth grade level. Therefore, they tend to rely primarily on material from textbooks, which are often old-fashioned and rigid, leaving little room for creativity. Regardless, research has shown that only 16 to 19 percent of eighth grade students in public schools have a mathematics textbook, while the equivalent figure in private schools is 63 percent. One cause of this low quality of teaching may be that educational opportunities widened so rapidly that the curriculum, instructional materials and teacher training could not keep pace.

Framework

In this analysis,[34] we modify the earlier models to take into account the three different types of schools in the Dominican Republic: the O-type and F-type private schools and the government schools. A standard method for estimating school-type effects is to postulate the following reduced form model. The "ith" student's achievement score (A) in the three types of schools is a function of observed background variables (X) and unobserved variables (e).[35]

$$(8.1) \quad A_{if} = b_f X_{if} + e_{if},$$
$$(8.2) \quad A_{io} = b_o X_{io} + e_{io},$$
$$(8.3) \quad A_{ig} = b_g X_{ig} + e_{ig}.$$

If the effects due to unobserved variables, e, are randomly and normally distributed, ordinary least squares regression techniques can then be used to estimate the parameters of equations 8.1 to 8.3. Private-public comparisons can then be made using this information. For example, for a student with the characteristics of the average public school student, the difference in achievement score if he/she were to attend an F-type private school would be:[36]

$$(8.4) \quad \text{Effect} = (b_f - b_g) X_g.$$

As before, a critical problem arises if the observed public and private subsamples are basically incomparable due to selection bias. To correct for sample selection when parents choose among three alternatives, we use a variant of Heckman's two-step technique. The first step in this methodology is to estimate what determines the choice of type of school. We assume that schools are ranked by status in the following descending order: F-type, O-type and public. Individuals will choose an educational plan, including the type of school, that maximizes the child's economic well-being, net of private costs. The solution to this problem can be shown to result in the following choice equation for the "ith" child as in Chapter 2:

$$(8.5) \quad I_i^* = k Y_i + w_i,$$

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[34] The rest of this section is drawn from Jimenez, Lockheed, Luna and Paqueo (1991).

[35] Alternatively, equations 8.1, 8.2 and 8.3 can be estimated as one equation with a dummy variable for private and public types of schools. However, statistical (F-) tests led us to reject the hypothesis that the coefficients of all the other variables are equivalent in both types of schools.

[36] This can be easily shown. Subtract the estimated equation 8.2 from 8.1. Then, add and subtract $b_f X_g$ on the right-hand side of the resulting equation. The resulting difference an be expressed as:
Difference = $b_f (X_g - X_p) + (b_f - b_p) X_g$,
where the first term is interpreted as the endowment effect (i.e., the difference in scores due to differences in characteristics) and the second term is the school effect shown in equation 8.4 above.

where I_i^* is an unobserved variable that characterizes the propensity of a household to choose a certain type of school for the child. Since it is unobserved, we use the indicator variable:

$$\begin{aligned} I_i &= 2 && \text{if } I_i^* > c \\ I_i &= 1 && \text{if } 0 < I_i^* < c, \text{ and} \\ I_i &= 0 && \text{if } I_i^* < 0, \end{aligned}$$

where 0 and c are unobserved cutoff points for status (2 = F-type, 1 = O-type, 0 = public), Y indicates the explanatory variables and w is a random error term. Under suitable assumptions,[37] equation 8.5 can be estimated as an ordered probit model.

The second step is to use the results of the first step to correct for the selection bias in 8.1 to 8.3. With selection, the expected values of A_i are conditional on the choice of public and private sector. This means that the error terms e_i are correlated with w_i. The expected value of e_i will no longer be equal to zero, and the estimated parameters in 8.1 to 8.3 will suffer from omitted variable bias if OLS is applied. Under appropriate distributional assumptions,[38] the first step probit equation can be used to generate selection terms. Including those terms in expanded regressions equations 8.1 to 8.3 would enable us to treat the selection bias as a problem of omitted variables. The selection terms (called lambdas, by convention) times their OLS coefficients can then be interpreted as the direction and magnitude of selection bias in each of the public and private school achievement equations. The estimation of 8.1 to 8.3 with the inclusion of the lambda by OLS would be consistent (unbiased) because, in theory, the equations hold constant for the probability of being selected in one subsample or another.

Data

These data come from a national sample of students and schools included in a 1982-83 study of mathematics achievement in the Dominican Republic (Luna and Gonzalez, 1986). Because both types of private schools in the present sample are located exclusively in urban areas, we compare them to urban public schools only.

Sample

The sampling frame for the original study stratified schools by type (three types of public schools and two types of private schools) and by location (five types of urban and three types of rural settings); a random sample of schools from each cell in the frame was drawn, and within each school, one or two classrooms were sampled. This chapter analyzes data from 2,472 students in 76 urban schools.

At both the beginning and the end of the school year, students took an IEA mathematics test and completed detailed background questionnaires. Teachers completed several questionnaires at the pre-test, the post-test and at other times during the school year, giving information on their background and on general classroom teaching processes. They also provided information about the characteristics of their randomly selected "target" class. Data about the school were provided by a school administrator when the original data were collected, and additional data on costs and enrollments were subsequently obtained in conjunction with the preparation of this book.

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[37] Details available from the authors on request.

[38] Details available from the authors on request.

The independent variables analyzed in this paper include fixed student socioeconomic variables, characteristics of students that changed over the course of the year, school characteristics, teacher characteristics, teaching practices and peer characteristics.

Student Achievement

A mathematics test similar to that developed by IEA, covering arithmetic, algebra, geometry, statistics and measurement, was administered to students at the beginning (pre-test) and end (post-test) of the school year. All students were administered a "core" test of 40 items (27 items from the IEA core test and 13 other IEA items) and one of four "rotated" tests. This paper analyzes data from the core test.

Student Background Characteristics

Basic background information about each student included his or her sex, age in months, type of material used in construction of the student's residence (an indicator of socioeconomic status), highest maternal education in years completed, maternal occupation and paternal occupation. The material used in constructing the student's residence was classified as either (1) block house (block, brick or cement), or (2) other (mud or brick, for example). Maternal occupation was classified as (1) full time worker or (2) part-time or not employed outside the home. Paternal occupation was classified as: (1) white-collar, (2) blue-collar, (3) agricultural or (4) unclassified. In the analyses used in this paper, "blue-collar" serves as the comparator group. The actual data set included a wide variety of student social class background variables, but analyses have revealed considerable collinearity among them. Therefore, we have chosen those that provide the most information without showing excessive collinearity.

Two variables were identified that can affect achievement but have little effect on the choice of public or private schools. They were commuting time (or the length of time it takes a student to reach school) and days absent (or the number of days the student was absent in the past month). Commuting time was categorized as: (1) less than 15 minutes, (2) about 30 minutes, (3) more than 45 minutes or (4) no response. Days absent were categorized as: (1) never absent, (2) less than three days absent, (3) less than five days absent, (4) five or more days absent or (5) no response.

Basic Results

Table 8.1 presents the means (and standard deviations) of the student characteristic variables by type of school. Students in both types of private schools in the Dominican Republic come from distinctly more advantaged backgrounds than their public school counterparts. This difference is not surprising given that private schools charge fees and public schools do not. On average, private school students have more educated mothers, are more likely to have a father in a white collar occupation and are more likely to live in a "block house" than students attending urban private schools.

School Teacher and Peer Characteristics

Four school characteristics were examined: type of school, student-teacher ratio, average tuition of F-type schools in the region in which the school was located and average tuition of O-type schools in the region in which the school was located. Type of school was classified as: (1) "F-type" private schools authorized to administer national examinations, (2) "O-type" private schools not authorized to administer examinations and (3) public schools.

Three teacher characteristics were analyzed: (1) "teacher education," the number of years of formal education attained by the teacher, (2) "teacher experience", the number of years teaching either grade eight or second year at the middle level of the Reformed Program, and (3) the total number of class periods per week the teacher spent teaching at another school (an indicator of teacher involvement). Two teaching practices were analyzed: the amount of time in minutes spent in routine administration, and the amount of time in minutes for establishing and maintaining class order and getting students' attention during teaching periods. Two classroom quality variables were also included: the length of the mathematics period in minutes, and the percentage of students who had mathematics textbooks.

Peer group characteristics were indicated by four class average measures: class average pre-test score, class average years of maternal education, proportion of students having fathers with white-collar occupation, and percentage of students who were female.

Table 8.2 presents the means (and standard deviations) of the school variables by type of school. There are differences among the types of schools, but the differences are not consistently correlated with the status of the school. Private F-type schools appear to be the most advantaged, with the most educated and experienced teachers, the highest proportion of students with textbooks and the longest average periods of instruction. However, teachers in F-type schools also spend more time establishing order in their classroom, indicating that less time is spent on instruction, and are more likely to teach additional classes in other schools, suggesting that they have a greater need to supplement their salaries.

The differences between O-type and public schools are irregular. Public schools have more educated and experienced teachers than private O-type schools, and their teachers are less likely to seek additional employment. But private O-type schools have a higher proportion of students with textbooks, and teachers in O-type schools spend less time establishing order or on administrative processes. There are virtually no differences in mean student-teacher ratios or in the average duration of a class period.

The Effect of Background and Achievement in Public and Private Schools

According to Table 8.1, the average post-test scores of students in private O-type schools is one point (about 0.25 standard deviations) greater than average post-test scores of students in public schools; the average score of F-type students is over four points (1.18 standard deviations) greater. The gain in learning over the eighth grade, as measured by the difference between pre- and post-test scores, is virtually the same in public and O-type schools: 1.87 points. However, the gain of F-type students, at 2.53 points, is 0.66 points greater than the gain of public school students.

Because students in public schools differ from those in both types of private schools, these gross achievement differences should not be used to conclude that one school type is more or less effective than the other. The previous comparisons between students in the three types of schools (Table 8.1) showed that private school students—particularly those attending F-type schools—come from more advantaged backgrounds, compared to public school students. They have more educated mothers, live in better houses, tend to have a fulltime working mother and have fathers with white-collar occupations. Since both types of private schools charge tuition and the public schools do not, these differences in socioeconomic status are not surprising.

Table 8.1. Student Background and Achievement in Public and Two Types of Private Schools, Dominican Republic, 1983

Variable description	*Public*	*Private (O-type)*	*Private (F-type)*
Student post-test score A_{i7}	10.26	11.25	14.34
	(3.46)	(3.86)	(6.16)
Student pre-test score A_{i8}	8.39	9.39	11.81
Time-invariant background Z_{i8}			
Student's age in months	183.66	174.56	164.16
	(22.18)	(19.61)	(13.39)
Female	0.58	0.55	0.55
Residence built of cement blocks or brick	0.51	0.69	0.85
Mother's education in years	6.26	8.06	11.15
	(3.92)	(3.90)	(4.19)
Mother works full time	0.16	0.24	0.31
Father's occupation			
White-collar	0.29	0.49	0.73
Blue-collar	0.41	0.33	0.11
Agriculture	0.22	0.08	0.10
Unclassified	0.08	0.10	0.06
Background during eighth grade (X_{i8H})			
Student commutes to school:			
Less than 15 minutes	0.63	0.73	0.73
About 30 minutes	0.28	0.22	0.22
More than 45 minutes	0.09	0.04	0.04
No response	0.01	0.00	0.01
Days absent from school last month:			
Never	0.57	0.60	0.61
Fewer than 3 days	0.27	0.25	0.27
Fewer than 5 days	0.08	0.08	0.06
More than 5 days	0.07	0.07	0.06
No response	0.01	0.01	0.01
Number of observations	1,619	402	453

Note: Numbers in parentheses are standard deviations for continuous variables.

Table 8.2. School and Peer Group Characteristics, Dominican Republic, 1983 **(mean and standard deviation)**

Variable description	*Public*	*Private O-type*	*Private F-type*
Teacher and class characteristics			
Teacher's education in years	13.70 (1.64)	13.01 (1.00)	14.01 (1.64)
Teacher's Grade 8 mathematics experience in years	6.49 (5.01)	4.36 (4.72)	10.47 (5.84)
Number of class periods taught elsewhere	6.20 (9.66)	10.87 (9.99)	13.83 (11.68)
Length of mathematics period in minutes	43.80 (4.13)	43.09 (2.97)	45.30 (5.19)
Minutes spent on routine administration	22.54 (14.47)	19.41 (15.19)	21.79 (12.82)
Minutes spent on establishing order in class	19.20 (17.98)	7.20 (8.61)	23.07 (17.27)
Percentage of students with textbook	17.50 (23.06)	55.97 (38.57)	62.75 (43.67)
Student-teacher ratio	31.03 (9.01)	30.78 (9.04)	30.60 (16.44)
Peer group characteristics			
Class average pre-test score	8.27 (1.15)	9.35 (0.88)	11.84 (3.61)
Class average mother's education in years	6.23 (1.25)	8.11 (1.35)	11.23 (1.92)
Proportion of students having fathers with white-collar occupation	0.28 (0.10)	0.46 (0.16)	0.69 (0.20)
Percentage of female students in class	42.74 (8.25)	35.24 (10.87)	42.52 (9.82)
Number of observations	1,619	402	453

Note: Numbers in parentheses are standard deviations.

Much research indicates that background variables are positively correlated with achievement level. Therefore, it is necessary to adjust for differences in student background. But simply correcting for background is not sufficient. If the impact of background on achievement increases or remains constant over time, then correcting for background will tend to lessen the private school advantage in terms of gain over the eighth grade. Only if the impact of background diminishes over time will correcting for background strengthen the private school advantage. In either case, it is necessary to correct for sample selection differences. As mentioned above, we use an adaptation of a now-standard two-step methodology to correct for background variables in an unbiased way. The first step is to estimate what determines the choice of type of school, ranked ordinally in order of status: F-type private schools, O-type private schools and public schools. We assume that parents and students choose the type of the school that they calculate will maximize the child's lifetime earnings, net of tuition. The second step is to use the results of the first step to correct for the selection bias in the achievement equations. The details of the methodology are available from the authors. In the next two subsections, we discuss the results of each of the two steps.

What Determines the Choice of School Type?

The results of a regression of the choice of school type, as measured by an ordinal ranking of high (F-type), middle (O-type) and low (public) status schools, are presented in Table 8.3. Mother's education, the quality of the student's house (a proxy for wealth) and father's occupation (white-collar, agricultural and unclassified occupations versus blue-collar workers) were all strongly positively correlated with

Table 8.3. Choice of Public, Private O-type or Private F-type School: Probit Equations, Dominican Republic, 1982-83

Variables	Coefficient	Standard error
Intercept	1.59	-2.56
Mother's education	0.08[a]	11.46
Student's age	-0.01[a]	-9.63
Block house	0.27[a]	4.36
Female	-0.03	-0.54
Full-time working mother	0.01	0.14
Father occupation		
White-collar	0.57[a]	8.64
Agricultural	0.25[b]	2.81
Unclassified	0.20	1.92
Average tuition of F-type (1987-88)	-0.00[b]	-2.80
Average tuition of O-type (1987-88)	0.02[b]	3.96
MU	0.68[a]	18.13
Log likelihood	-1,769.1	

Notes:
[a] $p < .001$
[b] $p < .01$
O-type private = 1; F-type private = 2

choosing a higher status alternative. Older students, who may have repeated one or more grades, tend to choose lower status schools. Neither mother's working status nor student sex significantly affected the choice of school type.

The other group of variables that affects school type is the relative cost of attending that school. In this analysis, the comparator cost is that of public schools, which do not charge any tuition. For each observation, the cost of F- and O-type schools was calculated from the average tuition charged by those schools in the sample stratum. Although we assume that there is no variation in cost within each stratum, we expect there to be considerable variation across strata. For example, schools in larger urban areas probably have to pay teachers higher salaries and, therefore, may have to charge higher tuition. Because we do not have data on other private costs, we assume that these costs, while significant, are roughly the same across school types.

The coefficient of F-type tuition is negative and significant, as we expected. When the cost of attending an F-type school as compared with public schools rises (holding constant for the relative cost of O-type versus public schools), the demand for status falls. Students will switch to lower status O-type schools or public schools.

The coefficient of O-type tuition can be positive or negative. When the cost of attending an O-type school rises compared to public schools (holding constant for the relative cost of F-type versus public schools), the demand for O-type schools falls. This displaced demand can be met by lower status public schools or higher status F-type schools. In our sample, the displaced demand is met predominantly by F-type schools. Thus, the coefficient of O-type tuition is positive.

The estimated achievement equations for private F-type, private O-type and public schools are presented in Table 8.4. Because standard F-tests revealed that differences in the coefficients among the three types of schools were significant, we estimated the equations separately. The explanatory variables include the background variables used in the equation for choice of school type plus some variables not contemporaneous with school choice. The latter include the pre-test score, actual commuting time to school and days absent from school. The two tuition variables included in the school choice equation are excluded from the achievement equations.

They are average prices for sample strata and should have little effect on an individual's performance once in school. Moreover, excluding them from the achievement equations helps to identify the system.

The coefficient of the pre-test score can be interpreted as the lagged effect of previous background inputs on current-year achievement. This effect is twice as large for the high prestige F-type schools than for either private O-type or public schools.

What is the Effect of Background on Achievement?

Holding constant father's occupation and other variables, mother's education is negatively related to achievement. This relationship is perhaps attributable to the fact that more highly educated mothers are apt to work part time and are less available at home. Girls in private F-type schools are not disadvantaged relative to boys, while in public and private O-type schools, they gain significantly less than boys. Commuting time and days absent have little impact on achievement.

Table 8.4. Achievement Functions for Private and Public Schools, Dominican Republic, 1982-83

Explanatory variables	*Public*	*Private O-type*	*Private F-type*
Constant	10.50[a]	9.53[a]	10.10[a]
	(10.44)	(4.52)	(3.50)
Pre-test score	0.41[a]	0.38[a]	0.81[a]
	(16.65)	(6.74)	(19.24)
Mother's education	-0.05	-0.20[c]	-0.14
	(-1.55)	(-2.29)	(-1.68)
Age in months	-0.02[a]	0.01	0.01
	(3.47)	(0.81)	(0.66)
Block house	-0.04	-0.53	-1.03
	(0.21)	(-1.01)	(-1.59)
Female	-0.55[a]	-1.14[b]	0.22
	(-3.50)	(-3.28)	(0.59)
Full-time working mother	0.16	1.01[c]	-0.07
	(0.75)	(2.42)	(-0.16)
Father's occupation			
White-collar	-0.33	-1.13	-1.03
	(-1.32)	(-1.70)	(-1.24)
Agricultural	-0.47[c]	-0.28	-0.43
	(-2.23)	(-0.39)	(-0.55)
Unclassified	-0.35	-0.06	0.14
	(-1.15)	(-0.08)	(0.15)
Commuting time			
About 30 minutes	0.06	0.60	0.02
	(0.35)	(1.47)	(0.05)
More than 45 minutes	-0.51	-2.14[c]	-1.04
	(-1.87)	(-2.43)	(-1.07)
No response	0.79	-2.19	2.19
	(0.84)	(-0.64)	(1.05)
Days absent			
More than 5	0.02	0.22	-0.58
	(0.07)	(0.31)	(-0.73)
Fewer than 5	-0.36	-0.06	1.11
	(-1.26)	(-0.10)	(1.40)
Fewer than 3	0.01	0.53	0.74
	(-0.07)	(1.28)	(-1.72)
No response	-2.46[b]	-0.76	-2.27
	(-3.21)	(0.49)	(-0.98)
Lambda	-1.06	-2.52[b]	-3.86[b]
	(-1.70)	(2.68)	(-3.02)
Adjusted R^2	0.20	0.20	0.59
Number of observations	1619	402	453

Notes:
Numbers are regression coefficients with t-statistics in parentheses.
[a] $p < .001$
[b] $p < .01$
[c] $p < .05$

The selection term in each of the achievement equations is lambda times its coefficient, where the latter is the ratio of the covariance between the error terms in the achievement and choice equations to the standard error of the choice equation. If this value is positive and significant, then the estimated expected value of achievement will be greater due to selection effects. Thus, correcting for selection will lead to the lowering of the expected value of achievement. The converse will hold if the value is negative and significant. If the coefficient of lambda is not significantly different from zero, then selection effects are not important.

In our sample, the selection effects are positive for public schools and negative for both O-type and F-type private schools. This result is somewhat surprising because we initially thought that the background advantage of private school students would lead them to a positive selection bias. However, the strong price effects indicate that, by charging tuition, private schools are depriving themselves of bright, highly motivated but poor students who select public schools. This effect appears to counterbalance the background selection effects.

With Background Held Constant, Is There a Private School Effect?

The estimated differential in the achievement of public and private school students can be computed from the parameters presented in Table 8.3 to hold constant for the effect of background, standardized according to the public school means. The unconditional effect measures the change in student's test score had that student gone to a private school. The same calculation can be performed standardizing at F-type and O-type means to test the robustness of the results, which are presented in Table 8.5.

Table 8.5. Private School Effects on Grade 8 Mathematics Achievement, Holding Constant for Background Characteristics and Controlling for Selection Bias, Dominican Republic, 1982-1983 **(two-stage correlation)**

Characteristics of the randomly chosen student set at mean of:	*Predicted score*			*Raw differential*		*Effect Size*	
	Public	*O-type*	*F-type*	*O-pub.*	*F-pub.*	*O-pub.*	*F-pub.*
Public school subsample	9.79	12.86	17.26	3.08	7.47	0.89	2.16
Private O-type subsample	0.31	12.67	17.41	2.36	7.10	0.68	2.05
Private F-type subsample	11.29	12.54	18.36	1.26	7.07	0.36	2.04

The results indicate that, after holding constant for past achievement and socioeconomic background, eighth grade students in private schools who have the mean characteristics of a public school student have an unconditional advantage in test performance of about three points (about one standard deviation) in private O-type schools and of about seven points (about two standard deviations) in private F-type schools. These results are largely invariant when computed at O-type or F-type characteristics.

Had we used the biased coefficients of an OLS (without correcting for selection), we would have come up with qualitatively similar results. However, the magnitudes would have been different—only about 0.3 points (0.10 standard deviations) advantage for private O-type schools and one to two points for private F-type schools (0.25 to 0.50 standard deviations) (Table 8.6).

Table 8.6. Private School Effects on Grade 8 Mathematics Achievement, Holding Constant for Background Characteristics and Controlling for Selection Bias, Dominican Republic, 1982-1983 (OLS)

Characteristics of the randomly chosen student set at mean of:	*Predicted score*			*Raw differential*		*Effect Size*	
	Public	*O-type*	*F-type*	*O-pub.*	*F-pub.*	*O-pub.*	*F-pub.*
Public school subsample	10.26	10.35	10.24	.09	-.02	0.03	-0.01
Private O-type subsample	10.99	11.25	11.66	.26	.67	0.08	0.19
Private F-type subsample	12.25	12.63	14.34	.38	2.10	0.11	0.61

The Nature of the Public-Private Differential

The previous section showed that private school students in the Dominican Republic scored higher in mathematics achievement tests at the end of eighth grade than did their public school counterparts, after controlling for previous achievement, socioeconomic background and systematic selection by school type. The effect was larger for higher status F-type schools. In terms of policy, the important question is, why does this difference exist? Is it possible to identify the characteristics of private schools that contribute most to the achievement effect? What do administrators and teachers in private schools do that is different? What peer group effects are there? These questions are answered systematically in the next two subsections.

School, Classroom, Teacher, and Teaching Practice Variables

Table 8.2 showed that there were substantial differences in school, classroom, teacher qualification and practice variables among the various types of schools. These differences were not, however, consistently commensurate with the status of the school type. Table 8.7 shows the results of adding these variables to the achievement equations for the various types of schools. Holding student background characteristics constant, few of the school, classroom or teaching practice variables are statistically significant. In F-type schools, students of more educated teachers score about one point higher than students of less well-educated teachers for each additional year of teacher education. Also, students of teachers who teach elsewhere score about one-tenth of a point higher for each additional class period than students of teachers who teach fewer class periods elsewhere. The remaining teacher and teaching practice variables have no effect on student achievement. In O-type schools, no teacher or teaching variable is associated with differences in achievement. In public schools, only the number of class periods the teacher taught elsewhere has an effect on student achievement, and the effect again is positive.

After holding constant for these variables, one would expect that some of the private school advantage would disappear. After all, these differences in teacher characteristics and teaching practices may account for a portion of that advantage. The results in Table 8.8 indicate that this is indeed the case, at least for F-type schools. The private F-type advantage over public schools falls from seven points to about four to five points, dropping by one-half to three-quarters of a standard deviation. However, it does not

Table 8.7. Results of Achievement Equation after Holding Constant for Student and School Characteristics, Dominican Republic, 1982-1983

Variable		*Public*	*Private O-type*	*Private F-type*
Intercept		10.71[a]	7.08	-5.25
		(1.81)	(4.98)	(7.19)
Pre-test score		0.41[a]	0.39[a]	(0.71[a]
		(0.03)	(0.06)	(0.05)
Mother's education		-0.05	-0.23	-0.10
		(0.04)	(0.16)	(0.13)
Age in months		-0.02[b]	0.02	-0.01
		(0.01)	(0.03)	(0.03)
Block house		-0.12	-0.63	-0.58
		(0.19)	(0.69)	(0.78)
Female		-0.56[a]	-1.11[b]	0.22
		(0.16)	(0.35)	(0.40)
Full-time working mother		0.19	1.07[c]	-0.19
		(0.22)	(0.42)	(0.42)
Father's occupation	White-collar	-0.37	-1.34	-0.66
		(0.27)	(1.10)	(1.06)
	Agricultural	(0.40)	-0.34	-0.13
		(0.22)	(0.84)	0.86)
	Unclassified	-0.41	-0.17	0.50
		(0.31)	(0.73	(0.98)
Commuting time	About 30 min.	0.04	0.49	-0.14
		(0.18)	(0.42)	(0.46)
	More than 45 min.	-0.53	-2.37[b]	-1.35
		(0.27)	(0.89)	(0.94)
	No response	0.77	-2.22	2.14
		(0.93)	(3.43)	(2.03)
Days absent	More than 5	-0.01	0.40	-0.50
		(0.32)	(0.72)	(0.78)
	Fewer than 5	-0.38	0.02	0.87
		(0.29)	(0.65)	(0.79)
	No response	-2.47[b]	-0.84	-2.07
		(0.77)	(1.55)	(2.29)
Student teacher ratio		-0.01	0.01	0.05
		(0.01)	(0.03)	(0.04)
Teacher's experience in years		0.00	0.02	1.13[a]
		(0.06)	(0.26)	(0.34)
Class periods taught elsewhere		0.03[b]	0.00	0.10[b]
		(0.01)	(0.03)	(0.04)
Length of mathematics period		-0.01	0.04	-0.03
		(0.02)	(0.10)	(0.06)
Minutes spent on routine administration		-0.00	0.02	0.02
		(0.01)	(0.02)	(0.03)
Minutes spent on establishing order		(0.01)	(0.03)	(0.02)
Lambda		-1.22	-2.91[c]	-2.25
		(0.71)	(1.91)	2.14)
Adjusted R^2		.20	.19	.60
N (students)		1,619	402	453

Note: Numbers are regression coefficients with standard errors in parentheses.

[a] $p < .0001$.

[b] $p < .01$.

[c] $p < .05$.

Table 8.8. Private School Effects after Holding Constant for Background, Teacher and School Characteristics, Dominican Republic, 1982-1983

Characteristics of the randomly chosen student set at mean of:	Predicted score			Raw differential		Effect size	
	Public	O-type	F-type	O-pub.	F-pub.	O-pub.	F-pub.
Public school subsample	9.72	12.76	14.32	3.04	4.60	0.88	1.33
Private O-type subsample	10.34	12.90	14.59	2.56	4.25	0.74	1.23
Private F-type subsample	11.32	12.08	16.69	0.76	5.37	0.22	1.55

disappear, indicating that there are unmeasured practices, teacher characteristics or factors that motivate teacher performance that account for a residual impact. For the private O-type schools, holding constant these characteristics has virtually no impact on their advantage over public schools, which remains at about two to three points.

Peer Group Effects

Because students interact with each other in school, the ability and backgrounds of fellow students may have an effect on individual achievement. To account for this possibility, we added to the achievement equations three classroom-level peer variables: average pre-test score, the average years of education of students' mothers and the proportion of students whose fathers have white-collar jobs. (Because of collinearity, these variables were added to those in Table 8.4; school and teacher variables are not included.) As we saw in the tables of means, these classroom peer characteristics rise with school status.

Table 8.9 shows the effect of adding these variables on the results. The selection terms become insignificant, indicating that these peer group variables may be capturing their effect. This result is not surprising, if students with similar backgrounds are led to select similar status schools. Thus, an important methodological result is that adding peer group variables may substitute for more cumbersome techniques designed to correct for selection bias. The impact that these variables have on the private school effect is interesting as well. According to Table 8.10, adding peer group effects to the achievement equations significantly diminishes the private school advantage, even turning the F-type private school advantage into a disadvantage. We also found this result in Thailand using similar data.

Relative Cost of Private and Public Schools

Two questions will now be explored: What is the relative cost-effectiveness of the three types of schools? What is the value-added for private schools?

Our cost data are admittedly incomplete. When the school background data were originally gathered in 1982-83, financial information was not included. We returned to the sample schools in 1987-88, but very limited information on costs could be obtained. Nevertheless, the available data on salaries for teaching

Table 8.9. Results of Achievement Equation after Holding Constant for Student and Peer Group Characteristics, Dominican Republic, 1982-1983

Variable		School Type		
		Public	Private-O	Private-F
Intercept		6.64[a]	2.45	6.46[c]
		(1.25)	(3.30)	(3.26)
Pre-test		0.36[a]	0.35[a]	0.67[a]
		(0.03)	(0.06)	(0.05)
Mother's education		-0.03	-0.12	0.10
		(0.03)	(0.09)	(0.11)
Age in months		-0.01[c]	0.01	-0.04
		(0.01)	(0.02)	(0.02)
Block house		-0.07	-0.16	-0.16
		(0.19)	(0.54)	(0.69)
Female		-0.53[a]	-1.18[a]	0.03
		(0.15)	(0.35)	(0.37)
Full-time working mother		0.13	0.99[c]	-0.18
		(0.21)	(0.42)	(0.41)
Father's occupation	White-collar	-0.27	-0.46	0.67
		(0.25)	(0.71)	(0.95)
	Agricultural	-0.18	0.12	0.37
		(0.21)	(0.74)	(0.83)
	Unclassified	-0.32	0.29	0.87
		(0.30)	(0.68)	(0.98)
Commuting time	About 30 min.	-0.02	0.50	-0.30
		(0.17)	(.41)	(0.44)
	More than 45 min.	-0.63[c]	-2.25[b]	-1.75
		(0.27)	(0.87)	(0.93)
	No response	0.77	-2.24	1.39
		(0.91)	(3.40)	(2.01)
Days absent	More than 5	0.26	0.21	-0.62
		(0.31)	(0.71)	(0.78)
	Fewer than 5	-0.31	0.13	0.87
		(0.28)	(0.65)	(0.79)
	Fewer than 3	0.05	0.58	-0.55
		(0.18)	(0.41)	(0.42)
	No response	-2.31[b]	-0.85	-1.83
		(0.75)	(1.53)	(2.29)
Class average pre-test scorer		0.45[b]	0.49	0.49[a]
		(0.08)	(0.25)	(0.11)
Class average mother's education		-0.12	0.20	-0.31
		(0.08)	(0.18)	(0.20)
Proportion of students having fathers with white-collar occupations		4.11[a]	0.14	2.41
		(0.96)	(1.55)	(1.71)
Percentage of female students		-0.01	0.01	-0.01
		(0.01)	(0.02)	(0.02)
Lambda		-0.49	-1.25	1.18
		(0.64)	(1.03)	(1.68)
Adjusted R^2		0.23	0.20	0.61
Number of observations		1619.00	402.00	453.00

Note: Numbers are regression coefficients with standard errors in parentheses.
[a] $p < .001$. [b] $p < .01$. [c] $p < .05$

Table 8.10. Private School Effects after Holding Constant for Background and Peer Group Characteristics, Dominican Republic, 1982-1983

Characteristics of the randomly chosen student set at mean of:	Predicted score			Raw differential		Effect size	
	Public	O-type	F-type	O-pub.	F-pub.	O-pub.	F-pub.
Public school subsample	10.04	10.97	8.12	0.93	-1.92	0.27	-0.55
Private O-type subsample	11.56	11.95	9.95	0.39	-1.60	0.11	-0.46
Private F-type subsample	14.05	14.23	13.12	0.18	-0.93	0.05	-0.27

and non teaching staff, which often account for as much as 90 to 95 percent of recurrent costs in education, do give useful indications.[39]

Two types of evidence are presented to address the issue of relative cost-effectiveness. One relies on actual but partial unit cost data: in other words, salary expenditure per student among schools (Table 8.11). The other (Table 8.12) compares roughly estimated full unit costs relative to predicted mathematics achievement scores, assuming that tuition and fees reflect the long-run average cost per student year of private education. For public schools, two estimates of the average cost per student year are presented, calculated on some assumed ratio of nonsalary to total expenditure to take into account capital costs (for example, buildings, library and equipment) and other expenses; this ratio in our opinion is at least 15 percent. The level of mathematics achievement used to divide the average cost per student is the predicted post-test score, holding constant background characteristics and controlling for selection bias. For this analysis, background characteristics are set equal to their mean values for public school students.

Table 8.11. Comparative Cost Data by Type of School, Dominican Republic, 1982-1983

Variable	Public	Private O-type	Private F-type
Expenditure per student			
Teacher salaries (RD$/month)	15.90	9.71	16.77
Nonteaching staff salaries (RD$/month)	6.99	3.36	7.20
Total	22.89	13.07	23.97
Average annual salary			
Teachers (RD$/year)	444.30	237.10	447.80
Nonteaching staff (RD$/year)	421.50	309.40	728.00
Nonteacher salaries as percentage of all salaries	30.55	25.69	30.04
Tuition and fees (RD$/year)	0	209.20	472.40
Government grant per student (RD$/month)	..	.80	.72

Note: .. not applicable.

[39] United Nations Educational, Scientific and Cultural Organization data for the Dominican Republic show that 95 percent of public general secondary education expenditures in 1983 was accounted for by teacher emoluments.

Table 8.12. Cost Per Predicted Points on Post-test Mathematics Test, by School Type, after Holding Constant for Background Characteristics and controlling for Selection Bias, Dominican Republic, 1982-1983

	Predicted post-test score[a]	*Effect size*[b]	*Cost per student*[c]	*Cost per point on math test*	*Cost per unit of standard deviation*
Public (15% nonsalary)	9.79	..	323	33.0	..
(5% nonsalary)	9.79	..	289	29.5	..
Private O-type	12.86	.89	209	16.3	234.8
Private F-type	17.26	2.16	472	27.4	218.5

Note: .. not available.

[a] From Table 8.5.

[b] Effect size is defined as the difference between the predicted private school mathematics score and the predicted public school mathematics score divided by the standard deviation of the public school scores.

[c] Tuition and other fees reflect long-run average cost per student in the private schools. For the public schools, the following formula is used: $C = X/(1 - N)$ where C = cost per student, X = salary expenditure per student and N = nonsalary cost as a proportion of total cost.

O-type Private Schools

On average, O-type private schools are much more cost-effective than public schools. That is, per student salary expenditures in private O-type schools are 43 percent lower than those in public schools, but mathematics achievement is 31 percent higher. This conclusion, which is confirmed by data in Table 8.12, is robust. The table shows that the ratio of full unit cost to predicted mathematics score is lower by at least 50.6 percent in O-type private schools compared to public schools. Moreover, the advantage of private O-type schools over public schools may be underestimated inasmuch as our cost estimates include economic profit. One reason why private O-type schools are more cost-effective than public schools is that they hire teachers at lower cost. Average expenditures per teacher in private O-type schools are close to 47 percent less than in public schools. Another reason may be that private schools are closed less often for public holidays.

F-type Private Schools

The conclusions are less clear cut for F-type schools, although these schools are probably more cost-effective than the public schools. Private F-type schools spend 4.7 percent more per student on salaries than public schools, but the predicted cognitive achievement of children is 76.3 percent greater in F-type schools. In terms of the estimated (full) cost per cognitive achievement score in Table 8.12, private F-type schools also appear to be more cost-effective than public schools.

F-type versus O-type Private Schools

In comparison with private O-type schools, private F-type schools have a 70 percent higher cost-to-achievement ratio. A major reason for higher cost in F-type private schools is a much larger expenditure on salaries, with private F-type schools spending 83.5 percent more per student on salaries than private

O-type schools. The additional cost is associated with mathematics achievement scores that are 34.2 percent higher in F-type private schools than in O-type private schools, other things being equal.[40]

The apparent advantage of private O-type schools over private F-type schools in terms of cost-effectiveness, however, is dependent upon the metric of achievement. When costs per point on the mathematics test are compared, private O-type schools appear to be substantially more cost-effective than are private F-type schools (as well as being more cost-effective than public schools). When the score advantage of both types of private schools is converted to standard deviation units, or effect sizes, the comparative advantage of O-type private schools is reduced. Students in O-type private schools score less than one standard deviation higher than students in public schools, while students in F-type private schools score over two standard deviations higher. The cost per standard deviation of achievement in both types of private schools is roughly equivalent.

We now turn to the next question, what is the value-added of private education? A fundamental contribution of private schooling is to fill market demand not satisfied by public educational systems. Also, from the public finance point of view, the private school system makes an important contribution in that it allows children to achieve a higher level of learning than would be expected from a public school without adding to the financial burden of the government. Public schools are normally geared to the average child. In a pluralistic society, however, there are parents who want more for their children than the standard of education that the public school system can deliver.

[40] It is intriguing, however, that relative to the F-type schools, parents sending their children to O-type schools are paying only slightly more for each unit of extra learning achievement (gained over and above their children's predicted scores in a public school setting). In this regard, parents sending their children to O-type schools pay slightly less at RD$ 63. This finding indicates that profits are higher for the O-type than F-type schools, which, given differences in religious affiliation, is not surprising.

Part III

Beyond the Case Studies

9

What Accounts for the Differences?

The Theoretical Framework

Why are private schools more effective than public schools in boosting student achievement? The previous chapters have examined the contribution of student selectivity, peer effects and, to a limited degree, the effects of school inputs, such as teacher training and experience and student-teacher ratios. This chapter extends the discussion of school-level resources and inputs and then departs sharply from the previous chapters by going "inside" public and private schools to examine how they are organized and managed. Here, we raise the question of whether it is possible for public schools to reorganize themselves along lines developed by private schools.

Resources and Inputs

One reason that private schools may be more effective than public ones is that they concentrate their resources on the classroom by investing in better educated teachers, more instructional materials and a larger stock of institutional resources such as libraries, laboratories or subject rooms. Another explanation is that they are more likely to choose a mix of inputs that accelerates student learning, while economizing on those inputs that have little impact on student learning. We have seen in previous chapters that per student expenditures in private schools are lower, not higher, than those in public schools, which suggests that the explanation for their greater effectiveness does not lie in the greater abundance of resources in general. In this chapter, we compare the types of resources available in public and private schools to see what, if any, differences emerge in the mix of inputs each choose.

Management

Private schools may also be more effective and efficient because of their internal management. Hannaway (1991) argues that schools and school systems organize themselves to enhance the objectives of their resource providers. In the case of private schools, these are parents; in the case of public schools, they are local, regional and national authorities. The result is that private schools adopt an organizational structure that is flexible with respect to the needs of individual students and that is aligned with the

structure that promotes internal compliance with the multiple objectives not only of individual parents and students but also of the wider society. Hannaway also argues that so long as public schools receive their financing directly from "central" sources, they will not be able to adopt the more flexible organizational structure private schools use in response to parental sources of funding.

In many countries, efforts have been made to decentralize the responsibility for resource provision to local levels in an attempt to encourage greater school-level responsiveness to local needs. However, in many cases, shifting financial responsibility has been viewed as a means of relieving a burden on the central budget, not as a means of providing greater autonomy to local schools. The result has been that decentralization has neither supplied more material resources at the school level nor enhanced school-level autonomy over decisionmaking (Lockheed and Zhao, 1992).

School-level autonomy is a key difference between public and private schools. In her research on Catholic and public schools in the United States, Hannaway found that school autonomy was higher for Catholic schools than for public schools, even with a number of adjustments for student characteristics, organizational context and principal characteristics. She notes that "even if we changed public schools in terms of their clients, their organizational and political contexts, and the characteristics of their principals, these schools would still not be managed the way private schools are managed" (Hannaway, 1991). The reason is that as long as public schools are accountable to central bureaucracies, they will be organized in a management structure that limits school-level autonomy.

In this chapter, we examine in depth two aspects of public and private schools that we were unable to explore in the case study chapters: school-level resources and school-level management.

The "Mini-survey": Back to the Five Countries

What accounts for the differences between the effectiveness and efficiency of private and public schools? The previous chapters have examined the contribution of selectivity, peer effects and, to a limited degree, the effects of school characteristics. In this chapter, we examine other features of schools that differentiate private from public institutions. We focus on a wider range of material inputs and on school management. To address these issues, we undertook a "mini-survey" of public and private schools in the five case-study countries. This survey was undertaken from a distance. We invited a senior researcher in each country to gather systematic data about a variety of institutional practices in public and private schools, using a survey instrument we provided (see Annex). In each country, the researcher was asked to identify three schools in each of the following categories: private elite, private nonelite, public elite and public nonelite schools. This made a total of 12 schools per country. All of the schools were visited by the researcher or a representative of the researcher who interviewed the headmaster or principal teacher. Although 12 surveys were returned from each country, for a total of 60 schools, all types of schools were not represented equally. We received returns from 14 private elite schools, 17 private nonelite schools, 13 public elite schools and 16 public nonelite schools.

The results from the mini-survey confirmed much of what we have observed previously with respect to student selectivity and resource similarities among schools in the two sectors. The private schools in this survey were not systematically more advantaged than the public schools in terms of the material resources available to them, although their students may have been more capable than those in the public schools.

The mini-survey also confirmed our suspicion that private schools are more advantaged in terms of their ability to manage themselves and make educational decisions at the level of the school site.

In this section, we present the results of the mini-survey in a descriptive form. We also evaluate the statistical significance of the differences observed, although we recognize that the way in which the 60 schools in the mini-survey were selected largely contradicts the basic assumptions of statistical inference. The results are presented in two sections: resources and management.

Resources

General Characteristics

In many respects, the public and private schools in the mini-sample were similar (Table 9.1). The majority of both the private and the public schools were coeducational (81 percent and 86 percent respectively) day schools with only 20 percent having any type of boarding facility. Approximately the same proportion (45 percent) were classified as "elite" schools (a consequence of the instructions issued to the researcher). However, despite these similarities, there were significant differences between the public and private schools in our mini-survey. Public schools admitted more applicants (36 percent) than did private schools (23 percent) and were less likely than public schools to admit students on the basis of test performance (55 percent and 65 percent respectively). Second, a higher proportion of teachers in public schools were "fully qualified" than in private schools. Third, the public schools were larger, enrolling more students and employing more full-time teachers; possibly as a result, the public schools were more likely to operate on two shifts. Fourth, the public schools taught fewer different grades than the private school (5.8 grades and 8.5 grades respectively). While public schools differed from private schools in terms of the numbers of students and teachers and in the number of grades offered, they had only one more administrator, on average, than private schools had. The picture that emerges here is of administrators in private schools managing somewhat more able students in physically small but educationally complex organizations, and administrators in public schools managing somewhat less able students in physically large but educationally simple organizations.

Physical Characteristics

Physically, the public and private schools in the mini-survey differed very little, and both sectors appeared relatively advantaged (Table 9.2). In particular, the conditions for teaching did not differ significantly between public and private schools. Most students were accommodated in regular classrooms; most classrooms had seats and desks for both students and the teacher. Virtually all classrooms had blackboards. Both public and private schools reported having an average of 11 of 13 important physical resources: file cabinets, telephone, typewriter, television, computer, radio, duplicating machine, school library, science laboratory, subject rooms, storage facilities for books, staff room, office for school head and a kitchen. The only difference between public and private schools was that more private schools than public schools reported having a school library (93 percent and 79 percent respectively), whereas more public schools than private schools reported having a copying machine (85 percent and 61 percent respectively).

The physical plants of public and private schools were also similar with respect to selected "modern" amenities. All private schools and 83 percent of public schools reported having water piped to the

Table 9.1. General Characteristics of Private and Public Schools in Mini-survey, Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990

Characteristics	*Private*	*Public*	*Statistical significance*
Percent coeducational	80.6	86.2	n.s.
Percent residential	19.3	20.7	n.s.
Percent elite	45.2	44.8	n.s.
Number of shifts	1.4	2.0	$F = 9.29, p < .01$
Number of students	1,113.1	1,917.0	$F = 3.57, p < .01$
Number of grades	8.5	5.8	$F = 8.43, p < .01$
Number of full-time teachers	43.5	85.1	$F = 6.30, p < .05$
Percent fully qualified teachers	89.7	104.0	$F = 7.39, p < .01$
Number of administrators	7.0	8.0	n.s.

Note: n.s. = not significant.

schools, and about three-quarters of both public and private schools reported having electricity that worked regularly. Most schools reported having flushable toilets for students (74 percent of private schools and 83 percent of public schools). Both public and private schools attempted to protect the building from vandalism, although more public schools than private schools employed someone to guard the school at night, on weekends and over holidays (90 percent and 77 percent respectively). Private schools reported greater concern with ongoing maintenance; three-quarters of the private schools employed a regular maintenance man, whereas only 43 percent of public schools employed such a person. From this description, it seems that the schools in the mini-sample may not represent typical secondary schools in developing countries.

Inputs (Instructional Materials and Time)

Reflecting the similarities in the overall physical plant and resources available at the school level, the number of instructional materials available to teachers in public and private schools were approximately the same (Table 9.3). Teachers in both types of schools had about five out of a list of eight important instructional materials: chalk, writing implements, paper, instructional guides, illustrations, science kits, textbooks and dictionaries. However, more private school teachers (66 percent) than public school teachers (52 percent) had a storage cupboard in which to store these supplies. Students in private schools appeared slightly more advantaged than those in public schools. While most students in both public and private schools had writing implements and paper, private school students were more likely to have dictionaries (63 percent) and a complete set of textbooks (70 percent) than students in public schools (40 percent and 66 percent respectively). The differences could reflect the differences in student selectivity between public and private schools or could reflect investment choices on the part of the schools.

Table 9.2. Physical Characteristics and Facilities of Private and Public Schools in Mini-survey, Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990

Characteristics	*Private*	*Public*	*Statistical significance*
Student-teacher ratio	24.2	22.1	n.s.
Number of classrooms	27.0	29.6	n.s.
Number of resources[a]	11.2	11.5	n.s.
Percent students that have class outside	0.9	5.2	$F = 3.5$ $p < .10$
Percent students with seats and desks	99.7	95.7	n.s
Percent classrooms with teacher desk	90.4	81.8	n.s.
Percent classrooms with blackboard	100.0	99.8	n.s.
Percent with health facility	50.0	50.0	n.s.
Percent with regular electricity	79.3	75.9	n.s.
Percent with piped water	100.0	82.8	n.s.
Percent with flushable toilets	74.2	82.8	n.s
Percent with building guard	77.4	89.7	n.s.
Percent with maintenance person	74.2	42.9	$p < .01$

Note: n.s. = not significant.

[a] File cabinets, telephone, typewriter, television, computer, radio, duplicating machine, school library, science laboratory, subject rooms, storage facilities for books, staff room, office for school head and kitchen.

Official instructional time was also relatively similar for public and private schools (Table 9.4). Both types of schools reported having a school year of approximately 200 days, a school day of seven or eight periods, and periods lasting about 50 minutes. However, public schools were closed for nearly four times as many school days (15) as private schools (4).

The overall resources available in public and private schools in the mini-survey were remarkably similar. However, where differences emerged, they suggest a decision on the part of private schools to invest in resources more closely aligned with instructional goals: libraries, dictionaries, textbooks, classroom storage areas for instructional materials and instructional time. By comparison, public schools tended to invest in personnel, such as teachers and building guards, and to pay for higher teacher qualifications.

Table 9.3. Instructional Materials in Private and Public Schools in the Mini-survey: Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990

Characteristics	*Private*	*Public*	*Statistical significance*
Number of materials[a]	5.0	4.5	n.s.
Percent of teacher with storage cupboards	65.7	51.9	n.s.
Percent of students with pen/pencils	96.7	99.1	n.s
Percent of students with paper/notebooks	96.6	96.4	n.s.
Percent of students with complete sets of texts	70.0	66.3	n.s.
Percent of students with dictionaries	63.2	40.1	n.s.

Note:
n.s. = not significant
[a] Chalk, writing implements, paper, instructional guides, illustrations, science kits, textbooks and dictionaries.

Table 9.4. Instructional Time in Private and Public Schools in the Mini-survey: Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990

Characteristics	*Private*	*Public*	*Statistical significance*
Number of days in school year	202.0	203.0	n.s.
Number of periods in school day	7.2	8.0	n.s.
Length of instructional period in minutes	47.0	48.0	n.s.
Number of days school was closed	4.3	15.1	$F = 5.79$ $p < .02$

Note:
n.s. = not significant.

Management

Public and private schools differ significantly in terms of their management organization. In most developing countries, public schools are financed and managed by the central government. Teachers are hired and deployed by a central agency, the curriculum is set nationally and admission to secondary school is often controlled by national examinations with students placed in schools through central agencies. As a result, neither the local community nor the school principal exercises much control over

key decisions. Unlike centrally controlled public schools, private schools in both developed and developing countries exercise managerial control over a wide range of decisions. For example, research has found that, in U.S. Catholic private schools, principals, teachers and parents have significantly greater control over decisions about the curriculum, instructional methods, allocating funds, hiring teachers, dismissing teachers and discipline policies than do their counterparts in public schools (Hannaway, 1991). Hannaway concludes that "there is something about public educational institutions that restricts their adaptation to local conditions" (Hannaway, 1991). Similar differences in patterns of control were found in the Philippines (Lockheed and Zhao, 1992).

In the mini-survey, large differences between the public and private schools emerged in two regards: (1) the degree of influence exercised by the principal over school-level decisionmaking, and (2) the importance apparently placed on academic achievement. Private school principals reported having more influence over school-level decisions and greater attention to matters of teaching and learning.

Decisionmaking

We listed 13 areas of school-level decisions: selecting teachers, selecting nonteacher staff, dismissing school personnel, selecting teachers for in-service training, evaluating teacher performance, adapting the curriculum, establishing standards for student promotion, improving instructional practice, choosing textbooks, purchasing equipment, establishing homework policies, selecting students and setting and spending school fees. Then, we asked principals to indicate which of five groups (head office or ministry of education, school board, headmaster or principals, teachers, parents or the PTA) exercised the most influence over each area.

Principals of private schools were more influential over these areas than principals of public schools in two respects (Table 9.5). First, principals of private schools influenced more areas of decisionmaking than did principals of public schools (5.5 areas versus 3.4 areas respectively). Second, principals of private schools influenced more of these decisions than did any other group, including the head office.

Table 9.5. Influence Over 13 School-level Decisions[a] in Private and Public Schools in the Mini-survey: Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990

Characteristics	*Private*	*Public*	*Statistical significance*	
Head office/Ministry of Education	1.11	3.92	F=4.34	p < .001
School board	1.88	1.44	n.s.	
Headmaster/principal	5.46	3.40	F=2.13	p < .02
Teachers	3.23	3.56	n.s.	
Parents/PTA	0.00	0.16		p <0.10

Note: n.s. = not significant.

[a] Decisions over: selecting teachers, selecting nonteacher staff, dismissing school personnel, selecting teachers for in-service training, evaluating teacher performance, adapting the curriculum, establishing standards for student promotion, improving instructional practice, choosing textbooks, purchasing equipment, establishing homework policies, selecting students, setting school fees and spending school fees.

Principals of private schools influenced over five times as many areas (5.5 areas and 1.1 areas respectively) as did the head office. By comparison, principals of public schools influenced fewer of these school-level decisions than did the head office (3.4 areas and 3.9 areas respectively). As a consequence, the head office or Ministry of Education influenced nearly four times as many decisions in public schools as they influenced in private schools.

We also looked at each specific decisionmaking area. Principals were the most influential group in at least 40 percent of the private schools for eight areas: selecting teachers for in-service training, purchasing equipment, evaluating teacher performance, selecting nonteaching staff, selecting students, dismissing school personnel, selecting teachers and spending school fees. By comparison, in the public schools, principals were most influential over only two areas: evaluating teacher performance and selecting teachers for in-service training (Table 9.6).

Table 9.6. Decisions over which the Principal has the most Influence in Private and Public Schools in the Mini-survey: Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990
(percent of schools)

Area	*Private*	*Public*	*Statistical Significance*
Selecting teachers	41.9	27.6	n.s.
Selecting nonteacher staff	51.6	17.2	$F = 8.64$, $p < .01$
Dismissing school personnel	45.2	37.9	n.s.
Selecting teachers for in-service training	63.0	40.7	n.s.
Evaluating teacher performance	54.8	57.1	n.s.
Adapting the curriculum	16.1	13.8	n.s.
Establishing standards for student promotion	16.1	6.9	n.s.
Improving instructional practice	25.8	17.2	n.s.
Choosing textbooks	16.7	0.0	$F = 5.60$, $p < .05$
Purchasing equipment	58.1	34.5	$F = 2.43$, $p < .10$
Establishing homework policies	6.5	10.7	n.s.
Selecting students	45.2	27.6	n.s.
Selecting school fees	29.0	14.8	n.s.
Using school fees	41.9	34.6	n.s.

Note: n.s. = not significant.

Concentration on Good Teaching

Another explanation for the higher achievement in Catholic private schools versus public schools in the United States is that they place greater emphasis on engagement in academic activities, including having higher rates of enrollment in academic courses. This, in turn, translates into such differences in student behavior as spending more time on homework (Coleman, Hoffer and Kilgore, 1982). In developing countries, curricula are typically set nationally, and students have little choice over course selection. However, differences in the emphasis placed on academic achievement may vary among schools, translating into differences between public and private schools in the level of effort spent by students on academic activities.

In the mini-survey, we found that private school principals not only had significant influence over what occurred in their schools but also had established a school climate that promoted learning and rewarded those who contributed to its success. The mini-survey showed that private schools emphasized teaching and learning more than public schools did and that they provided rewards that were contingent on good performance (Table 9.7). Both in-service training and regular staff meetings were more likely to be designed to strengthen teaching methods than were similar activities in public schools. Virtually all private schools offered monetary incentives to good teachers, in comparison with only about half of public schools.

Table 9.7. Attention to Teaching and Learning in Private and Public Schools in the Mini-survey: Colombia, Dominican Republic, Philippines, Tanzania and Thailand, 1990
(percent of schools)

Characteristics	*Private*	*Public*	*Statistical significance*
Staff meeting devoted to "specific pedagogical practices"	33.3	17.2	n.s
Monetary rewards for good teaching	100.0	45.4	F= 15.45, p < .00
In-service training devoted to "better" teaching methods"	67.9	50.0	n.s.
"Critical thinking and reasoning skills" identified as most important educational goal	9.7	13.8	n.s.

Note: n.s. = not significant.

While both public and private school principals ensured that teaching materials were available in the school, principals of private schools also ensured that teaching materials were readily available to teachers by providing them with storage cabinets in their classrooms. They also protected the school building and its contents by ensuring regular maintenance and by taking precautions against vandalism. In short, they used their decisionmaking powers to improve the conditions for learning in the schools.

One reason that private school principals may have paid more attention to teaching and learning is that they themselves were more likely to be involved in teaching. On average, private school principals spent 7.2 hours a week teaching a regular class, compared with public school principals who spent on average only 4.8 hours teaching per week. Private school principals also spent significantly fewer hours on fundraising, communicating with the head office and performing general administrative duties than did public school principals (17.1 hours and 24.2 hours respectively). Thus, more of their time was available to attend to matters more directly related to teaching.

Summary

The mini-survey provided evidence on why private schools are more effective and efficient than public schools. It showed that simple resource availability could not explain the differences in effectiveness because the public and private schools in the sample were very similar with respect to their overall resources. However, the mix of resources was somewhat different in public and private schools, with private schools choosing to invest in instructional materials and improving teacher performance at higher levels than those chosen by public schools. This finding supports the hypothesis that private schools organize themselves to be more responsive to the demands of parents, students and educational professionals than do public schools.

10

Summary and Conclusions

The case studies and mini-survey reported in this report concern the relative effectiveness and efficiency of private and public schools. In carrying out the case studies, we addressed directly the issue of selectivity into private versus public schools. Our principal findings are:

1. Although students in private schools come from more privileged families than those in public school on average, there is a significant overlap between the two groups.
2. With student background and selection bias held constant, students in private schools outperform students in public schools on a variety of achievement tests.
3. The unit costs of private schools are lower than those of public schools.
4. Private schools have greater school-level decisionmaking and put more emphasis on enhancing student achievement; this seems to affect the mix of inputs that private versus public schools choose.

This chapter integrates the results of the case studies and mini-survey and discusses the implications of these results for education policy in developing countries.

Choice of School

Unless there is an excess demand for places, students and parents choose the type of school to attend based on costs and benefits. If school places are rationed, the selection criteria of the schools themselves determine which applicants are accepted.

Because the private schools in our case-study countries charge tuition while the public schools are almost free, the most important factors in the household decision are income (or income-related variables such as parents' education and occupations) and the relative cost of schooling. According to Table 10.1, in Colombia and the Philippines, average income indicators for students in private schools were about twice as high as those for students in public schools. Interestingly, in Tanzania, this difference was much lower, which suggests that public schools attract students from higher-income families. These findings are corroborated by data showing that private school students in Tanzania tended to come from families where the father had a white-collar job and the mother had some education. In both Thailand and the Dominican Republic, private school students came from families with more educated mothers and with

Table 10.1. Background Indicators for Private School Students as a Multiple for Public School Students

Indicator	Colombia	Dominican Rep.[a/] O-type	Dominican Rep.[a/] F-type	Philippines	Tanzania	Thailand
Income (of household head or father)	1.94	..	..	2.07	1.20	..
Coefficient of variation of income	1.24	..	..	0.72	0.83	..
Mother's education (percentage beyond primary)	1.87	1.62	2.21	1.23	1.27	1.61
Father's occupation (percentage white-collar)	1.09	1.69	2.52	..	1.50	1.94
Percentage male	1.04	1.29	1.78	0.98	1.07	0.91

Notes: .. not available.

The table shows the extent to which an indicator for private school students exceeds that for public school students. For example, in Colombia, the average household head income of students in private school is 1.94 times (almost twice) that of students in public school. A figure close to 1 implies that an indicator for private school students is equal to that for public school students.

[a] F-type schools are authorized to give Ministry of Education examinations. O-type schools are not authorized to do so.

fathers who were employed in white-collar occupations. The range in income, however, was only slightly higher for private than for public school students in Colombia and lower in Tanzania and the Philippines, which suggests a substantial overlap in the income categories of the public and private school samples.

The quality-adjusted price of attending the two types of schools is very difficult to measure. Tuition tends to reflect school quality, which itself is a dimension of school choice. Thus, we did not include this variable, even when it was available. In the Philippine study, however, we used the relative distance of public and private schools from each household as a measure of household cost. This variable was highly significant in explaining school choice.

Although many private schools are sectarian, religion is not included as an explanatory variable because, in most countries, all the students are of the same religion. Gender can be an important determinant of school choice, since some parents prefer single-sex schools and the private system has a higher proportion of these schools (Lee and Lockheed, 1990). In Colombia, the Dominican Republic and Tanzania, more males attend private schools; in Thailand and the Philippines, females predominate in private schools.

In sum, the average private school student comes from a more advantaged background than does his or her public-school counterpart. The magnitude of this advantage, however, varies across countries. Also, despite the difference in the averages, the overlap in the range of public and private indicators is significant, so that there are students from advantaged backgrounds in both public and private schools.

We have used these findings to make conclusions about selecting different types of schools and to correct for possible biases in the achievement equation. In the only studies that contained strict cross-country comparisons—Colombia and Tanzania—correcting for sample selection bias revealed that Colombian students tended to choose the type of school where they would prosper, while Tanzanian students were positively selected into the public system. This finding is important because, in Tanzania, student choice is more limited and public schools are viewed as elite (Samoff, 1987).

Relative Effectiveness of Public and Private Schools

Do private schools provide a better education than public schools? A principal finding of these studies is that, given student background, students in private schools generally outperform their public counterparts on standardized mathematics or language test or both. The calculation is as follows: The predicted scores in each type of school are obtained from the regression equations relating background to achievement, as evaluated at the level of background characteristics of the average public school student. This effectively holds constant for the effects of background. Table 10.2 shows the ratio of a student's predicted score in a private school to his or her score in a public school. For example, in Colombia, a student with the background of the average public school student would score 1.13 times (13 percent) better in a private school that in a public school. This ratio varies considerably across countries but is consistently greater than one for all subsamples and achievement tests (with the possible exception of mathematics achievement in the Philippines, where the differences are insignificant). In terms of standard deviation units, or "effect size," the private school advantage is large and meaningful in all cases, ranging from one-half to two standard deviations (Cohen, 1969). These differences in the effect size associated with private schools cannot be dismissed as trivial (Levin, 1987).

The phrase "given student background" is critical here. It is generally not valid to infer differences among types of schools based simply on comparing achievement on standardized tests because students' backgrounds vary so much between types of schools. As explained in the preceding section, in these comparisons, we control for the background effects by measuring achievement at the average characteristics of public or private school students. In fact, the advantage conferred by private schools is greater for the two countries with the best controls for student background--the Dominican Republic and Thailand. The data sets for these students contained test scores measured at the beginning and at the end of the school year, and the ratios measure change in the achievement over the course of the academic year (with controls for possible sample selection bias). Some caveats should be noted. The case studies focus on secondary school students and may not hold for other levels, even in the same countries. Moreover, it would not be valid to make any strict cross-country comparisons regarding the magnitude of the results. The tests are not standardized across countries. Also, because the data sets were designed by different researchers, the student background variables being held constant are only roughly equivalent.

Do these results hold for students from different socioeconomic groups? Qualitatively, the answer is yes. The private school advantage persists even when the computations in Table 10.2 hold constant the background of the average private school student, whose status is higher than that of the average public school student. The Philippines study is the only one that looked at the sensitivity of the private-public differential to a wider range of socioeconomic indicators. The authors found that variations in socioeconomic status, within a reasonable range, did not reverse the private school effect. But the magnitude of the private school advantage substantially decreases with lower socioeconomic status. This

Table 10.2. The Private School Advantage: Predicted Test Score in Private Schools as a Multiple of Predicted Test Score in Public Schools and in Standard Deviation Units

Country	*Indicator of achievement*	*Relative advantage*	*Effect size*
Colombia	Average math and verbal	1.13	0.55
Dominican Republic[a]	Mathematics (O-type)	1.31	0.89
	Mathematics (F-type)	1.47	2.16
Philippines	Mathematics	1.00	-0.09
	English language	1.18	0.33
	Filipino language	1.02	0.25
Tanzania	Average math and verbal	1.16	0.97
Thailand[a]	Mathematics	2.36	1.69

Notes:
The table shows the proportional gain in achievement score if a randomly selected student, with the characteristics of the average public school student, attends a private rather than a public school, holding constant that student's background.
[a] For the Dominican Republic and Thailand, the test score before the school year began was included as a regressor in the equation explaining achievement at the end of the year.

result is consistent with the fact that the more elite private schools in the Philippines tend to emphasize the development of English language skills and that advantaged children have more exposure to English and better access to English language media. Among children who speak Filipino, on the other hand, there is no relationship between socioeconomic status and attending private school. In mathematics, there is a virtual tie between public and private schools.

Can peer group characteristics affect student achievement? In the Dominican Republic and Thailand, the only two countries for which data were available, peer group effects (the academic background or social class of students in each school) were very important.

Relative Efficiency of Public and Private Schools

What about efficiency? Preliminary calculations based on school expenditure data indicate that, on average, the unit costs for private schools are lower than those for public schools (Table 10.3, column 1). Thus for the same unit cost, private schools provide as much as three times more learning as the public schools do (Table 10.3, column 2). Conversely, the same amount of learning in private schools can cost as little as 15 percent of its cost in public schools (Table 10.3, column 3). These results indicate that private schools are more efficient than public schools, at least in secondary schools in the sample countries.

But there are some important caveats. First, the orders of magnitude are rough. The cost estimates for Colombia and Tanzania are not precise because a number of private schools did not provide the necessary information. Second, in the Philippines, we used the average cost for a nationwide sample of schools (based on World Bank sector work) rather than the actual cost of the schools in the study. By comparison, in the Dominican Republic and Thailand, we had school-by-school cost data for the sample.

Table 10.3. Relative Average Cost and Efficiency of Public and Private Schools

Country	(1) Ratio of private cost to public cost	(2) Ratio of relative effectiveness to cost[a]	(3) Ratio of relative cost to effectiveness[b]
Colombia	0.69	1.64	.61
Dominican Republic			
O-type	0.65	2.02	.50
F-type	1.46	1.01	.99
Philippines[c]			
Math	0.83	1.20	.83
English	0.83	1.42	.70
Filipino	0.83	1.22	.81
Tanzania	0.69	1.68	.59
Thailand	0.39	6.74	.17

Notes:

[a] Figures from Table 10.2 divided by column 1 of Table 10.3.

[b] Column 1 of Table 10.3 divided by figures from Table 10.2.

[c] Public cost estimates, weighted average of national and local costs. Costs are assumed to be the same for all three subjects and are based on World Bank estimates.

Third, the cost figures generally do not include educational expenditures, such as books, supplies and uniforms, that are not paid to schools. We do not, however, expect these data to cause the qualitative results to change significantly. Generally, nonschool educational expenditures, such as books, supplies and uniforms, are higher in private schools. Interviews in the countries studied reveal that even religious private schools tend to use lay teachers rather than priests and nuns. Moreover, subsistence and other nonsalary personnel costs are covered in the cost data.

Finally, there is considerable variability within each school type, as noted in the data on private schools in the Dominican Republic. Philippine public schools (say, those that are primarily locally funded) have lower unit costs than some types of private schools (the elite schools). Unfortunately, the survey data did not distinguish student achievement among types of public schools. It would be interesting in any subsequent analysis to explore this comparison.

Why is There a Difference Between Public and Private Schools?

The case studies attempted to assess the differences between private and public schools in the Dominican Republic and Thailand and, to a lesser degree, in Colombia and Tanzania; the mini-survey extended this enquiry. Possible explanations for differences included: (1) the absolute resources available; (2) differences in the input mix selected in private and public schools; and (3) differences in management and

organization between private and public schools. The rationale for this enquiry is that, if public schools could adopt resources, resource mixes or management practices of private schools, there would be a broad improvement in the educational system as a whole. We discussed our findings regarding the absolute resources available in private and public schools in the previous section. In this section, we address differences in the input mix and management. Table 10.4 summarizes our findings.

Table 10.4. Average Private School Input and Management Characteristics as a Multiple of Average Public School Characteristics

Variable	Colombia	Dominican Republic		Tanzania	Thailand	Mini-survey
		0-type	F-type			
Input Mix						
Teacher salary	0.52	..	..	1.15	..	..
Student-teacher ratio/class size	0.85	1.00	1.00	1.07	1.05	1.10
Teacher's years of education	..	.95	1.02	..	..	..
Minutes spent on maintaining class order	..	.38	1.21	..	1.24	..
Proportion of students with textbooks	..	3.11	3.50	..	..	1.06
Proportion of teachers						
Qualified to teach math in student's school	..	..	..	..	0.17	0.87
With in-service training	..	..	..	..	2.29	
Teaching enriched math class	..	..	..	..	1.54	
Total resources	..	..	..	..	..	0.97
Total instructional materials	..	..	..	..	..	1.11
Management						
Total school-level autonomy	..	..	..	..	..	1.61
Instructional time	..	..	..	..	..	1.08

Note:
.. not available.

Input Mix

Although it is not possible to infer causality from Table 10.4, it shows some interesting comparisons. In all countries, private schools tend to choose slightly higher student-teacher ratios and to use the savings to purchase other inputs. For example, in Thailand, private schools make more efficient use of teachers by recruiting candidates with slightly lower qualifications, giving them more in-service training and by promoting better teaching processes (homework, tests and orderly classrooms). In the Dominican Republic, the most striking difference is that students in private schools have more access to textbooks. The mini-survey confirms the preference of private schools for slightly higher student-teacher ratios and slightly lower teacher qualifications and suggests that resources saved in this manner are spent on other inputs more directly related to student learning, such as textbooks, other instructional materials and instructional time.

Management

The most striking difference between private and public schools in the mini-survey, however, is the difference in their respective levels of school autonomy. Headmasters in private schools have significantly more control over school-level decisions. While the sample size of the mini-survey was too small for statistical significance, it shows greater school-level autonomy in private schools for a wide range of decisions affecting student achievement, including selecting teachers, adapting the curriculum, improving instructional practice and choosing textbooks. This autonomy enables private schools to be responsive to parents, to whom they are accountable.

Significance for Policy

The findings from our research have important implications for public education policy. Although some gains in efficiency may be achieved by mimicking the mix of resources of private schools (such as teacher-student ratios and teacher qualifications), this imitation is not likely to be enough to equalize the two systems. A more effective, albeit less transparent, measure would be to adopt the management practices of private schools, thereby mimicking their incentive structure. This school-level reorganization would not be possible, however, without significantly changing the source of their resources and the bureaucratic structure in which they are embedded.

The findings cited in this book should not be interpreted as a call to abolish or privatize public schools. The findings are preliminary and need to be tested with other data sets in other environments. Also, the marginal differences found in the studies may not persist if many students moved from public to private schools. Still, the studies do offer initial empirical evidence on an issue that has to date been speculative, often in the context of highly emotional debates.

One immediate implication for policy is that over-restrictive regulations on private schools (including outright prohibition in some countries) may be suppressing an efficient way to provide education. Another implication for policy is that, in some cases, governments could encourage greater private sector participation in education. It should be stressed, however, that the relative efficiency of private schools is highly dependent on the institutional regime and structure of the incentives under which they currently operate. Government subsidies, for example, may not necessarily lead to greater efficiency in the educational system. Such subsidies will be effective only if they are not linked to restrictions on the schools' ability to choose a suitable input mix and to strive for greater efficiency. The exact nature of those reforms that increase efficiency and equity is beyond the concern of this book. They might involve contracting for educational services, as is now being done in the Philippines, or even some form of voucher system, as in Chile. Restrictive rules and regulations intended to protect consumers could be modified, or tax exemptions could be granted for private schools. All such measures will have to be discussed in the larger context of the political economy of specific countries (James, 1991).

A final implication for policy is that public schools could emulate at least some of the teaching and administrative practices of their private counterparts. The usual assumption in considering government policies toward private schools is that the quality of education they provide is not commensurate with what is being paid by the consumers due to the asymmetry of information between consumers and providers. This widely held assumption is complemented by the view that bureaucrats have better information regarding the technology of education. The evidence, however, is that private schools, which

are more autonomous and responsive to students and their parents, will deliver education in a cost-effective way.

Although the rigorous methodology we have used in comparing public and private schools has allowed some clear advances in the literature, additional work is warranted. First, the data bases were not strictly comparable across countries, and it is not possible to make cross-country generalizations. Second, the scope of countries covered is also limited. Third, better information, particularly regarding the social and private costs of different kinds of schools, needs to be gathered. Fourth, it would be useful to compare results across the entire distribution of students rather than just for the average student. Finally, the studies covered only secondary schools. In Latin American and East Asia, the critical level for the future will be universities, which are the highest cost components in many budgets for public education. In Africa and the Indian subcontinent, the issue is also being discussed at the primary level.

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