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CREATING A NATURAL ADVANTAGE

DFID NEW ECONOMISTS' GUIDE

Chapter on Education Economics

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Contents

Abbreviations

EFA	Education for All
FTI	Fast Track Initiative
IEA	International Association for the Evaluation of Educational Achievement
LSMS	Living Standards Measurement Survey
MDG	Millennium Development Goals
PISA	Program for International Student Assessment
PPP	Purchasing power parity
PRSP	Poverty Reduction Strategy Paper
PTA	parent–teacher association
TIMSS	Third International Mathematics and Science Study
UDHR	Universal Declaration of Human Rights

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1. Introduction

1.1 The value of education

Education has both intrinsic and instrumental value. Its inherent value is formalised in the right to education which is enshrined in the Universal Declaration of Human Rights to which many countries in the world are signatories. The recognition of education as an inalienable human right leads to the rights based approach to education which focuses attention on those children and adults whose educational human rights are not fulfilled (Section 2.4).

The instrumental value of education derives from the financial and non-financial benefits it confers. For instance, education is known to improve people's labour market outcomes and incomes, to lower infant-mortality and fertility, and to raise civic participation and social capital (Section 2.1). At the more macro level, education also promotes economic growth (Section 2.2) and may reduce inequality (Section 2.3).

1.2 Current directions in economics of education

A wide range of issues regarding the determinants and consequences of schooling have interested education economists. While traditionally, they have been concerned mostly with estimating economic returns to schooling and analysing alternative modes of financing education, more recently, they have studied issues of school effectiveness – i.e. identifying the school and teacher factors most well correlated with increased schooling participation/achievement – and have analysed the institutional conditions most conducive to the efficient provision of education.

While economics of education encompasses both theoretical and applied aspects, applied work has become more and more important over time. This reflects in part the increased analysis of the education sector and its problems in various developing countries, sponsored by country governments and international agencies. However, it also partly reflects the progressively greater availability of data over time to analyse education sector issues. For instance, from the early 1990s, reliable household datasets with detailed questions on educational participation have become available from a large number of developing countries, permitting analysis of access issues, and also allowing research on the relationship between education, on the one hand, and labour market and social outcomes, on the other. Some datasets have also become available on schools and teachers and a few of these are linked to student achievement tests too, permitting analysis of issues of school quality and student educational outcomes. More and better data on educational finance at disaggregated regional levels has become increasingly available.

As a result, education economics is currently the subject of a great deal of applied research and lively discussion. Some of the topics of interest have been:

- Does education enhance economic growth? This issue is addressed by the cross-country growth literature

- Can the effect of education on earnings be separated from the effect of ability on earnings? This issue is addressed in the ability bias literature

- Should policy-makers be concerned with expanding schooling supply or improving the quality of existing schools? This is known as the quantity versus quality debate

- What factors determine schooling participation/achievement of students? Also known as 'school effectiveness research'

- The relative efficiency and cost-effectiveness of alternative delivery mechanisms in education. This encompasses the private versus public school debate and the school vouchers debate

- Impact evaluation of educational policy interventions, using new methods such as randomised experiments and statistical techniques that permit causal inferences

1.3 Focus and plan of the chapter

This chapter is intended as an introduction to economics of education for DFID economists. It presents theoretical and conceptual arguments on important issues and, where possible, supplements these with a survey of the evidence. It also addresses education economics issues in operations. The chapter is written with the education related Millennium Development Goals in mind, and reference is made to these where relevant in the latter sections relating to issues in operations.

Section 2 discusses the rationale for public sector action in education markets. Section 3 is concerned with the measurement of and evidence on the returns to education. The internal efficiency of the schooling system and the role of the private sector are the subjects of focus in Sections 4 and 5. Section 6, titled 'Funding of the education sector' is concerned with the pattern of public education expenditure, its equity implications and the dominance of salary costs in education spending, *inter alia*. Finally, Section 7 considers the interventions to improve access to and quality of education.

2. Rationale for public sector action in education markets

2.1 Market failures in education

The market for education suffers from several notable failures. The existence of these failures provides the justification for public sector involvement in the funding or provision of education. Market failures in education include the existence of economic and social externalities and the lack of credit markets to cater for profitable educational investments.

1) Economic externalities of education: theory suggests that the schooling of an individual exerts beneficial effects on the economic and other outcomes of nearby individuals. The size of these positive externalities is not known but recent studies show that the higher the average education of the population in a community, the significantly better are the economic outcomes of any given individual in that community (Weir and Knight, 2004). When making their personal educational decisions on the basis of implicit cost-benefit calculations, individuals will not take into account this positive economic impact on others since these benefits accrue to others. The existence of learning externalities – the fact that the learning of one individual raises the learning of other nearby individuals – is precisely what leads to economic growth, according to the 'new' or 'endogenous' growth theory (see Section 2.2).

2) Social externalities of education: education also has powerful non-economic benefits, such as better health, lower fertility, greater civic participation, etc. If, when making their cost-benefit calculations for educational decisions, individuals implicitly factor in these non-market benefits to themselves, they do not count as externalities: they are internalised. However, if the education of any one person improves the social outcomes of nearby others, then these *are* social externalities of education, though they are difficult to quantify in monetary terms. A substantial literature documents that education, particularly of women, significantly lowers infant/child mortality rates and fertility rates, and improves child health and education outcomes (Drèze and Murthi, 2001; Ainsworth, Beegle, Nyamete, 1996; Subbarao and Raney, 1995; review of this literature in Glewwe, 2002).

3) Financial market failures: if education is provided by a private market, then only those well-off enough to afford it can obtain education. If all individuals have access to private capital markets, then those who cannot afford to pay tuition fees could borrow, providing the expected return to education was higher than the cost of borrowing. However, credit market imperfections are common: people normally cannot borrow without collateral and investment in education is risky, long term and uncertain. Mobility of educated persons can also make it difficult to track defaulters. Under financial market imperfections and lack of public sector involvement, not only would there be underinvestment from the social point of view but income inequalities would be preserved from one generation to the next. Thus, if lack of credit deters people from investing in high return education, it provides a case for public funding of education either through outright subsidy – as in the case of primary education in many countries – or via government student loan schemes such as those found in higher education in several countries (Barr, 1999).

It is sometimes thought that other types of market failure also apply to education, namely the public good argument and economies of scale. However, education does not have pure public good characteristics, such as non-excludability and non-rivalness. Moreover, the creation of schools does not involve large economies of scale or very heavy initial sunk costs that cannot be recuperated within reasonable time frames.

2.2 Education and economic growth

Solow growth accounting

In 1962, Edward Denison used the Solow growth accounting framework to examine the factors that contributed to economic growth in the US over the period 1910 to 1960. He found that increases in the quantity of labour and physical capital over the period 1910-1960 did not explain the increase in GNP very much and that there was a large unexplained growth residual (the so-called Solow residual). The Solow growth model – like its predecessors such as the Lewis and the Harrod-Domar models - had treated labour as undifferentiated, homogenous, units. Denison analysed the components of the Solow residual and found that improvements in the quality of the labour force were important, together with technological change, in explaining growth. He found that as much as 23% of US annual rate of growth of GNP could be explained by increases in the level of education of the workforce. In other words, education was an important determinant of economic growth. This was really the start of what came to be known as the human capital revolution in economics.

While Denison style growth accounting shows that education has important productivity returns, this beneficial effect of schooling on growth is not consistently manifested in macro cross-country growth regressions (Pritchett, 2001; Easterly, 2001; Benhabib and Spiegel, 1994). However, empirical work in the macro growth literature is fraught with methodological difficulties such as the quality and international comparability of schooling data, the issue of conditioning (e.g. whether 'change in physical capital over time' is included), the presence of outliers, parameter heterogeneity and measurement error (Sianesi and van Reenen, 2002). Studies taking these factors into account do find a robust relationship between various measures of education on the one hand and economic growth on the other (Krueger and Lindahl, 2001; Temple, 1999; Gemmell, 1996).

Endogenous growth theory

Propounded in the late 1980s, endogenous or 'new' growth theory also gives education/learning a central place in its explanation for economic growth (Lucas, 1988; Romer, 1986; Barro and Sala-i-Martin, 1995). Investments in learning have positive externalities, i.e. they improve the productive capacity not only of individuals who receive education but also of others around them because of spill-overs in knowledge and learning.

New growth theory shows that increasing returns to at least one factor of production are required to achieve sustained growth in per capita income. With fixed stocks of land and natural resources, the increasing returns need to be large enough to offset diminishing returns from fixed factors of production. A key source of increasing returns is the ongoing creation of knowledge from schooling and also from R&D and from "learning-by-doing" of workers. This achieves increasing returns if increases in the stock of existing knowledge increase the rate at which new knowledge is created. The more knowledge there is, the higher the marginal productivity of workers.

Knowledge externalities achieve increasing returns to the extent knowledge is non-rival: this means that new knowledge created by one person or entity spreads to other people/entities, boosting their rate of knowledge creation without reducing anyone else's ability to create knowledge. In summary, growth theory shows that factors traditionally considered to be sources of market failure – externalities – are in fact essential for sustained economic growth.

These positive externalities mean that if left to individuals, there will be less than optimal accumulation of human capital. New growth theory thus provides a basis for the prescription that government should subsidise human capital formation in the interests of economic growth.

2.3 Education and reductions in inequality

There is evidence that education permits greater economic mobility and reduces the inter-generational transmission of economic status and poverty.

Intergenerational economic mobility is said to have occurred if children occupy different positions in their generation's distribution of earnings/income than their parents did in their generation's distribution of earnings/income (see Appendix 1 for a description of the methods in measuring the extent of intergenerational economic mobility).

Early estimates surveyed in Becker and Tomes (1986) suggested that in a regression of son's earnings, the coefficient on father's earnings was low, around 0.2, suggesting a relatively low degree of intergenerational transmission of economic status, or a high degree of intergenerational economic mobility. However, more recent estimates suggest this coefficient is between 0.4 and 0.6 (see literature in Dearden et. al., 1997, for the UK; Asadullah, 2005 for Bangladesh; Lillard and Kilburn, 1995 for Malaysia; and Hertz, 2001 for South Africa), i.e. economic mobility is considerably lower than previously thought. The fewness of studies for developing countries reflects the lack of appropriate longitudinal data for intergenerational analyses in these countries.

The role of education in promoting inter-generational economic mobility has received relatively little research attention. Asadullah (2005) who examines the factors underlying intergenerational mobility in rural Bangladesh finds that low mobility in educational attainment is the key determinant of limited father-son mobility in wealth. He finds that the fall in transitional probabilities on the diagonal axis (see Appendix 1) is the largest when he adjusts for educational attainment, indicating that schooling is a key source of persistence in wealth across generations of the same family. In her study of US, UK, Canada and Germany, Blanden (2005) highlights the importance of education in explaining intergenerational mobility. Differential levels of education explain between 35 and 50 percent of intergenerational mobility across countries. She finds that the strong returns to education play an important role. Davies et. al. (2003) find that inequality is lower and mobility is higher in the long run under public than under private education. The same contrast between the schooling regimes is also found for societies beginning with the same level of inequality.

Regarding the cross-section relationship between schooling and wage inequality, the literature is less sanguine. The evidence does not support the notion that higher levels of education are associated with lower levels of inequality: characteristics of educational systems and labour market institutions are crucial in determining the return to schooling, and the relationship between education and inequality depends not only on the level of schooling but also importantly on the *returns* to schooling (Sullivan and Smeeding, 1997). Similarly, the role of education in reducing gender wage inequality will depend on gender equality in both the level of and return to education. Moreover, there is evidence that returns to schooling increase with ability. Martins and Pereira (2004) find that in their 16 country study, the earnings increment associated with schooling was higher for individuals whose unobservable characteristics place them at the top of the conditional wage distribution. One possible explanation is that the most able both acquire more schooling and benefit more from their schooling. Another explanation is differences in school quality whereby the bottom of the wage distribution may be over-represented with workers with low-level school quality. Regardless of the explanations, this finding suggests that wage inequality cannot be cut simply by public policy investing in the attainment of higher schooling levels. Quality of education will need attention but even then, differences in (unmeasured) innate ability will lead to wage inequality among otherwise comparable individuals.

2.4 The rights-based rationale for public action

Box 2.1 A definition of the rights-based approach

"A rights-based approach to development describes situations not simply in terms of human needs, or of development requirements, but in terms of society's obligations to respond to the inalienable rights of individuals, empowers people to demand justice as a right, not a charity, and gives communities a moral basis from which to claim international assistance when needed"

Kofi Annan, UN Secretary General, 1998.

The rights-based approach to education, and to development more generally, provides a human rights based justification for state action in the education sector. Underlying this approach is the realisation that fulfilling the human right to education for *all* people is the first and foremost goal. A human rights-based approach has many elements and methods in common with other approaches currently used by development practitioners, such as the capabilities approach of Sen (1999) and Nussbaum (2000). The idea of human rights within this approach implies the moral principle that the capabilities of human beings should not be permitted to fall below a certain floor, in so far as nation-states and the international community are able to produce that minimum threshold for everyone. However, the rights based approach also differs from other approaches in its emphasis on obligations of the state, the importance of participation and empowerment as intermediary 'process' goals, and regarding charity as an insufficient motivation for meeting citizens' needs. DFID's perspective on the rights-based approach is summarised in Box 2.2.

Box 2.2 DFID articulation of the rights-based approach

The rights-based approach facilitates more effective development in the following ways:

• The UDHR (and subsequent human rights instruments) defines clearly the economic, social, cultural, civil and political rights that should be available for all people, thereby setting out the core responsibilities that all governments have towards their citizens. Some can be measured against the International Development Targets;
• Human rights provide a means of empowering all people to be active citizens with rights, expectations and responsibilities; and
• It focuses the discussion of poverty elimination on addressing the root causes.

Overall, we shall give priority to linking poor people's perspectives with national and international policy processes. We shall do this within a strategy for integrating a rights perspective into development. This strategy is based on three cross-cutting principles:

- ***Participation:*** enabling people to realise their rights to participate in, and access information relating to, the decision-making processes which affect their lives.
- ***Inclusion:*** building socially inclusive societies, based on the values of equality and non-discrimination, through development which promotes all human rights for all people.
- ***Fulfilling obligation:*** strengthening institutions and policies which ensure that obligations to protect and promote the realisation of all human rights are fulfilled by states and other duty bearers.

Source: DFID (2000) *Realising Human Rights for Poor People*, London, October 2000.

Fundamentally, the rights-based approach differs from other approaches to education by claiming that others have duties to facilitate the fulfilment of people's educational rights, which thereby necessitates action. This claim is backed by international law that specifies obligations that are legally binding under international law. By ratifying or acceding to the international human rights

treaties such as the Universal Declaration of Human Rights and others, states have agreed to these legal obligations that require them to take necessary legislative, administrative or policy measures and to provide appropriate remedies in case of violations (Ljungman, 2004).

While a rights-based approach provides the poor with an internationally recognised legal basis for access to education, there are serious challenges in applying the approach. These arise from the under-development of state legal systems and poor awareness of human rights among the population and among state agencies. Impediments also arise from the fact that those concerned with educational development have inadequate knowledge of the human rights to education and a lack of experience of applying rights-based approaches. Most importantly, however, the challenge arises from a reluctance, on the part of states, to codify the international treaty obligations on education into domestic law because of the potentially far reaching legal implications of such a step. For instance in the late 1990s the Indian government resisted the popular demand to make basic education a fundamental human right in Indian law. This was because making it a right would confer a corresponding legal and justiceable obligation upon the state, from which it could not derogate, without being guilty of violating the right.

The rights based approach to education is regarded by some as the most compelling rationale for public sector action in education, and it is widely subscribed to by many international and bilateral development agencies and NGOs (Appleyard, 2002).

3. The external efficiency of education

The external efficiency of investment in education is judged by comparing the private and social benefits of education with its costs, i.e. by the 'return' to education. The internal efficiency of the education system describes the relationship between educational inputs (such as teachers, classes, textbooks) and outputs (such as student achievement levels), with those systems considered more efficient that produce greater amounts of output for given levels of input. This section is concerned with external efficiency of education and the next section deals with internal efficiency.

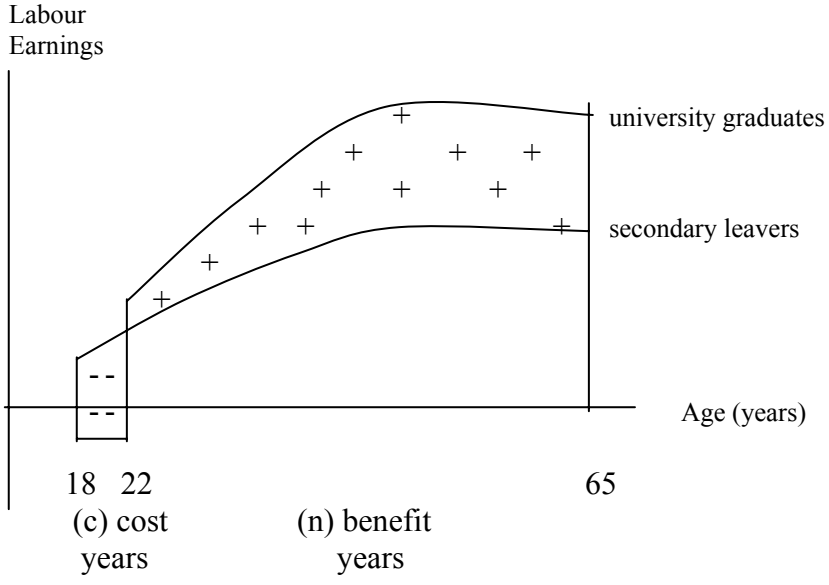
Returns to education may be both economic returns (e.g. increased earnings) and non-economic returns (e.g. benefits such as lower infant-mortality, the joy of learning, better participation in a democracy). Similarly, returns to education may be private - i.e. accruing to the educated individual only – or they may be social. Estimates of returns to different levels of education (primary, secondary, higher), different types of education (general versus vocational) and to different subjects (medicine, law, agriculture, humanities, etc.) are used for various policy and evaluation purposes. For instance, intra-sectoral budgetary allocations are sometime justified on the basis of the estimated returns to different levels and types of education. Similarly, some governments look at the economic returns to different degree subjects in setting fees for different university courses (Barr, 1998).

Much of the focus in the economics of education literature has been on the estimation of the *economic* returns to education. A very large body of research has examined the association between education and individuals' productivity. Productivity is measured either by a farmer's physical output or, in urban settings, by the individual's wages/ earnings; the latter assumes that labour markets are competitive and that workers are paid their marginal product.

3.1 Measurement of the returns to education

The rates of return to education are computed by either direct comparisons of earnings profiles (the cost-benefit method, also called the 'long' method) or by the regression method.

The cost-benefit method



The rate of return to education is the ratio of schooling benefits to schooling costs. These benefits and costs can be depicted as in the Figure above. The area marked with positive signs measures the gains from university education and the area marked with negative signs measures the costs of university education for a secondary school completer (both direct costs of university such as fees and books as well as indirect opportunity costs of foregone earnings). The internal rate of return is defined as that interest rate which just equates the net present costs and benefits of education.

An algebraic representation and an example are given in Appendix 2.

Mincer's regression method (Jacob Mincer, 1974)

An alternative method is to regress the natural log of earnings on years of schooling and then to interpret the resulting coefficient on schooling as the rate of return to each year of schooling. Note that this method assumes that the rate of return to each extra year of schooling is the same.

To see the reasoning behind this procedure (Addison & Siebert, 1979, chapter 4), define the rate of return to the first year of education, r_1, as:

$$r_1 = (Y_1 - X_0) / X_0 \qquad (1)$$

where Y_1 denotes earnings after 1 year's education, assumed constant over the lifecycle, and X_0 denotes earnings without education. Thus,

$$Y_1 = X_0(1+r_1)$$

Similarly, $r_2 = (Y_2 - Y_1) / Y_1$

so that $Y_2 = Y_1(1+r_2)$

$$= X_0(1+r_1)(1+r_2)$$

Therefore, after s years schooling,

$$Y_s = X_0(1+r_1)(1+r_2)....(1+r_s) \qquad (2)$$

If we assume that $r_1 = r_2 = ... = r_s = r$, then (2) becomes

$$Y_s = X_0(1+r)^s$$

and if we approximate $(1+r)$ by e^r, as we can if r is small [for small values of r, say for r<0.2, $ln(1+r)$ is approximately equal to r][1], then (2) becomes

$$Y_s = X_0.e^{rs}$$

Or in log form, $\ln Y_s = \ln X_0 + r s \qquad (3)$

This is the basic form of the earnings function.

[1] Taylor series: $e^r = 1 + r + \frac{r^2}{2!} + \frac{r^3}{3!} + ... + \frac{r^n}{n!}$

However this is usually modified to take account of the fact that earnings increase with experience but at a decreasing rate. In other words, the equation usually estimated is

$$\ln Y_s = \ln X_0 + rS + \beta E + \gamma E^2 \qquad (4)$$

where S is years of schooling, E is years of experience and E^2 is experience squared. As with the cost-benefit method, this method also requires cross-section data on a sample of workers of varying ages and education levels.

Jacob Mincer (1974) showed that the coefficient on 'years of education' in such an earnings function gives the extra lifetime earnings an individual will earn as a result of one extra year of schooling.

Mincer's (1974) earnings function using US annual earnings looked as follows:

$$\ln Y = 7.58 + 0.07S \qquad (R^2=0.067)$$

$$\ln Y = 6.20 + 0.107S + 0.081E - 0.0012E^2 \qquad (R^2=0.285)$$

In this regression, earnings peak after 34 years of experience. An extra year of schooling leads to just under 11% extra earnings for the rest of person's life.

Mincer's regression method is far more commonly used than the cost-benefit approach as it allows for flexible ways of controlling for other worker characteristics. Age earnings profiles typically show that earnings increase with experience but at a decreasing rate and this provides the basis for the inclusion of both experience and its square.

United States 1973: $\ln Y = 6.20 + 0.107S + 0.081E - 0.0012E^2$ $(R^2=0.285)$
South Africa 1993: $\ln Y = 4.66 + 0.159S + 0.057E - 0.0008E^2$ $(R^2=0.316)$
India 1995: $\ln Y = 4.70 + 0.106S + 0.068E - 0.0011E^2$ $(R^2=0.520)$

The three Mincerian earnings functions above show that the marginal returns to education in the years shown were 10.7% in the US, 15.9% in South Africa and 10.6% in India. The US equation is taken from Mincer (1974) and the ones for South Africa and India are computed by the author with data used in Kingdon and Knight (2004) and Kingdon (1998) respectively.

Strictly speaking the coefficient on *S* is simply the marginal benefit and not the marginal *return* to schooling since it does not take into account the direct costs of education. Private returns to education are always higher than the social returns if education is publicly subsidised.

Here there is an implicit assumption of a linear relationship between schooling and earnings but it is easy to allow for non-linearities in the education-earnings relationship, and indeed for a number of other factors such as gender, marital status, health, etc.

Regressions like these are very popular and have been fitted for more than 100 countries. The results look quite similar across countries, with the coefficient on years of education typically varying between about 0.08 and 0.15. In other words, education substantially increases earnings. If earnings reflect productivity, it can be said that education increases individual productivity. This is known as the human capital interpretation of education. This is what provides the economic efficiency rationale for investments in education.

3.2 Evidence on returns to education

Psacharopoulos has collated findings from studies of economic rates of return to education from scores of different countries. He first published these in 1985 and updated them in 1994 (Psacharopoulos, 1994).

His world-wide patterns of rates of return to education (Table 3.1) have become widely quoted.

Table 3.1
Private and social rates of return to education, 1994 (cost-benefit method)

Country	Mean p.c. income *US $*	Social			Private		
		Primary	Secondary	Higher	Primary	Secondary	Higher
Low income	299	23.4	15.2	10.6	35.2	19.3	23.5
L middle income	1402	18.2	13.4	11.4	29.9	18.7	18.9
U middle income	4184	14.3	10.6	9.5	21.3	12.7	14.8
High income	13100	n.a.	10.3	8.2	n.a.	12.8	7.7
World	2020	20.0	13.5	10.7	30.7	17.7	19.0

The coefficient on years of schooling (Mincerian method)

		Mean years of schooling	Coefficient on years of schooling
Low income	301	6.4	11.2
L middle income	1383	8.4	11.7
U middle income	4522	9.9	7.8
High income	13699	10.9	6.6
World	3665	8.7	10.1

Source: Psacharopoulos (1994).

From these patterns, Psacharopoulos infers that:

- The social rate of return to education is at least as high as any reasonable measure of the opportunity cost of capital, i.e. investment in people is as or more conducive to economic growth than investment in machines.

- The private returns to education are always higher than the social rates of return because of public subsidisation of education in most countries.

- The discrepancy between private and social returns is greatest at university level. This raises issues of equity as well as of how education expansion should be financed.

- The rate of return to primary education is greater than that to secondary education which, in turn, is greater than the return to higher education. In other words, there are diminishing returns to extra years of education.

- The same diminishing returns apply across countries: the more developed the country, the lower the returns to education at all levels. The high returns to education in low-income countries must be attributed to their relative scarcity of human capital.

While Psacharopoulos' worldwide patterns of returns to education have become widely quoted, Bennell (1996) finds unsafe inferences in this work: he argues that many of the original studies on which Psacharopoulos' synthesis draws relied on very poor quality data and utilised methods that were seriously flawed. For example, one of the studies in the Africa set of papers that Psacharopoulos draws from, found a 66% rate of return on primary schooling – and this considerably boosted the Africa wide average of the returns to primary education. This was based on civil service salary scales. Bennell critiqued:

"*virtually no hard data were available in these three countries [Nigeria, Ghana, Uganda] on the individual incomes of primary school graduates and those with no education. Their authors had no alternative therefore but to make a series of guesses and assumptions in deriving primary-no education income differentials*".

However, a further update of global patterns in returns to education in Psacharopoulos and Patrinos (2004) - based on a larger number of more recent and more comparable studies – largely confirms the patterns noted in Psacharopoulos (1994), as seen in Table 3.2.

Table 3.2
Private and social rates of return to education, 2004 (cost-benefit method)

Country	Mean pc income US $	Social			Private		
		Primary	Second.	Higher	Primary	Second.	Higher
Low income	363	21.3	15.7	11.2	25.8	19.9	26.0
Middle income	2996	18.8	12.9	11.3	27.4	18.0	19.3
High income	22530	13.4	10.3	9.5	25.6	12.2	12.4
World	7669	18.9	13.1	10.8	26.6	17.0	19.0

The coefficient on years of schooling

		Mean years of schooling	Coefficient on years of schooling (Mincerian return to schooling)
Low income	375	7.6	10.9
Middle income	3025	8.2	10.7
High income	23463	9.4	7.4
World	9160	8.3	9.7

Source: Psacharopoulos and Patrinos, 2004.

3.3 Challenges in estimating returns to education accurately

In order to estimate returns to education accurately, one needs to take account of a number of further factors that affect the profitability of the education investment:

- Ability bias: ability bias is the possibility that it is not education that determines productivity (measured by wages) but, rather, innate ability. If this is true, it has important implications and it is important to take account of ability bias (see the 'ability bias challenge' sub-section below).

- Adjustment for unemployment: There are two sorts of adjustment for unemployment needed. Firstly, if there is unemployment of educated persons, the returns are over-estimated and need to be adjusted downward to adjust the length of the benefit stream. However, if education reduces the incidence of unemployment over the adult life, then this will lead to positive adjustment to returns estimates.

- Adjustment for quality of schooling: If school quality varies between individuals, then it will be important to control for it. For instance, 10 years of schooling in a high resource high quality school may lead to a much higher amount of learning and increase in productivity than 10 years of schooling in a poor quality school. Studies by Behrman and Birdsall (1983), Boissiere, Knight, & Sabot (1985) and Glewwe (1996) find that returns accrue not only to years of schooling but also to quality of schooling, variously defined.

- Adjustment for family background: typically reduces returns to schooling (Lam & Schoeni, 1993; Heckman and Hotz, 1986; Behrman & Wolfe, 1984; Kingdon, 1998). This could be because inclusion of family background controls for ability, quality of schooling and nepotism in the labour market.

- Allowing for sheepskin effects – namely for the fact that the return to completion of certain threshold levels of education is higher than the return to intervening years of education within a given level; i.e. the last year of schooling in a level (primary, secondary, higher) is disproportionately rewarded in terms of higher wages. This is tested by including a dummy for each year of schooling in the earnings function, and observing whether the return to those years of schooling that represent the completion of particular cycles (primary, junior, secondary, higher) is higher than the return to intervening years.

- Not relying on wages as the sole measure of productivity: since labour markets are not perfectly competitive, wages may not be market determined, and workers may not be paid their marginal product but rather some institutionally determined or bureaucratically set minimum wages. However, the notion that education enhances productivity does not inevitably rely upon the use of earnings as a measure of productivity. For example, studies examining the effect of education on the production of farm output often find that in modernising environments, educated farmers produce greater physical output than uneducated ones (Jamison and Lau, 1982; Appleton & Balihuta, 1996); Moreover, there are positive returns to education in the informal sector of several countries where there is something close to a competitive labour market.

The 'ability bias' challenge to the human capital interpretation of education

There are two major interpretations of education:

- the human capital interpretation, and
- the screening/signalling/credentialist interpretation

The human capital interpretation of education states that education enhances productivity and therefore represents human capital, rather like physical capital (e.g. a machine) enhances productivity. However, 'ability bias' is potentially the most damaging critique of the human capital interpretation of education – the possibility that it is not education that determines productivity but, rather, innate ability.

Why is the challenge to the human capital view of education so damaging? If it is innate ability or other innate qualities such as drive or motivation, rather than education, that enhance productivity then the economic efficiency rationale for government investments in education disappears. Under the screening hypothesis, acquiring education is still privately profitable since education level can be used to signal ability and thereby earn higher wages, but education does not increase a person's productivity and it is not a socially profitable activity and the economic efficiency rationale for public subsidy to education no longer exists. Thus, it is of considerable theoretical and practical interest to estimate returns to education more accurately.

Because of the high correlation between years of schooling and *unobserved* innate ability, it is difficult to estimate the causal effect of schooling on an individual's productivity. Nevertheless, many studies have attempted to isolate the effect of education on productivity from the effect of ability on productivity. The problem is this: the error term in the mincerian earnings function contains unobserved ability which is correlated with the included variable 'years of schooling' or S. Thus, a fundamental assumption of OLS model {corr(u,S)=0} is violated. Estimation by OLS leads to upward 'endogeneity' bias (and downward measurement error bias) in the coefficient of schooling. Some of the ways of separating out the effect of ability and schooling in the applied economics of education literature have been:

- Controlling for ability by including a direct measure of ability (such as IQ score) in the earnings function. This has been done for Kenya/Tanzania (Boissiere, Knight and Sabot, 1985) and for Ghana (Glewwe, 1996). Introduction of IQ scores typically reduces the return by about 10% (e.g. from 11% to 10%). However, there is no perfect IQ measure.

- Twin studies, pioneered by Taubman (1976) whereby the difference in earnings between twin-pairs is regressed on difference in schooling between the twins. Taubman estimated $\Delta \ln Y = r\Delta S + \gamma \Delta A + \Delta \varepsilon$ but this led to a collapse of the return to education from about 11% to a mere 2.6%. Subsequent twin-studies, which correct for measurement error, find that in these twin-differencing models, the returns to education marginally increase from their OLS levels (Ashenfelter and Krueger, 1994; Rouse, 1999). These studies have very demanding data requirements that are rarely met in developing countries.

- Instrumental variable (IV) approach: This is the dominant solution, namely to instrument the 'endogenous' variable S by instruments that are well correlated with schooling but not correlated with ability. The IV strategy looks to the educational attainment literature for appropriate instruments or exploits some 'natural experiment' that assigns extra years of schooling to individuals irrespective of ability. Appendix 3 provides examples.

3.4 The poverty reduction implications of the pattern of returns to education

Education is a powerful tool of empowerment, particularly for disadvantaged groups such as girls, ethnic minorities, disabled persons, orphans and rural people. It is also commonly stated that education is one of the most powerful ways of reducing poverty. The economic returns to different levels of education, together with the observed distribution of educational levels across the adult population, can give an idea about the poverty reducing role of education, and can potentially guide policy makers about education and labour market policies. For instance, if the return to *primary* education is low in a country, then a policy to universalise primary education – as sought in the Millennium Development Goals – will not be sufficient to reduce poverty since primary graduates do not obtain well-paying jobs in that labour market.

Compared with Psacharapoulos's (1994) study, in Psacharapoulos and Patrinos (2004) the private return to primary education had fallen from 35% to 26% and the return to higher education had risen slightly from 24% to 26% in low income countries. Thus, by the 2004 update, the returns to primary and higher education were equal. However, three quarters of the studies on which the 2004 update is based used data from the 1950s, 60s, 70s and 80s. Only 21 out of 83 studies use data from the 1990s. Given the very significant changes in the supply of primary, secondary and higher education graduates over time in various countries, it is likely that there have been important shifts over time in the rewards to different levels of education. In particular, due to the spectacular increase in the supply of primary schooling in many developing countries, the returns to primary education are likely to have fallen. In this case then, old data will not be informative about the current/recent pattern of returns to different levels education.

A number of recent studies find that the Mincerian wage return to primary education has collapsed and is substantially lower than that to higher education. For instance, Appleton, Hoddinott and Krishnan (1999) for 3 African countries; Kingdon (1998) and Kingdon and Unni (2001) for India; Knight et. al. (1992) for Kenya; Moll (1996) for South Africa; and Schultz (2003) for 6 African countries (Schultz's results are summarised in Table 3.3). The main potential explanations for the decline of primary returns are shifts in labour supply and a decline in quality of schooling.

Table 3.3
Estimates of Mincerian returns to different levels of education in Africa, using recent data

	Primary	**Middle**	**Secondary**	**University**
Ghana (1998) (males aged 25-34)	11.0	3.9	12.0	44.0
Cote d'Ivoire (1987) (males aged 25-34)	15.0	14.0	22.0	16.0
Kenya (1994) (males aged 25-34)	--	11.0	7.4	21.0
South Africa (1993) (African males aged 25-34)	--	7.3	22.0	32.0
South Africa (1993) (White males aged 25-34)	--	1.4	20.0	20.0
Nigeria (1999) (males aged 25-34)	1.6	--	4.0	12.7
Burkina Faso (1998) (males)	7.9	--	10.9	12.9
Average	8.9	7.5	14.0	22.7

Source: Schultz (2003). The estimates show the marginal returns. E.g., in Kenya, for males aged 25-34, each extra year of university education raises wages by 21% but each extra year of middle education raises earnings by only 11%

Thus, the common assertion that wage returns are highest at primary school level and decrease at secondary and postsecondary levels appears not to be true with recent data from a number of developing countries. This suggests that the poor can attain substantial wage returns only if they attain beyond the primary level of education. There are various policy implications. Firstly, for poverty reduction, it may no longer be sufficient to ensure universal primary education. Secondly, the recent pattern of returns has implications for the pattern of public funding of education. In particular it implies that the large universal public subsidies for postsecondary education may not be needed to motivate students to enroll in tertiary education.

4. Internal efficiency of the schooling system

The internal efficiency of the education system is judged by the amount of educational output (such as student achievement) produced for a given level of educational inputs (such as teachers, classes, textbooks, school expenditures). Those educational systems are considered more internally efficient which produce greater amounts of output for given levels of input.

4.1 Measures of the school system's performance

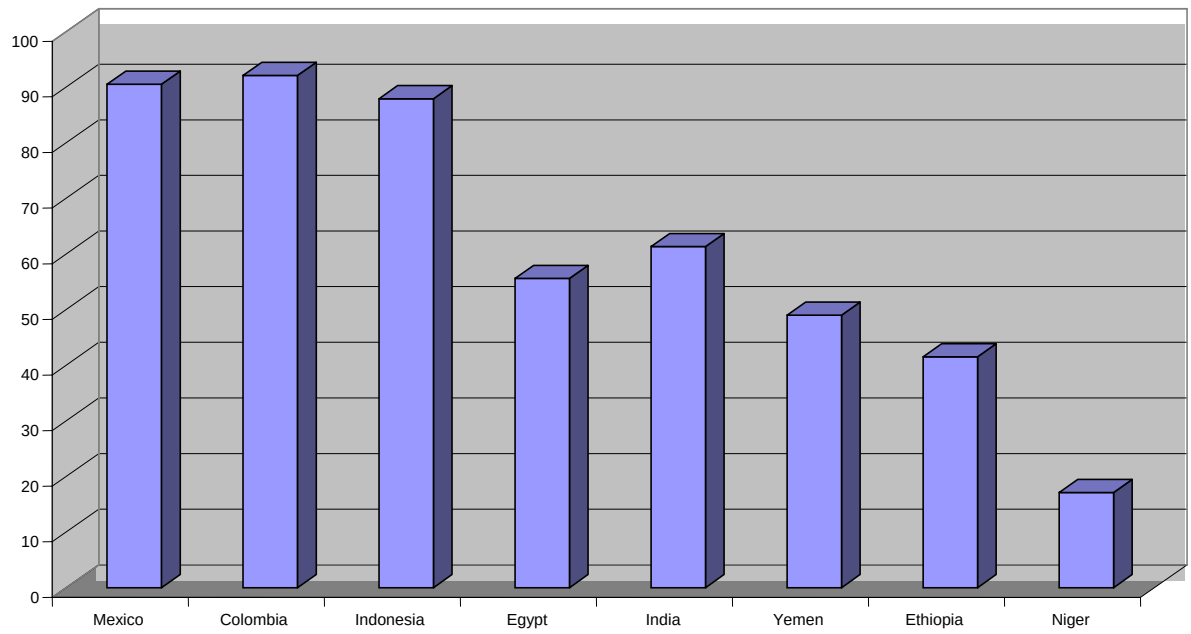
Developing an effective strategy for the education sector involves first assessing school performance and outcomes and understanding the factors that influence those outcomes. This section outlines the measures of school sector performance and considers the factors that affect performance measures.

Commonly used measures of the performance of the current schooling system are:

- out of school population
- school enrolment rates
- school attendance rates
- primary school completion rates
- grade repetition
- learning achievement

In addition, the adult literacy rate is a measure of the past performance of the schooling system. It is the proportion of adults – variously defined (e.g. aged 15 years or over) – who can read and write, in the population of all adults. The level of proficiency required for being considered able to 'read' and 'write' differs somewhat from country to country.

Figure 4.1: Adult literacy rate in selected countries



Source: Human Development Report, 2004. Table 11.

For each of the above measures, the gender, ethnicity and regional (rural/urban) gaps in performance are also important indicators of the equity aspect of the education system's performance. School and teacher characteristics such as teacher-pupil-ratio, pupils per classroom, per pupil expenditure, and teacher qualifications and experience are sometimes also used as indicators of the performance and quality of the education system but these are really 'inputs' into the schooling process rather than outcomes of it.

The most important indicator, from the point of view of the education-related Millennium Development Goals (MDGs), is the primary school completion rate, targeted to be 100% by 2015 in all countries. The measures that feed into the education component of the Human Development Index (HDI) of the UNDP are gross primary, secondary and tertiary enrolment rates combined with the adult literacy rate, with the latter having two-thirds weight.

Out-of-School Population

This is the total population of primary (or secondary) school age children who are not enrolled in any level of education, expressed as a percentage of the official school-age population corresponding to the primary (or secondary) level in a given school-year. This measure tracks children who are not enrolled in any education level and, as such, it measures the real magnitude of young persons at risk. For the primary level, it can be expressed as:

$$\text{Out of school population} = \frac{\text{No. of primary school age kids not enrolled in any level of education}}{\text{Population of the official age group for primary level}}$$

Gross Enrolment Rate (GER)

The GER is the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the official school-age population corresponding to the same level of education in give school-year. The GER is widely used to show the general level of participation in a given level of education. It indicates the capacity of the education system to enrol students of a particular age-group. Together with the adult literacy rate, the combined primary, secondary and tertiary gross enrolment rate of a country is used in calculating its education index to feed into the UNDP's Human Development Index (HDI). The gross enrolment rate for a given level of education is used as a substitute indicator to net enrolment ratio (NER) for that level when data on enrolment by single years of age are not available. It can also be a complementary indicator to NER by indicating the extent of over-aged and under-aged enrolment.

The GER is calculated by dividing the number of pupils enrolled in a given level of education (regardless of age) by the population of the age-group which officially corresponds to that level of education, and multiplying the result by 100.

$$GER_x = \frac{E_x}{P_{x,a}} * 100$$

where:

GER_x = Gross Enrolment Ratio at level of education x

E_x = Enrolment at the level of education x

$P_{x,a}$ = Population in age-group a which officially corresponds to the level of education x

Net Enrolment Rate (NER)

The NER is the ratio of the number of children of official school age who are enrolled (in a given level of education) to the total population of children of official school age for the corresponding level of education. NERs show the extent of participation in a given level of education of children or youth belonging to the official age-group corresponding to that level of education.

The NER is calculated by dividing the number of pupils enrolled who are of the official age-group for a given level of education by the population for the same age-group, and multiplying the result by 100.

$$NER_x = \frac{E_{x,a}}{P_{x,a}} * 100$$

where:

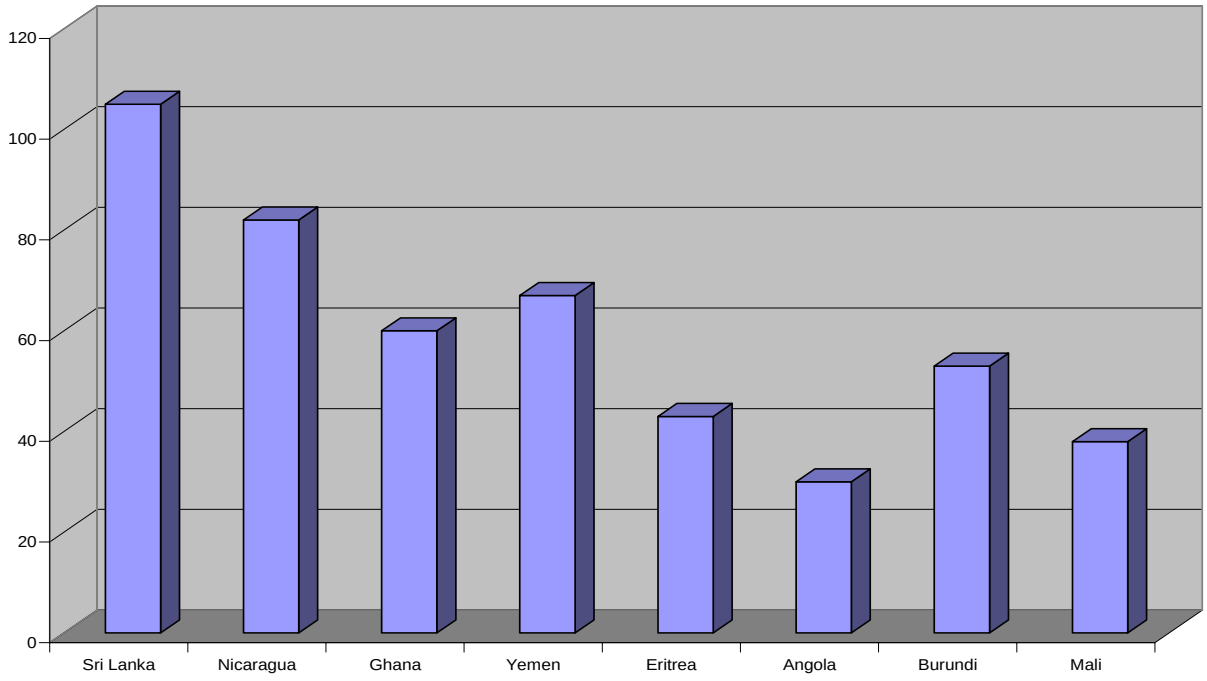
NER_x = Net Enrolment Ratio at level of education x

$E_{x,a}$ = Enrolment of the population of age group a at the level of education x

$P_{x,a}$ = Population in age-group a which officially corresponds to the level of education x

For example, if the entrance age for primary education is 6 years and the duration of the primary school cycle (without repetition) is 5 years, then the relevant age population for the denominator is all children aged 6 to 10 inclusive. The disadvantage of this measure is that if overage or underage children are enrolled in a particular level of education, they are not counted.

Figure 4.2: Net enrolment rate in primary school in selected countries



Source: Human Development Report, 2004. Table 11.

School attendance rate

School attendance rate for primary education is the number of children of the official age for primary education 'regularly' attending school, as a proportion of the total population of children of the official age for primary education. Thus, if attending school for at least 15 days each month during school term is regarded as attending 'regularly', and if the official age for primary school attendance is ages 6-10 inclusive, then the primary school attendance rate is the ratio of the number of children aged 6-10 who attended school regularly to the total population of children aged 6-10 years old. This indicator measures actual attendance as distinct from mere enrolment. In some countries, due to 'enrolment drives' at the start of the school year or due to incentives for teachers to over-report enrolment, school enrolment is not a good measure of school attendance.

$$\text{Primary school attendance rate} = \frac{\text{No. of children of official primary age regularly attending school}}{\text{Population of official age group for the primary school}}$$

Gross primary school completion rate

The gross primary completion rate is the total number of students graduating from the final year of primary education, regardless of age, expressed as a percentage of the population of the official primary graduation age. For tracking progress towards the achievement of the education-related Millennium Development Goal of basic education for all by 2015, this is the most important indicator of the performance of an education system. It measures the proportion of all children who complete the primary education cycle. Various factors may lead to poor performance on this indicator, including low quality of schooling, discouragement over poor performance and the direct and indirect costs of schooling. Students' progress to higher grades may also be limited by the availability of teachers, classrooms and educational materials.

The gross primary completion rate is calculated by dividing the number of students completing the final year of primary education by the population at the official primary graduation age, and multiplying the result by 100. For countries where the number of primary graduates is not reported, a proxy primary completion rate is calculated as:

$$\text{Primary completion rate} = \frac{\text{No. of students in the last primary grade} - \text{Repeating students}}{\text{Population of official age group for the last primary grade}} * 100$$

The numerator may include overage children who have repeated one or more grades of primary school but are now graduating successfully. The age-specific estimates are less reliable than overall population estimates, and this is particularly an issue in countries with relatively rapid changes in population and its age and gender distribution due to causes such as migration, civil unrest and displacement. When age-specific population breakdowns are not available, the primary completion rate cannot be estimated.

While the World Bank and UNESCO's Institute for Statistics attempt to monitor this indicator annually, systems for collecting and standardizing the data from 155 developing countries are not yet in place. As a result, the current database has many gaps, particularly for small countries, earlier years and gender breakdowns, and there are obvious anomalies and suspect estimates. The current database is a mixture of enrolment data and data based on different systems of graduation (exams, diplomas, automatic promotion), limiting international comparability (UNDG, 2003).

Table 4.1
Gross primary school completion rate, 2001/02

	Percentage of students enrolled in the final grade of primary school			Gender gap
	Total	Boys	Girls	
Developed regions	98.8	---	---	---
Developing regions	83.0	85.9	79.8	6.1
Latin America/Caribbean	98.0	97.2	98.9	-1.7
Northern Africa	85.5	87.1	83.9	3.2
Sub-Saharan Africa	52.8	57.0	48.6	8.4
Eastern Asia	104.2	104.1	104.2	-0.1
Southern Asia	75.4	81.5	68.9	12.6
Western Asia	76.3	81.1	71.3	9.8
Oceania	63.3	64.5	62.0	2.5
Least developed countries	50.1	54.0	46.1	7.9
Landlocked developing countries	57.4	63.4	51.3	12.1

Source: Based on United Nations Statistics Division, "World and regional trends", Millennium Indicators Database, http://millenniumindicators.un.org (June 2005); based on data provided by UNESCO.

Repetition Rate

The repetition rate is the proportion of pupils from a cohort enrolled in a given grade in a given school-year who study in the same grade in the following school-year. The repetition rate measures the incidence of pupils repeating a grade, and its effect on the internal efficiency of an educational system. It is one of the key indicators for analysing pupil flows from grade to grade within an educational cycle. It is calculated by dividing the number of repeaters in a given grade in school-year $t+1$ by the number of pupils from the same cohort enrolled in the same grade in the previous school-year t.

$$r_i^t = \frac{R_i^{t+1}}{E_i^t}$$

where:

r_i^t = Repetition Rate at grade i in school-year t

R_i^{t+1} = Number of pupils repeating grade i, in school-year $t+1$

E_i^t = Number of pupils enrolled in grade i, in school-year t.

Learning achievement

Although there is good reason to value the socialisation benefit of school attendance, many people regard learning achievement as the most important goal of schooling. Under this view, school enrolment, attendance, retention and completion can all be seen as intermediary goals, necessary to ensure that learning takes place and cognitive skills are developed. Students, parents and schools value learning achievement and studies have shown that employers also value learning: returns to education in the labour market accrue not to years of schooling *per se* but more to what is learnt at school. Measures of cognitive achievement enter earnings functions with substantially sized and statistically significant coefficients (for a list of studies see Table 4.3 and 4.4), suggesting that

learning enhances worker productivity. Thus, learning achievement is often regarded as the ultimate measure of the performance of the schooling system.

Learning achievement is typically measured by students' scores on standardised tests in different skill areas such as numeracy and literacy. The main problem is that because examination boards and curricula differ by province, language-medium of instruction, and type of school within a country, there is typically no common or comparable measure of learning achievement for a given age group or grade. Thus, it is not possible to monitor learning achievement levels across regions or by school-type, gender or ethnicity etc. within a country.

At the global level, the International Association for the Evaluation of Educational Achievement (IEA) collects comparable cross-national data on learning achievement in basic school subjects under its 'Trends in Mathematics and Science Study' or TIMSS (1995, 1999, 2003) and under its 'Progress in International Reading Literacy Studies' (PIRLS) programme. However, the coverage of these studies is small. For example, TIMSS 2003 covered only 50 countries and only a handful of these were developing countries (Martin et. al., 2004). Similarly, PISA, a three-yearly survey by the OECD in 2000, 2003, etc., tests 15-year-olds in the main industrialised countries to assess how far students near the end of compulsory education have acquired some of the knowledge and skills essential for full participation in society (OECD, 2005). Data from these studies have been extensively analysed to shed light on the school and teacher factors that explain variations in student achievement. Two recent examples are Fuchs and Woessman (2005) and Woessman and West (2004), but TIMSS data in the few developing countries that did participate in it have led to a large amount of school effectiveness research in those countries.

4.2 Efficiency of inputs in the production of educational achievement

4.2a The education production function

While investigations into the effectiveness of school inputs or school programmes can legitimately be carried out by a variety of methods, economists have usually carried them out empirically within the framework of a production function model.

Educational production functions, also referred to as input-output analyses, examine the relationship between various inputs into and outcomes of the educational process.

In microeconomic theory, production functions are generally assumed

- to be well-known by decision makers,
- to involve only a few inputs that are perfectly measured,
- to be characterised by a deterministic relationship between inputs and outputs, and
- also often assumed that all inputs can be varied freely.

Knowledge of the production function and of the prices of each of the inputs allows a relatively straightforward solution of the 'least cost' set of inputs, yielding technical efficiency.

How the educational production function varies from the usual production function:

- the production function is unknown and must be estimated using imperfect data
- some important inputs such as pupils' home background and innate ability cannot be changed by policy makers
- estimates of the production function will be subject to considerable uncertainty

Nevertheless, the concept of a production function, in its basic form, is applicable to a wide range of 'industries', including education, health, and fertility. As Hanushek (1986) states, there is no a priori indication that this structure applies to some industries or sectors and not to others.

However, not everyone accepts the production function approach. Some economists and many non-economists have questioned the propriety of transposing the efficiency concept implicit in production function analysis from a technical, industrial setting to a social or behavioural one. Explanations for this critique are:

1. it reflects a general reaction against the quantitative evaluation of education
2. it is a reaction against the fact that educational production function studies often show that schools are very inefficient in their use of resources
3. the multiple outcomes of schooling cannot be simply captured in single statistics
4. inputs can only be defined in an inadequate, mechanistic way – e.g. textbook availability is often used as an input in these production function analyses but what matters more is how textbooks are used in the classroom, what is retained from them and how knowledge is used.

As some analysts put it: education, health and fertility share an inherent subjectivity in terms of judgements about their benefits, costs, inputs, and outputs. Such analysts argue for more descriptive and ethnographic research based on class-room observation. There is validity in many of the criticisms and it is important to acknowledge that studies which imply a high degree of objectivity in the use of a production function approach, give a false impression. As Fraser et. al. (1987) aptly put it: "in educational research, no single study, no matter how large, can be taken by itself as definitive. The imprecision of measurements and controls in education requires that the results of many individual studies are considered in order to draw more valid conclusions".

Outputs of schooling

The specification and measurement of the 'output' of schools is another conceptual issue in the micro-econometric analysis of education. The concept of varying quantities of a homogeneous output in traditional areas of economics is not easily translated into an educational equivalent. Education studies must focus on the quality differences between individuals who have received schooling.

Researchers face the problem that post-school outcomes cannot be observed contemporaneously with schooling. Given this data problem, by far that most common approach is to use a measure of output which can serve as proxy for future performance of educated persons. The output measures most used in the literature have been students' :

- score on standardised tests of achievement
- school-enrolment or attendance rate
- educational attainment (grades attained)
- attitudes
- college-continuation/drop-out rates
- literacy rate

The measures used are proxies for more fundamental outcomes of schooling. Scores on achievement tests are the most commonly used measure of the output of schooling.

Inputs into schooling

There are multiple inputs into schooling. Input specification in an educational production function is often guided more by data availability rather than by notions of conceptual desirability.

Table 4.2
Inputs into schooling

Teacher inputs Teacher education Teacher experience Teacher salary Quality of teacher education Teacher training Teacher attendance and effort	School inputs School infrastructure- water/toilets Instructional materials - blackboard Equipment- books, maps, charts, labs Length of school week Homework setting policy Form of instructional organisation
Child and parental inputs Child ability Child industriousness/motivation Child age, gender, health, disability Home environment (newspapers/books) HH resources (e.g. determine nutrition, space/light for study, child labour) Parental interest in child's schooling Parental education, occupation, income	Peer-group inputs Peer family background Peer ability

Usually, a production function of the following type is used:

$$A_{ij} = f(I_{ij}, FB_{ij}, PG_{ij}, T_{ij}, S_j)$$

where *i* denotes individual student and *j* denotes the school attended by/available to the student. *A* is achievement score of the *i*th child at a given time; *I* is a vector of innate abilities, motivation, and child's personal characteristics; *FB* is a vector of family background inputs; *PG* is a vector of peer-group influences; *T* is a vector of teacher and *S* a vector of school inputs.

Problems:

1. The production function relationship is cumulative, i.e. past inputs affect current output (e.g. current achievement level) but usually it is very difficult to obtain data on past school, teacher, and peer-group inputs. Current inputs have to stand as proxies for the cumulative value of past inputs, implying measurement error. Most studies suffer from this limitation.
2. As far as teacher and peer variables are concerned, typically only overall school averages are available – such as mean characteristics of all teachers. However, such data can give misleading indications of the actual inputs to any given student in the school. For example, 'average education of teachers in the school' is an overall school variable but the sample students may be exposed to only a subset of the teachers in the school. Similarly, overall pupil-teacher ratio (PTR) of the school may differ from the PTR in the particular class attended by the student.
3. Ability/intelligence/work ethic/motivation – all important determinants of achievement – are usually unobserved and unmeasured, and cannot therefore be included in the achievement production function.

One way of overcoming this last problem is to use panel data. If a student's achievement is measured at two points in time, say one or two years apart, then a value-added formulation becomes possible, i.e. one can use an individual 'fixed effect': change in achievement can be regressed on change in inputs. Thus, only the effects of change in unobserved variables (e.g. growth in motivation or ability over time) are now omitted. However,

- Very few panel datasets are available for developing countries
- As Krueger (1999) points out, a value-added specification may miss much of the value that is added from a school-resource that confers a one-time effect which permanently raises achievement level without raising the achievement trajectory greatly, i.e. a value-added specification may under-estimate the effect of certain inputs.
- The measurement error problem is much greater in a value-added specification of the educational production function since, in this 'differenced' specification, the ratio of signal to noise will be low, compared with that in the 'levels' specification.

Other ways of dealing with the effect of unobserved variables is to use randomised experiment studies and statistical approaches and these are discussed under 'third generation studies' below.

4.2b Results from education production function studies

First generation studies: Do schools and teachers matter?

Much of the research on the determinants of pupil achievement in developing countries until the 1980s was largely reactive to the policy question initially asked in the 1960s within developed countries, namely, do schools matter in shaping the academic achievement of students?

Large scale studies in UK (Plowden Report 1967, Peaker 1971) and USA (Coleman Report 1966) sought to discover the aggregate influence of school quality on achievement after empirically 'controlling for' pupils' family background. Their common conclusion that differences in schools had no significant impact on student achievement was largely corroborated by a large-scale study of science achievement in 19 high and low income countries conducted for the IEA by Comber and Keeves (1973) and of reading achievement in 15 countries by Thorndike (1973). This was rather depressing for the school industry and the teaching profession.

The conclusion that students' achievement was overwhelmingly determined by home background factors in developing as well as developed countries was challenged by Heyneman and Loxley, (1982) who argued that the process of model specification in the original IEA studies was erroneous. They resubmitted the IEA data to a new process of variable selection to find that whereas in developed countries, home background of students mattered much more to achievement than school quality, the reverse was true in low income countries. For example, Heyneman and Loxley (1982 p18) found that, of the variance in science achievement that could be explained in India, 90% was attributable to school and teacher quality, and only 10% to pupils' home background factors. This finding gave some comfort but it has its critics.

Second generation studies: What particular inputs boost achievement most?

While early research focused on *whether* school and teacher factors – as a whole – were more important to student learning than home background and personal endowments – as a whole – ideally one wants to know *what specific school and teacher inputs* have the greatest impact on achievement, and their relative costs. For policy purposes, that is likely to be the most useful type of analysis as it can enable educational policy makers to potentially make the most cost-effective use of scarce educational resources by directing monies towards those particular inputs.

Some studies were also looking at this question during the 1970s and 80s. Findings from 72 such studies for developing countries were synthesised by Fuller (1986) and findings from 147 such studies for developed countries were synthesised by Hanushek (1986). Each of these studies examined the impact of school/teacher factors holding constant student home-background characteristics. Fuller found that while availability of textbooks, instruction time, library activity, and length of teacher training mattered to student achievement, class size and teacher salaries did not. Hanushek found that teacher-student ratios, teacher education and teacher experience had no consistent positive effect on student achievement. Hanushek (2003) collates evidence for 97 developing country studies and finds that school facilities raised student achievement statistically significantly in 65% of the studies, teacher education in 56% of the studies and per pupil expenditure in 50% of the studies. However, in the case of pupil teacher ratios, teacher experience and teacher salary, none of these raised student achievement significantly in the majority of cases. This evidence is summarised in Box 4.2.

However, not everyone agrees with Hanushek's rather pessimistic conclusions about the effect of pupil teacher ratios (see Kremer, 1995; Angrist and Lavy, 1999; Case and Deaton, 1999; Krueger, 1999, 2003).

Box 4.1
Summary of findings in Fuller (1986)

Fuller (1986):

"Those material inputs directly linked to the instructional process consistently influence pupil achievement. For instance of the 22 studies of the influence of textbooks, 14 have found a significant effect on achievement. 15 of the 18 studies of school libraries (and intensity of utilisation) found that they contribute to student achievement. Of 31 analyses of teacher training, 21 found that the length of training influenced pupil achievement. All studies reviewed empirically tested multivariate models and controlled on the independent influence of pupils' family background….. Some costly inputs are not consistently related to achievement. For instance, 9 of 13 studies have found that teachers' salary levels are not related to pupils' achievement. 16 of 21 empirical studies have found that pupils enrolled in classrooms with fewer students do not achieve at higher levels than those in larger classrooms. Such disconfirmation of any relationship between input and actual achievement suggests where cost-savings can be generated without detrimental effects on pupil performance".

Set 1 Quality elements not consistently related to achievement:

1. Class size	(no effect in 16 of 21 analyses)
2. Laboratories	(no effect in 7 of 11 analyses)
3. Teacher salary levels	(no effect in 9 of 13 analyses)

Set 2 Quality elements consistently related to achievement:

4. Expenditure per pupil	(effect in 6 of 11 analyses)
5. Instructional materials	(effect in 17 of 25 analyses)
6. Library activity	(effect in 15 of 18 analyses)
7. Teacher training	(effect in 21 of 30 analyses)
8. Length of instruction	(effect in 11 of 13 analyses)
9. Teacher's social class	(effect in 7 of 10 analyses)

Box 4.2
Summary of findings in Hanushek (2003)

Hanushek (2003)

Percentage distribution of estimated effect of key resources on student performance, From 96 educational production function estimates (developing countries)

Resources	Number of estimates	Statistically significant (%)		Statistically insignificant (%)
		Positive	Negative	
Pupil teacher ratio	30	27	27	46
Teacher education	63	56	3	41
Teacher experience	46	35	4	61
Teacher salary	13	31	15	54
Per pupil expenditure	12	50	0	50
School facilities	34	65	9	26

Critique of meta-analyses

Meta analyses such as those by Fuller and Hanushek have been criticised by Kremer (1995) and Case and Deaton (1999). One of the main critiques is that the studies in meta analyses are of very mixed quality. Case and Deaton (p 2081) state: "Many have never been peer-reviewed, some are no longer available and, when they are, it is often very difficult to discover exactly what data were used and how the analysis was done. The descriptions of the econometric procedures … are sometimes so exotic as to raise serious doubts about the validity of the results. Nor do the meta analyses tell us what other variables are being controlled for in any given study. For example, the insignificance of class size on outcomes means something different depending on whether or not expenditure per pupil is also included in the regression. We would argue that the only reasonable inference from a meta-study is that the mass of this literature permits no conclusion whatever. Secondly, if we disregard the meta-analyses and move to individual studies instead, the conclusions are often far from the dictum that 'resources do not matter'. The matter rests on the key issue of conditioning". In studies which include a large number of variables, it is hard to know how pupil teacher ratios could be reduced while holding such variables constant. In order to know the total effect of class size, one needs to exclude its covariates (the factors through which class size has an effect). Case and Deaton believe that the insignificance of class-size in such regressions has little relevance for a national policy on class-size.

Third generation studies: Challenge to the view that inputs do not matter

One of the problems with the second generation studies was that they did not pay attention to the issue of 'endogeneity' of class size (also known as pupil teacher ratio, *PTR*) in the achievement production function. The problem of endogeneity can be understood by means of an example: Suppose we are interested in examining the causal effect of *PTR* on student achievement (*A*). However, suppose that parents of more intelligent or more motivated children are willing to move house to be closer to a school that has low *PTR*. Then if low *PTR* is associated with higher achievement across schools, it cannot be claimed that low *PTR causes* higher achievement. This is

because the *PTR* variable could be 'picking up' the effect of unobserved and unmeasured child intelligence/motivation, which is in the error term of the achievement production function:

$$A = a + b.PTR + u$$

Similar problems of interpretation can arise if schools group low ability pupils in smaller classes. Endogeneity problems are pervasive in educational production functions and they undermine researchers' ability to draw causal inferences. The solutions to the endogeneity problem are:

1. Experimental approach: here the idea is to assign students randomly to classes of small and large size so that there is no presumption *a priori* that unobserved ability is correlated with class-size either negatively or positively. Then ordinary least squares (OLS) regression yields perfectly unbiased results. An example of this approach is provided by Krueger (1999)
2. Exogenous Class-size using OLS: this approach relies on finding a situation where it can be believed that class-size is exogenous. An example of this approach is provided by Case and Deaton (1999) based on data from apartheid South Africa.
3. Instrumental variable approach: The idea here is to find a valid instrument for class size and then use the Instrumental Variables (IV) approach. An example of this approach is provided by Angrist and Lavy (1999) from Israel.

Appendix 4 summarises these papers to showcase the above three approaches.

The findings from these studies suggest that Hanushek's conclusion – that school resources such as teacher-pupil-ratios have no causal effect on learning - may be premature because studies are often confounded by a failure to isolate a credible source of exogenous variation in school-inputs. Several techniques permit overcoming problems of confounding by exploiting exogenous variation in the endogenous variable. When this sort of exogenous variation is used to study class-size, smaller classes appear beneficial.

4.3 Access-quality trade-off in education

Throughout the developing world, school enrolments have expanded rapidly, particularly at the primary level but also increasingly at the secondary and tertiary levels. This raises the question: does greater access to education come at the expense of lower educational quality, given that these objectives must compete for the same budget? In other words, is there a quantity-quality trade-off in education? There are three main types of argument:

- Improving quality of education reduces the amount of resources available for expanding educational access. Thus there is a trade-off between access and quality.
- Improving quality of education reduces grade repetition and wastage in education, thereby generating cost savings which can be used to expand educational access. By this argument, there is no trade-off between quality and access.
- Improving quality of education improves the economic return to schooling and thus raises the demand for schooling, leading to improved educational access. By this argument too, quality and quantity in education are complementary rather than competing.

There is evidence for both the trade-off and the complementarity views.

If, as enrolment rates rise, the new students joining the school system are from increasingly less educated homes, then greater resources per pupil may be needed to produce the previous levels of educational output (e.g. achievement levels). In other words, for any given level of educational efficiency, increased enrolments may require increased resources in order to maintain quality. If such resources are not made available, the increase in educational quantity may come at the expense of educational quality. Duraisamy et. al. (1999) find a negative effect of expanded enrolments on school conditions and learning, using a cross-district time series analysis of Tamil Nadu, India. They find that while a wide array of government initiatives made schools accessible and attractive to families, resources did not keep up with enrolments, raising the student-teacher ratio dramatically over the1990s and lowering the pass rate on the state's tenth grade examination. The study shows that the rise in the student-teacher ratio and the consequent diminution of the growth rate in examination passes has been greatest in districts with the fastest enrolment growth – providing evidence of a quantity-quality tradeoff.

However, Harbison and Hanushek (1992) find the opposite. They find that in the poor-education-quality environment of rural north east Brazil, investment in school quality is "a real money machine" (p149) because improved school quality raises promotion and retention rates and reduces grade repetition and wastage in education. This better flow-efficiency of schools results in substantial cost savings that can permit improvements in overall access. Thus, their study implies that instead of a trade-off, there is complementarity between the quality and access goals.

Table 4.3
Studies finding substantial wage returns to cognitive skills

Authors	Country	Year
Developing countries		
Behrman and Birdsall	Brazil	1983
Boissiere, Knight and Sabot	Kenya/Tanzania	1985
Glewwe	Ghana	1996
Aslam	Pakistan	2005
Developed countries		
Murnane et. al.	USA	2000
Lazear	USA	2003
McIntosh and Vignoles	United Kingdom	2001
Green and Riddell	Canada	2003

Notes: Full references for these studies are given in the list of references at the end.

Evidence for the complementarity view also comes from the observation that utilisation of existing education facilities is low in areas where school quality is poor, combined with the literature showing that economic returns to education accrue not simply to years of schooling but also, or more importantly, to the cognitive skills learnt at school. Empirical work in many studies shows that quality of schooling, measured by learning achievement of students, is important to productivity and earnings (see Table 4.3). Table 4.4 suggests the presence of strong economic returns to education quality: in most studies, a one standard deviation increase in test scores was

associated with wage increases ranging from 12% to 48%, suggesting a substantial return to higher levels of cognitive skills and probably, therefore, to higher levels of school quality.

Since the economic return to poor quality schooling is likely to be low, such schooling will attract low demand. This is consistent with Kingdon (1996) who finds a great under-utilisation of poor-quality publicly funded schools in urban India. This idea is reiterated in Hanushek (2004) who cites evidence of high returns to schooling and low enrolment rates, arguing that low quality of the available schooling explains the poor access to education. This body of evidence suggests that far from a trade-off between efficiency and equity (or between quality and access), there is a deep complementarity between them.

It seems reasonable to conclude that there is both a trade-off and a complementarity between equity and efficiency in education. In a simple sense, at the level of the education system as a whole, there is an obvious trade-off between better resourcing/management (quality) of existing schools and the creation of new schools to expand access, due to the fact that resources are scarce. However, from the point of the view of individuals, better quality schooling raises the economic return to schooling and is likely to cause people to decide to enrol or stay on in school longer, promoting the 'quantity' and access objectives.

Table 4.4 Estimated returns to a standard deviation increase in cognitive skills

Study	Country	Estimated Effect (1)	Notes
Glewwe (1996)	Ghana	0.21** to 0.30** (government) 0.14 to 0.17 (private)	Alternative estimation approaches yield some differences; mathematics effects shown to be generally more important than reading effects, and all hold even with Raven's test for ability.
Jolliffe (1998)	Ghana	0.05 to 0.07*	Household income related to average mathematics score with relatively small variation by estimation approach; effect from off-farm income with on-farm income unrelated to skills
Vijverberg (1999)	Ghana	uncertain	Income estimates for mathematics and reading with non-farm self-employment; highly variable estimates (including both positive and negative effects) but effects not generally statistically significant.
Boissiere, Knight and Sabot (1985); Knight and Sabot (1990)	Kenya	0.19** to 0.22**	Total sample estimates: small variation by primary and secondary school leavers.
Angrist and Lavy (1997)	Morocco	uncertain	Cannot convert to standardized scores because use indexes of performance; French writing skills appear most important for earnings, but results depend on estimation approach.
Alderman et al. (1996)	Pakistan	0.12 to 0.28*	Variation by alternative approaches and by controls for ability and health; larger and more significant without ability and health controls.
Behrman, Ross and Sabot (forthcoming)	Pakistan	uncertain	Estimates of structural model with combined scores for cognitive skill; index significant at .01 level but cannot translate directly into estimated effect size.
Moll (1998)	South Africa	0.34** to 0.48**	Depending on estimation method, varying impact of computation; comprehension (not shown) generally insignificant.
Boissiere, Knight and Sabot (1985); Knight and Sabot (1990)	Tanzania	0.07 to 0.13*	Total sample estimates: smaller for primary than secondary school leavers.

Notes: *significant at .05 level; **significant at .01 level. 1. Estimates indicate proportional increase in wages from an increase of one standard deviation in measured test scores. *Source:* Hanushek (2004).

5. The private sector in education

5.1 Types of schools

Despite the rationale for public subsidy to education outlined in Section 2, the private sector thrives to various degrees at different levels of education in many countries. The role of the private sector in education takes various forms. Publicly funded schooling can be publicly provided – as in LEA-funded state schools in the UK – or it may be privately provided, as in the grant-maintained or 'aided' schools run by private managements. Privately funded schooling is usually privately provided. These are the independent schools, also known as private unaided schools or simply private schools. Privately funded schooling can occasionally also be state provided – this is the case where the government runs and manages schools but charges full-cost or partial fee. A typology of school-types is presented in Table 5.1 and the share of private schools in total enrolment, by level of education and region is presented is Table 5.2. The latter shows that the private sector has a much larger share of enrolments at the pre-primary level than at the primary or the secondary, and a much larger share in developing than in developed countries.

Table 5.1
Types of schooling provision and funding

Provision	**Funding**	
	Public	Private
Public	Free state schools	Fee-charging state schools
Private	Free state-aided but privately run schools	Fee-charging private schools

5.2 Is state-run education truly 'free'?

Even in state run education systems, private financing of education often turns out to be substantial. While schooling may be free or nearly free in the restricted sense that tuition fees are negligible, it does not necessarily mean that education is free in the sense that it involves no expenditure for the parents. For instance, in tuition-free government run schools in India, the private out-of-pocket expense per enrolled primary school child in 1996 was an average of Rupees 318 a year. This was expenditure on various forms of non-tuition fees, books, slates, clothes etc. (Probe Team, 1999, p. 16). Given the local daily wage rates, it was estimated that an agricultural labourer with three children of school-going age would have to work for about 40 days in the year just to send them to primary school, a major financial burden on poor parents which may deter them from sending children to school. The importance of private financing of education even in seemingly state-run systems has important implications for public policy.

Table 5.2
Private enrolment as a percentage of total enrolment, by level of education

	Pre-primary	Primary	Secondary
World[1]	40.1	7.2	11.7
Transition countries	1.1	0.5	0.4
Developed countries	7.8	4.2	7.1
Developing countries	55.5	10.9	14.9
Arab States	86.5	7.4	7.6
Central & Eastern Europe	1.5	0.8	1.1
Central Asia	1.2	0.6	0.9
East Asia and the Pacific	59.9	8.2	16.1
Latin America / Caribbean	43.1	14.7	22.2
N. America & W. Europe	25.7	6.7	8.8
South and West Asia	40.1	3.8	14.4
Sub-Saharan Africa	61.8	9.2	13.3

Source: Table 14, EFA Global Monitoring Report, 2004-5.

5.3 The relative efficiency of private and public schools

Evaluations of the relative performance of firms in private and public sectors - in terms of output, productivity, employment and profits - have been a stock-in-trade of applied economics. This literature concludes strongly that private provision of a service raises the efficiency of its provision. Whether this is the case in education has been the subject of empirical research by education economists in the 1990s and onwards.

Several sources show that pupils of private schools greatly outperform government school pupils in common board examinations. While a part of the explanation for this achievement advantage of private schools must be the superior home background of their pupils, part may also lie in the practices and management style of private schools. Several reasons are postulated for private schools' superior efficiency. For example, since they are accountable to parents who pay their fees, private schools may have to exert themselves harder to provide good instruction to pupils. Competition among providers is thought to be good for quality of services and decentralised management, a hallmark of private operators, is conducive to greater efficiency. However, the suggested benefits of private provision need to be evaluated carefully.

There are several qualifications to the presumed efficiency of private provision of education. Firstly, private but government-aided educational institutions (the agents) may not operate efficiently under contract to the state (the principal) if such contracts are poorly specified or monitored. This issue is particularly important in countries where a good proportion of schools are government-aided but privately run. Secondly, private sector enterprises can be inefficient in the education service-industry which is characterised by information asymmetry between buyers (parents of students) and sellers (fee-charging private schools). They may also be inefficient if barriers to entry - because of public policy towards private education - award monopoly status to a small number of private schools.

The equity effects of fee-charging private provision may be adverse since it usually excludes the poor. Efficiency is just one of the criteria in assessing the welfare effects of service provision. Distributional consequences are also important, especially in the context of a service such as education which potentially affects people's life-chances. It may be that efficiency is attained in private provision by sacrificing equity. Thus, assessment of the relative welfare effects of private and state schools must also address the equity-implications of school ownership.

The evidence on the relative effectiveness of private and public schools is mixed. Many studies find that, after controlling for student background and for possible selection of more able students into particular school-types, private schools are more effective in imparting learning to students than are public schools (Jimenez et. al., 1991, for several countries; Kingdon, 1996, for India; Coleman, Hoffer and Kilgore, 1982 for the US). However, some studies find that all of the raw private school achievement advantage disappears after standardising for student background. A cross-national study of 19 OECD countries by Dronkers and Robert (2004) using PISA data finds that while private but state-aided schools are more effective than public schools, the same cannot be said of private independent schools vis a vis public schools, after controlling for student intake.

5.4 Public-private partnerships in education

Various forms of public-private partnerships (PPP) exist in the education sector. One type of partnership is via government grant-in-aid to privately managed schools. The idea is that by linking grants to various performance indicators, the government (the principal) can encourage the private schools (the agent) to be cost-effective. However, there is little research on what type of performance-incentives in the grant formula for aid to private schools work best (apart from the somewhat dated study by James and Benjamin, 1988). While formula funding to private schools enables decentralised provision of publicly funded education, it also creates opportunities for corruption and fraud. This aspect has been the subject of a recent comparative study of four countries by Levačić and Downes (2004).

Another form of PPP is via the use of school vouchers. Under voucher schemes, a government channels funds to both private and public schools by means of a school voucher given to families, rather than giving education funding directly to schools or to school districts. The objective is to seek to introduce competition between public and private schools. Vouchers allow families to select the public or private schools of their choice and have all or part of the tuition paid. Underlying school voucher schemes is the idea that parental choice and competition between public and private schools will improve education for all children. However, in practice voucher schemes have been criticised on the ground that they increase inequality between the haves and have-nots because private schools can reject poor applicants on grounds of low achievement, discipline problems, etc. and because poor students whose parents cannot supplement the voucher to shift to a 'good' or more expensive school, have to remain in the public schools, some of which are left with less money to teach the poorest of the poor students.

Evidence on the effectiveness of voucher programme – within the developing world – comes mainly from Latin American countries some of whom have experimented with voucher schemes. This evidence is somewhat mixed. Hsieh and Urquiola (2003) find that more than 1000 new private schools entered the schooling market when Chile introduced its nationwide voucher scheme in 1981, but they find no evidence that increased choice improved outcomes as measured by average test scores, repetition rates and years of schooling. They also found that the programme led to increased sorting, as the 'best' public school students left for the private sector.

However, more typical is the finding that voucher schemes have improved outcomes (Bettinger, 2001; Rouse, 1998; Green et. al., 1996; Angrist et. al, 2002). The randomised natural experiment approach to impact evaluation is considered the cleanest way of drawing causal inferences about the impact of any given educational policy intervention. Uniquely in a developing country context, Angrist, et. al. (2002) use this stringent approach to evaluate the impact of school vouchers in Colombia. Colombia used lotteries to distribute vouchers to low income families which partially covered the cost of private secondary school for students who maintained satisfactory academic progress. The study finds that three years after the lotteries, winners were about 10 percentage points more likely to have completed 8th grade, primarily because they were less likely to repeat grades, and scored 0.2 standard deviations higher on achievement tests. There is also some evidence that voucher winners worked less than losers and were less likely to marry or cohabit as teenagers.

In the US, the issue of school choice and vouchers has become contentious, with teacher unions opposing the perceived privatization of schooling via voucher schemes.

6. Funding for the Education Sector

Apart from the familiar primary, secondary and tertiary levels of education, the education sector also comprises pre-primary schooling, non-formal schooling, vocational education and adult education. However, the relative share of total expenditure going to these latter parts of the education sector is usually quite small in most countries.

This section examines government priority for education expenditures among competing other expenditures. It also examines the intra-sectoral allocation of public education expenditure as between the different levels of education and considers the equity implications of the pattern of allocations. Finally it discusses the distribution of educational expenditure as between salary and non-salary expenditures.

6.1 Domestic funding priorities for education

Appendix 5 shows the share of public education expenditure in the GDP and in the government budget for a selection of countries. Developing countries have been randomly selected from each one of the three 'types' of countries in the UNDP's Human Development Report: 'High HDI countries', 'Medium HDI countries' and 'Low HDI countries', where HDI stands for the Human Development Index. The HDI is an index of development based on three indicators for each country: per capita GDP, life expectancy and education, each given an equal weight of one-third[2].

Table 6.1 shows the means of the two variable of interest in Appendix 5, across high-, medium-, and low-HDI countries, at two points in time, 1990 and 2000 (the figures for 1999 to 2001 have been abbreviated as being for the year 2000). It also shows the change over time in the two variables, for countries on which data were available in both 1990 and in 2000. The associated t-test and the p-value of this test are also shown, to examine whether the change over time was statistically significant.

It is conspicuous that mean public expenditure on education as a proportion of the GDP (EXP_GDP) was the highest for High-HDI countries (4.70%) and lowest for the Low-HDI countries (3.79%) in 1990, showing a lower national priority to education in low HDI countries. In 2000, this hierarchy was maintained and, indeed, sharpened: the gap between high- and low-HDI countries nearly doubled over the decade from 0.91 percentage points (4.705 – 3.79%) to 1.6 percentage points (5.28% - 3.68%). Thus, not only do the more 'developed' countries typically have far higher absolute GDPs and absolute education expenditures than less developed countries, they also have a substantially higher mean *share* of GDP going to education. High-HDI countries' EXP_GDP in 2000 was 44% higher than that of Low-HDI countries'.

Taking all countries together, EXP_GDP was 4.39% in 1990 and 4.64% in 2000, an increase of 0.26 percentage points which was not a statistically significant increase. However, while EXP_GDP rose by 0.59 percentage points in 'high HDI' countries, it actually fell by 0.12 percentage points in the 'low HDI' countries. The increase of EXP_GDP by nearly 0.6 percentage points in high HDI countries implies a very considerable increase in the resources devoted to education in these countries, and this increase was statistically significant at the 1% level (p-value of 0.01). This indicates a worrying divergent trend: the countries that need

[2] As explained in section 4.1, the education component of the HDI comprises a country's adult literacy rate (two-thirds weight) and its combined gross primary, secondary and tertiary enrolment rate (one-third weight).

investment in education the most have suffered a decline in the share of GDP devoted to publicly funded education while countries that are already educationally and developmentally advanced have enjoyed increased shares of GDP devoted to public education.

Table 6.1
Change over time in 'expenditure on education as a percentage of the GDP' and in 'expenditure on education as a percentage of the government budget', 1990 and 2000

HDI-ranking	Public expenditure on education as a percentage of the GDP					
	N	1990	2000	Change	t-value	p-value
High	35	4.70	5.28	0.59	2.64	0.01
Medium	45	4.36	4.49	0.14	0.36	0.72
Low	16	3.79	3.68	-0.12	-0.34	0.74
All	96	4.39	4.64	0.26	1.28	0.20
	Public expenditure on education as a percentage of the government budget					
High	17	13.48	14.90	1.42	1.28	0.22
Medium	27	15.38	16.33	0.96	0.97	0.34
Low	8	14.76	16.63	1.86	1.49	0.18
All	52	14.66	15.91	1.25	1.93	0.06

Source: Own calculations based on data in UNDP Statistics: http://hdr.undp.org/statistics/data/
Note: N represents the number of countries on which data on both years (1990 and 2000) were available.

In view of the 'Education for All' goal as part of the Millennium Development Goals to which all major international institutions have signed up, it is seen as imperative that substantially increased resources are devoted to education, particularly in countries in danger of not reaching the EFA goal. The EFA Fast-track initiative aims to address the issue of resource shortages to meet the EFA goals by 2015. This initiative is discussed in Section 7 below.

Public education expenditure as a proportion of total government budget (EXP_BUD) was 14.7% in 1990 and 15.9% in 2000, an increase of just over 1.2 percentage points which is a statistically significant increase (at the 6% level). By this indicator the low-HDI countries give marginally more priority to education than do the high- and medium-HDI countries.

6.2 Patterns of public allocations to education

The allocation of government education expenditure can be analysed along several dimensions:

- Intra-sectoral pattern of government expenditure—aimed at assessing the appropriateness of spending priorities across different levels of education, e.g. primary versus higher education; general versus vocational education; formal versus non-formal education.

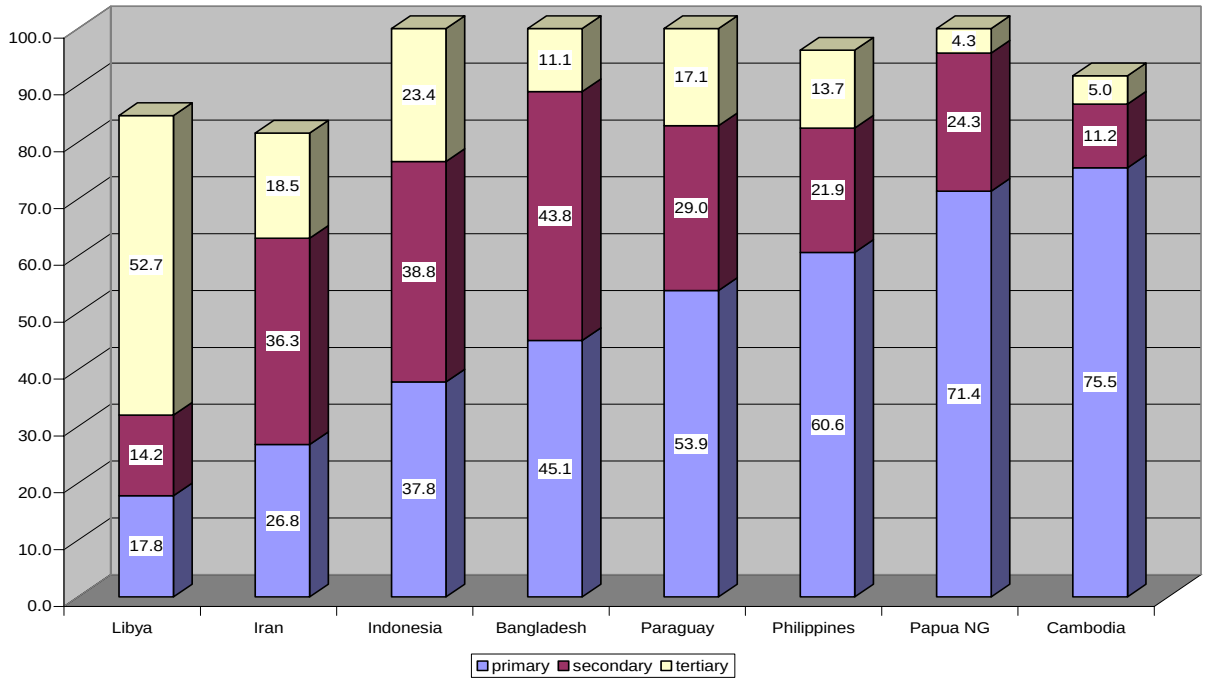
- Inputs composition of government expenditure—designed to evaluate spending priorities across

different types of inputs such as current vs. capital spending; salaries vs. non-salary spending.

- Regional distribution of government expenditure—intended to evaluate inter-regional equity in public education expenditure, e.g. as between rural and urban areas.

Figure 6.1 shows the share of primary, secondary and tertiary education in total public education expenditure for selected countries. It shows that these shares vary greatly between countries. For instance, the share of primary education in total public education spending was less than 18% in Libya and higher than 70% in Papua New Guinea and Cambodia. Correspondingly, the share of higher education was 52.7% in Libya but only 4.3% and 5.0% respectively in Papua and Cambodia. The share of tertiary education in total public education spending in a country partly reflects the proportion of the relevant age group enrolled in tertiary education and partly the extent of public priority for tertiary education *vis a vis* other levels of education.

Figure 6.1
Share of primary, secondary and tertiary education in total public education expenditure, Selected countries, 2000



Source: Own calculations based on data in UNDP Statistics: http://hdr.undp.org/statistics/data/

Table 6.2 shows the percentage allocation of public education expenditure to different levels of education, by the income level of the country. All countries on which data were available were divided into three groups by income tercile, using the 2001 per capita GDP in PPP dollars. The pattern of allocation to different levels of education depends partly on the government's priorities (which may be determined by political expediencies or on attitudes towards the role of private provision at different levels) and partly on the enrolment rates at different levels of education. If countries that allocate more to primary and progressively lesser to secondary and tertiary education levels are regarded as more equitable in their distribution of public education expenditure, then it seems from Table 6.2 that high income countries are more equitable than middle and low income countries.

Table 6.2
Percentage of public education expenditure to different levels of education, by income level, 2000

Income level of country	Primary %	Secondary %	Tertiary %
High income	49.7	26.3	17.5
Medium income	44.6	34.1	18.1
Low income	35.4	39.4	21.3
All	41.5	34.8	19.5

Source: Own calculations based on data in UNDP Statistics: http://hdr.undp.org/statistics/data/

6.3 Distributional implications of public education expenditure

The intra-sectoral pattern of education subsidies has distributional implications because it implies transfers between income groups. The distributional implications can be analysed using a benefit-incidence analysis.

Firstly, the unit costs are estimated and taken as unit education subsidies. Household expenditure on education is not deducted from these unit subsidies if no tuition fees are charged for public education at all levels. Secondly, unit subsidy data are combined with information on the current enrolment status of all household members, this information being obtained from a national household survey. Thirdly, households and individuals are ranked on the basis of a welfare indicator, such as per capita household expenditure, and are divided into equal groups (such as quartiles or quintiles) so that education subsidies in each group can be estimated and compared. The results for benefit incidence analysis for several African countries are presented in Table 6.3.

The evidence is that the subsidy for education is poorly targeted (Table 6.3). In absolute terms, the poorest quintile gains somewhat less than 20 percent of the subsidy, especially at the post-primary level. The richest quintile gains far more. The poorest quintile gains far more from spending at the primary level - typically about one-fifth of the subsidy - compared with only about one-tenth of the subsidy at the secondary level and almost nothing from the subsidy at the tertiary level (Castro-Leal, 1999). Thus the more governments spend on primary education, the more the poor will benefit.

Table 6.3
Benefit Incidence of Public Spending on Education in Selected African Countries (percent)

	Quintile shares of total spending					
	Primary		Secondary		Tertiary	
	Poorest	Richest	Poorest	Richest	Poorest	Richest
Cote d'Ivoire, 1995	19	14	7	37	12	71
Ghana, 11992	22	14	15	19	6	45
Guinea, 1994	11	21	4	39	1	65
Kenya, 1992	22	15	7	30	2	44
Malawi, 1994	20	16	9	40	1	59
Madagascar, 1993	17	14	2	41	0	89
South Africa, 1994	19	28	11	39	6	47
Tanzania, 1993-94	20	19	8	34	0	100
Uganda, 1992	19	18	4	49	6	47

Source: Table 8 from Castro-Leal et. al. (1999)

Table 6.4
Benefit incidence and educational needs

Country/quintile	Primary		Secondary	
	Share of subsidy	Share of school-going population	Share of subsidy	Share of school-going population
Cote d'Ivoire, 1995				
Poorest	19.1	23.8	6.8	20.9
Richest	13.9	13.5	37.2	20.9
Ghana, 1992				
Poorest	21.8	24.3	14.9	20.4
Richest	14.1	13.7	18.6	16.8

Source: Table 9 from Castro-Leal et. al. (1999)

The relatively high share of the primary school subsidy imputed to the poorest quintile shown in Table 6.3 (approximately 20%) is misleading because the educational needs of this group are much greater than those of other groups because they have a much greater proportion of children of school-going age. Table 6.4 shows that in both Cote d'Ivoire and Ghana, the share of primary school-age children in the poorest quintile is much greater than the share of subsidies that quintile receives. When per-adult-equivalent household expenditure was used instead of per capita household expenditure, to account for the poorer households being larger and having more children than richer households, benefit incidence became less unequal but still favoured the rich more than the poor, especially in tertiary education.

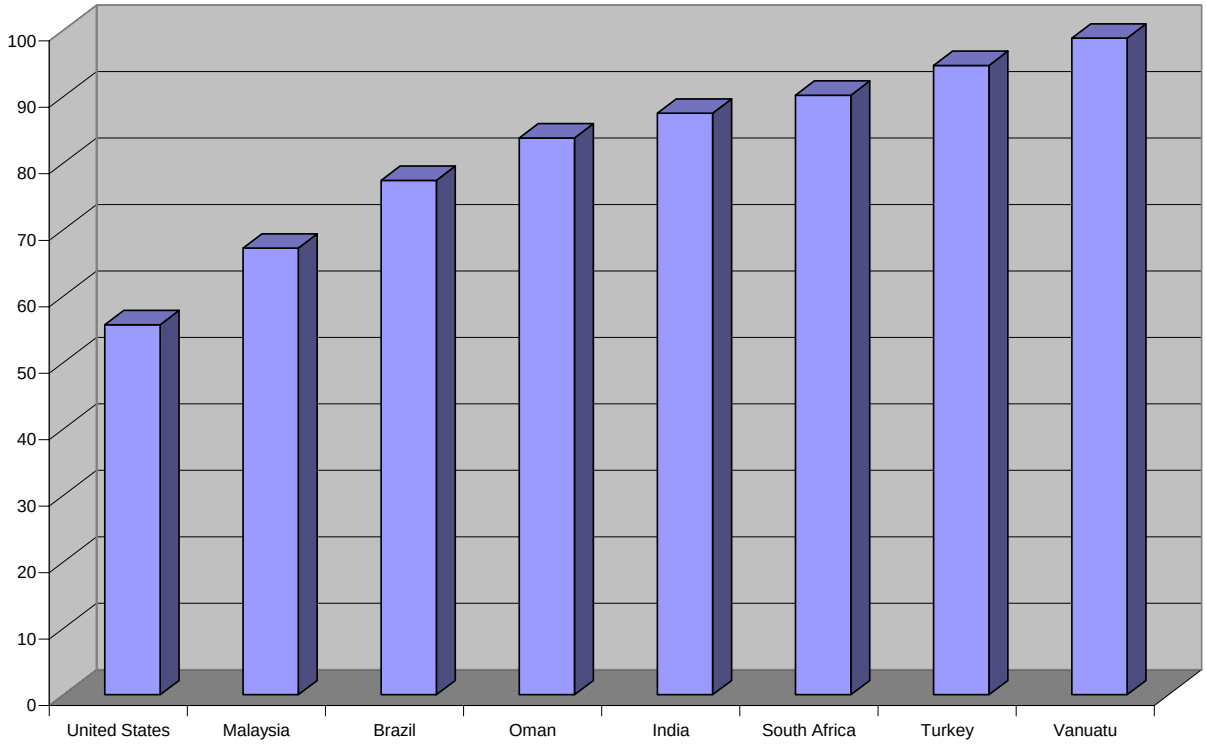
6.4 Dominance of salary costs in public expenditure

While teacher salary as a percentage of total recurrent public education expenditure varies greatly by country, as illustrated for selected countries in Figure 5.3, the average share of salaries in total expenditure at the primary level in 2001 is high, particularly in developing countries. Table 5.4 shows that while in Europe and North America, the share of primary schooling salaries in total public primary expenditure was 76 - 82 per cent, in South and West Asia, Sub-Saharan Africa and Arab states, it was around 95%. Only about 5% of total recurrent primary school spending went to non-salary costs!

Information on how the share of salaries in total education expenditures has changed over time is not available for a large number of countries. However, figures for India show a secular rise in the share of salaries in total education spending between 1960 and 1990 (Kingdon and Muzammil, 2003, Table 13.13). They find that over this period, the share of non-salary expenditure in total education expenditure declined from 12% to a mere 3% in primary education, from 15% to 6% in junior education and from 28% to only 9% in secondary education.

Various factors account for the dominance of salary expenditures in total education expenditures. Firstly, the technology of teaching makes the teacher the dominant input into schooling. Secondly, total teacher salary costs are determined by the average teacher pupil ratio. If this ratio rises (in the bid to lower class sizes and improve educational quality), then total salary costs rise. Thirdly, as average teacher age or qualifications rise, salary costs increase if public pay scales provide age-related and qualifications-related increments. Finally the high and rising share of salaries in total education spending may be explained by teacher lobbying for increased salaries and the lack of a lobby to demand corresponding increases in non-salary education expenditures.

Figure 6.2 Share of primary teacher salaries in total public primary education expenditure, 2001



Source: Selected data from Table 14, Statistical Annex, EFA Global Monitoring Report 2005 (UNESCO, 2005).
Note: Salaries of primary school staff other than teachers are not included.

Table 6.5
Primary education salary expenditure as a percentage of public primary education recurrent expenditure, by region, 2001

	Primary teachers' salaries as % of public current expenditure on primary education	Salaries of all personnel of primary education as % of public current expenditure on primary education
Arab states	89.7	95.2
Latin America & Caribbean	80.6	83.7
South and West Asia	87.5	95.8
Sub-Saharan Africa	88.3	93.8
East Asia and the Pacific	76.4	84.4
Central and Eastern Europe	62.7	76.1
North America and Western Europe	66.8	82.0

Source: Own calculations based on data from Table 14, Statistical Annex, EFA Global Monitoring Report 2005 (UNESCO, 2005).

6.5 Institutional and political economy of the education sector

As stated in the introductory section, education economists have recently focused on analysing the institutional conditions most conducive to the efficient production of education. This might loosely be termed the institutional economics of education.

The institutional economics of education is generally consistent with both a public-choice/rent-seeking framework and with a principal-agent perspective. Under the former, the government is seen as responding to the demands of lobbyists in order to maximise the probability of staying in power. Rent-seekers are people who seek to make profits that are unrelated to their productivity (for example, teacher unions demanding high or increased minimum-wages). Under a principal-agent perspective, the government or local authority may be thought of as the 'principal' and the teachers or schools as the 'agents'. The principal faces the 'moral hazard' that it cannot perfectly observe or monitor the effort level of its many agents and yet the achievement of its objectives depends upon the effort level of its agents. Its task is, therefore, to devise incentive structures in such a way as to elicit the maximum effort from the agents (who prefer to minimise effort due to the disutility of work). Such a framework is relevant in school education because centralised educational management implies that the government or local education authorities are responsible for hundreds or thousands of schools and teachers, giving rise to large-scale problems of moral hazard and asymmetric information between the principal and agent.

One solution to the moral hazard problem often advocated in publicly funded education is to decentralise the management of education to more local levels. It is thought that increased local level accountability reduces teacher absenteeism levels. Another method of improving accountability to parents is to design incentives such that a school's financial revenues depend on attracting parents/students. School voucher schemes are one such incentive being tried in a number of Latin American countries (see Section 5.4).

The political economy of education is not a topic that has attracted much recent research. Writing on the role of politics and of political systems in the education sector, educational sociologist Harold Gould (1972) observed that in all democratic societies, "continuous debate and competition occurs over who shall control education and for what purpose. The question, in other words, is not whether politics or politicians shall influence educational processes, but how and to what degree they will do so". Rudolph and Rudolph (1972) state: "we do not assume, as is often assumed, that there is such a thing as an educational system free of political intervention. In a democratic society and in educational institutions which receive government funds, there *will* be political influence… The real questions focus on distinguishing what type of political pressure and politicisation is benign and what not, ….., whether educational purposes are subsumed by the political system, or whether politics becomes a means for strengthening or redefining educational goals".

Apart from the rather dated Rudolph and Rudolph (1972), there is a general paucity of political economy analyses of the education sector. One exception is a study by Kingdon and Muzammil (2003) on India which analyses :

- Factors behind the passage of important pieces of educational legislation in India
- Teacher union activities, issues on which unions have lobbied, and their success
- Reasons why teacher unions campaigned for centralised management of schools
- Implications of the abandonment of local level accountability for the functioning of schools
- Extent of representation of teachers in the lower and upper houses of the state legislatures and in the council of ministers, and the reasons for this representation
- Implications of teachers' advantageous political position for teacher emoluments, the allocation of school budgets, and teachers' collective behaviour**.**

7. Interventions to improve access and quality in pro-poor ways

It is well documented that educational outcomes – enrolment, completion and achievement levels – in many countries are sharply skewed by economic status, gender, ethnicity and region. The fulfilment of the education related Millennium Development Goals, however, requires completion of primary education *by all.* The meaning of this is considerable: it implies that all inequalities in enrolment, attendance and completion of primary education be eliminated. The MDGs also specifically mention the achievement of gender equality in primary and secondary schooling. Although the MDGs do not explicitly stipulate targets for the quality of education, it is clear that to be meaningful, education has to be of a quality that leads to learning.

Box 7.1
Education related Millennium Development Goals

- To achieve universal primary education
  (Ensure that all boys and girls complete a full course of primary schooling)
- To promote gender equality and empower women
  (Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015)

Interventions to improve educational access and quality in ways that are pro-poor can be categorised into three broad types:

- Providing greater resources for education
- Making more efficient use of scarce educational funds
- Ensuring a more equitable spread of educational resources

7.1 Increased resources for education

We saw earlier in Section 4 that while collated meta studies of educational production functions found no strong or consistent effect from school expenditures to student achievement (Hanushek, 1995; 2003), carefully conducted individual studies using robust methods such as randomised experiments and instrumental variable approaches do find important effects. There is evidence that schooling participation and achievement of children in rural communities responds substantially and positively to resource-intensive interventions such as cooked school meals in India and Kenya (Drèze and Kingdon, 2001; Vermeersch and Kremer, 2004). Thus, while recognising that higher resources will not in all circumstances lead to better educational outcomes, there is a case for accepting that more resources can lead to better educational access and quality.

The paucity of resources for education manifests itself in the well-documented lack of even basic resources for schooling in many developing countries. Inputs such as textbooks, functioning blackboards, desks and chairs for students, and facilities such as rain-proof classrooms, toilets, drinking water etc. are unavailable or in short supply in a high proportion of publicly funded primary schools in developing countries. The Probe report in India partly blames resource-starved and dysfunctional schools for the lack of universal enrolment and school attendance in primary schools in India (Probe Team, 1999; Drèze and Kingdon, 2001).

Greater resources for education can come from within a country if there is a political will to give greater financial priority to education in the domestic budget, or they can come from outside. International agencies recognise the resource crunch and understand its effects on the ability of poor countries to achieve the educational MDGs (see Box 7.2).

At the request of the world's finance and development ministers, the World Bank developed the Education for All Fast Track Initiative (EFA-FTI) in 2002 for helping poor countries speed up efforts to get their children into school. FTI funds are available for countries that have developed approved poverty reduction strategy papers (PRSPs) outlining a credible strategy for achieving educational goals. The FTI is supported by a number of bilateral donors but financial and political support to it needs to be stepped up substantially.

Box 7.2
World Bank president appeals to rich countries to help educate 100 million out-of-school children worldwide

"Today we see that the rich world is not even close to meeting its commitment to children in developing countries. In a world tragically short of magic solutions, primary education remains one of the most dramatic development solutions available. And progress on education – as with many other development challenges – is possible when political will and resources come together…. The Fast Track Initiative has already been recognized for promoting better donor coordination and getting more kids into school, so why is this tried and true program still being starved of the large-scale money and support it needs to reach its achievable goal of helping every child go to school by 2015?

James Wolfensohn (World Bank News, 17th April, 2005)

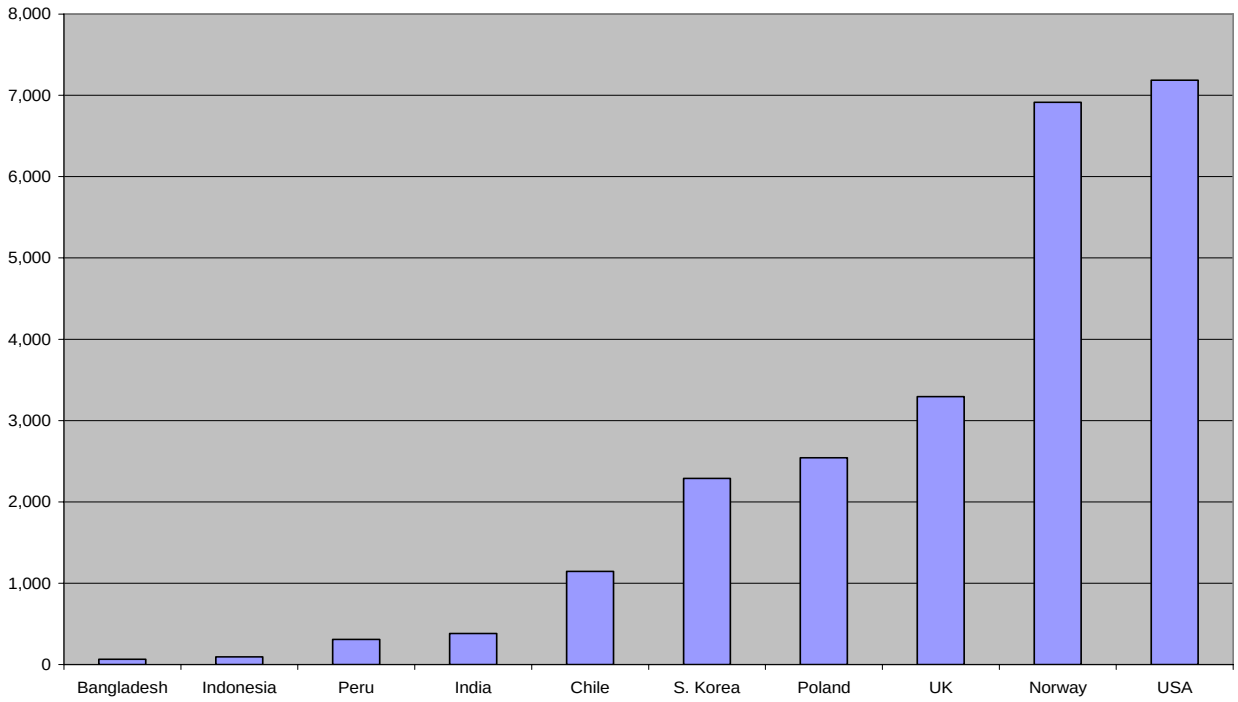
The lack of resources for education in poor countries compared with those in rich countries is highlighted starkly in Table 7.1 which shows per pupil expenditures on primary education in 2001 both in current dollars and in Purchasing Power Parity (PPP) US dollars. It shows a very high degree of international inequality in terms of per pupil expenditures on primary education. The ratio of the highest to the lowest in PPP terms is an extreme 260:1. For selected countries, this great inequality is shown in Figure 7.1. This inequality is worrying both from an equity perspective and also from an efficiency one, given that across countries, there is a positive correlation between per capita GNP and student achievement in mathematics scores in the TIMSS studies (Figure 7.2).

Table 7.1
Public current expenditure on primary education per pupil (unit cost), Selected countries, 2001

	Current US dollars	PPP US dollars
Madagascar	13	39
Bangladesh	15	66
Indonesia	23	95
Côte d'Ivoire	90	212
Bolivia	112	276
Peru	129	308
India	62	382
Malaysia	424	1,002
Mexico	834	1,131
Chile	539	1,145
South Korea	1,410	2,289
Poland	1,205	2,544
United Kingdom	3,304	3,296
France	3,624	3,929
Germany	3,480	3,934
Netherlands	3,808	4,369
Belgium	4,027	4,603
Switzerland	7,304	6,006
Austria	5,363	6,183
Norway	8,901	6,916
United States	7,386	7,186
Luxembourg	7,921	10,133

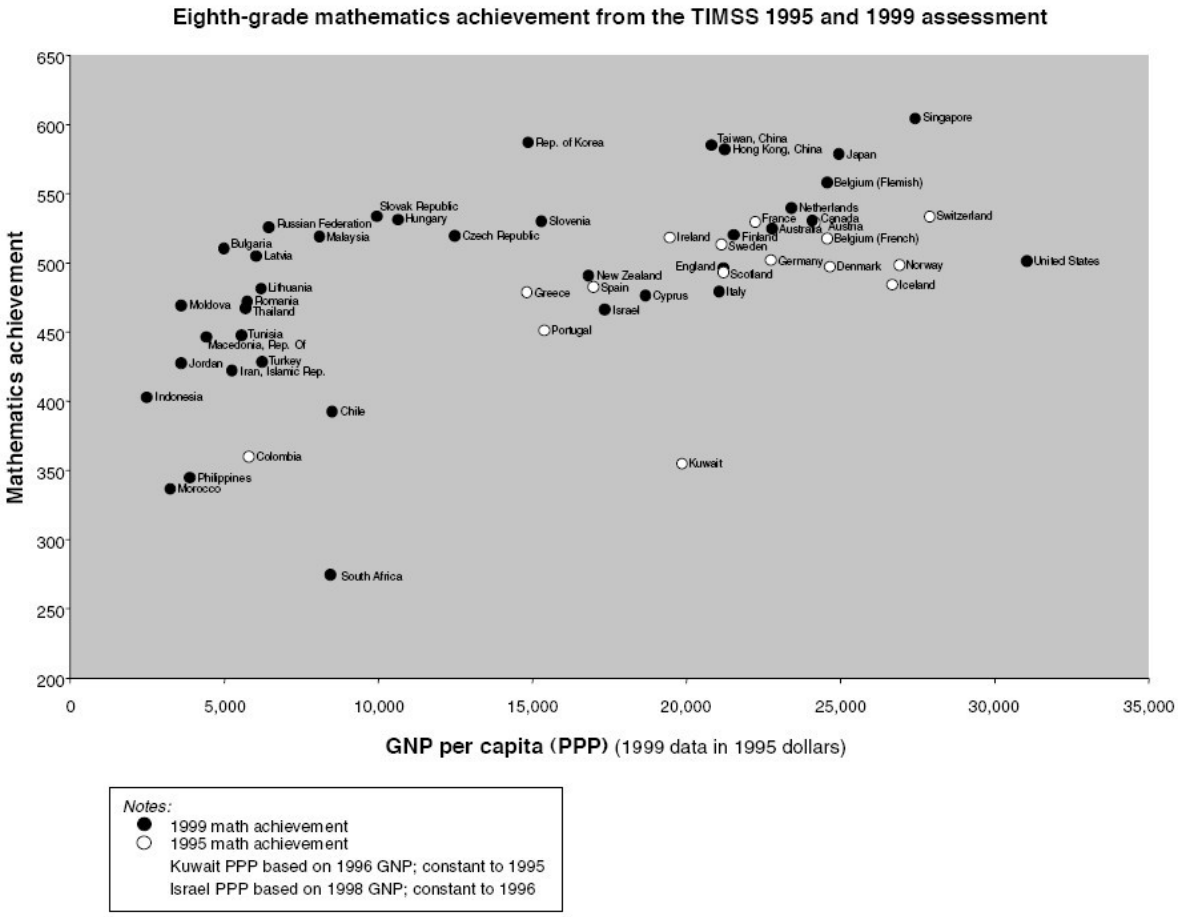
Source: Table 14, Statistical Annex, EFA Global Monitoring Report 2005, UNESCO (2005).

Figure 7.1 Per pupil expenditure in primary education, 2001: PPP dollars



Source: Selected data from Table 14, Statistical Annex, EFA Global Monitoring Report 2005, UNESCO (2005).

Figure 7.2 Student achievement in mathematics and per capita GNP



Source: Aoki et. al. (2002) who take this figure from IEA (2000).

7.2 Interventions to improve quality

The cost-effectiveness of public educational investments can be enhanced if scarce funds in the sector are directed towards those interventions that have the greatest impact on schooling quality. However, while there is a good degree of consensus about the access and quality *outcomes* that need to be improved (Section 4.1), there is less agreement on which particular *inputs* have the most impact on outcomes, and on the appropriate mix of inputs for any given country. Nevertheless, research does provide some directions. For instance, there is general agreement that quality goals in education (which are effectively complementary with access goals) can be achieved more easily by designing better incentives for teachers and schools. There is also general agreement about the importance of time spent studying, text-books, school resources, cooked school meals and parental involvement, especially in developing countries where these factors vary more than in rich countries.

Box 7.3, reproduced from the EFA Global Monitoring Report (UNESCO, 2005), summarizes the major findings from more than forty years of research conducted by the IEA studies. Three of the findings have particular importance for policies aimed at improving education quality.

- First, the distribution of abilities in the population has a significant impact on average achievement levels. The greater the overall proportion of children enrolled, the lower the average achievement levels tend to be. However, the cognitive achievement levels of the most able decile are unchanged by expansion.
- Secondly, time spent actually working on particular subjects, whether in school or as homework, affects performance, especially in mathematics, science and languages.
- Thirdly, while socio-economic status is influential in determining achievement in all contexts, textbook availability and school resources appear to be capable of countering the adverse effect of socio-economic disadvantage on student achievement, particularly in low-income settings.

Box 7.3 Major conclusions from more than forty years of international achievement surveys

Results of the IEA studies, now covering fifty countries and carried out over more than forty years, suggest the following conclusions:

- Marked differences exist between average levels of pupil achievement in the industrialized countries and those in less developed countries (LDCs) even though not all pupils in the various school-age groups were enrolled in the LDCs.
- The average level of achievement within a country at the terminal secondary school stage is inversely related to the proportion of the age group enrolled (or the age group studying the subject surveyed).*
- At the terminal level, when equal proportions of the age group are compared, only small differences in levels of achievement are found, irrespective of the proportion of the age group enrolled at that level. Thus, the best students do not suffer as retention rates increase.
- Student achievement in mathematics, science and French as a foreign language is positively related to the time spent studying the subject at school, both across and within countries.
- Student achievement in mathematics, science and French as a foreign language is also positively associated with the time spent on homework, after other factors influencing achievement are taken into account.
- The average level of student achievement across countries is positively related to the time spent in class studying the content of the items tested.
- The impact of increased textbook use on student learning in LDCs is strong. The same effects are not detected in richer countries, probably because of the wider availability of textbooks in those countries.
- Measures of the socioeconomic status of pupils' families are positively related to student achievement in all countries, at all age levels and for all subjects.
- Although the effects of home background variables on student achievement are similar for all subject areas, the effects of learning conditions in the schools differ by subject and are sometimes equivalent to or greater than the influence of home background on student achievement.

*Among the participating countries, the correlation between the proportion of an age group enrolled in a particular grade and the average measured achievement in mathematics and science, and that between the proportion of an age group specializing in one of the sciences and achievement in it, range from -0.69 and -0.88.

Sources: Keeves (1995: 2–23); Mullis et al. (2003: 36–38); Postlethwaite (2004). Cited in EFA Global Monitoring Report, UNESCO (2005)

The mix of educational inputs appropriate for different countries will be different, depending on circumstances. In general, school-related factors explain more of the variation in achievement in developing countries than in developed ones, and the factors with the greatest importance for student achievement appear to be somewhat different. For instance, school resources typically vary less in developed than in developing countries. The impact of class size on pupil learning will be different when average class size is 20-35 students than when it is 50 to 100 students, as frequently occurs in many developing countries.

A review of research on the factors promoting science achievement in developing countries found that in over four-fifths of the studies the length of instructional programmes, use of a school

library and school meals were important factors, and that over two-thirds identified teacher training and the presence of textbooks and instructional materials as important. By contrast, only one-quarter to one-third of the studies found the presence of science laboratories, increases in teacher salaries and reductions in class size to be important (UNESCO, 2005, chapter 2).

Interventions to design better incentives for teachers

Teachers are the most expensive resource in the education sector and, as seen in Section 6.4, teacher salaries constitute a very high proportion of total public education spending. Yet, teachers are frequently absentee in many countries (Chaudhury et. al. 2004) and neglectful of their teaching duties (Probe Report, 1999). Under centralised systems of school management, teachers are not locally accountable to parents or to school managers since their salaries are paid by a distant office and local managers do not have the authority to discipline lax teachers. Monitoring regimes are weak and, in any case, being permanent employees, non-performing teachers can virtually never be sacked in most public school systems.

Thus, how to design incentives for publicly paid teachers is a question that has attracted considerable recent attention. Raising teacher salaries across the board is unlikely to be a cost-effective investment given the lack of a relationship between teacher salaries and student achievement. The payment of high wages (so called 'efficiency wages') is advocated in labour economics as a way of motivating worker effort. The idea is that high wages (i.e. higher than what a worker could reasonably expect in the labour market, given his personal endowments) elicit greater effort from a worker because he will be naturally motivated to work hard in order to keep his well-paid job. However, in order for high wages to act as an effort-motivator, there must be a credible chance of dismissal if worker effort is found to be low. If publicly paid teachers are virtually unsackable even if they are at fault, paying higher wages will not elicit greater effort.

One intervention increasingly explored is the use of contract teachers. As these teachers are typically on annually renewable contracts rather than having life-time employment guarantees, they are thought to have better incentives to apply effort and not be frequently absent. Another motivation for the appointment of contract teachers is to rapidly expand access at low cost (see Section 7.3).

Interventions to design better incentives for schools

Designing better incentives in the financial grants to publicly funded schools is another potential way of raising the efficiency of education systems *within* existing resources. Government grant to schools provides a way through which the state can improve the efficiency of use of public resources. The idea is that by linking grants to various performance indicators, the government (the principal) can encourage the private schools (the agent) to raise quality in cost-effective ways. Grants to public and private schools account for the overwhelming proportion of the education budget in many countries but, at present, they are largely devoid of performance conditions or incentives in many of the countries.

There is little research on what type of performance-incentives in the grant formula work best, apart from a somewhat dated study by James and Benjamin, 1988, which examines alternative grant structures in Japan and the UK. For example, a structure may be desirable which relates grant levels to various school performance indicators such as percentage of total expenses spent on non-salary costs (to encourage quality improvements), percentage of total funds raised from non-fee sources such as parental donations (to encourage equitable resource-generation), percentage of parents who are satisfied with the school (to encourage accountability), and average number of

students per class (to encourage cost-consciousness), *etc*. A more rational grant structure could be a policy intervention that has potentially the biggest pay-offs in terms of improved quality and cost-efficiency in education in many developing countries.

A form of public private partnership that aims to improve the quality and accountability of schools is via the use of school vouchers. Under voucher schemes, a government channels funds to both private and public schools by means of a school voucher given to families, rather than give funding directly to schools or to school districts. The objective is to seek to introduce competition between public and private schools. Voucher schemes are quite a radical intervention in the schooling system and, although there is evidence that they improve school accountability and quality, there is some concern that they may not be a very equitable way of raising school performance (see Section 5.4).

7.3 Interventions to improve access

Interventions to improve quality tend to improve access too, by raising the expected return to education and thus creating demand for education (Section 4.3). In order to achieve the educational MDGs, access to schools and retention in schools needs to be improved greatly in many developing countries. In countries with large (and growing) out-of-school populations of primary school age, achieving the MDGs requires the provision of new schools and new teachers in unserved areas. It also requires the provision of extra teachers to reduce the incidence of multi-grade teaching and to relieve very high pupil teacher ratios in existing schools. For instance, the PROBE survey in India (Probe Team, 1999) found that if all children aged 6-10 in the sample villages were enrolled in a government primary school, there would be about 113 pupils per classroom on average, and 68 pupils for each teacher. It also found that one-quarter of the primary schools (with grades 1 to 5) were single teacher schools.

Contract teachers

In response to the great need for new teachers in primary schools, a number of countries have turned to the use of 'contract' or 'para' teachers (Cambodia, Ghana, Guinea, India, Nicaragua and Senegal). The rationale for these schemes is to achieve three major equity and efficiency aims at a low cost:

- rapidly expanding access to education in unserved communities,
- eliminating single-teacher schools and
- reducing high pupil teacher ratios.

Although the schemes vary across countries, generally contract teachers:

- are less well trained and educated than regular teachers,
- are paid a fraction of the regular teachers' salary levels,
- have annually renewable contracts rather than lifetime employment guarantees, and
- are usually under the authority of the village local government, rather than being employed directly by the state government. This is thought to raise locally accountability of teachers.

On the one hand, the use of contract teachers provides a low-cost way for the state to increase the number of teachers in the face of rising student populations, budgetary troubles and rapid real increases in salaries of regular teachers, who are unionised and frequently absent from school. On the other, it raises educational quality and educational equity concerns. The quality concern is the fear that these less trained teachers may be less effective in imparting learning. The equity concern arises because many contract-teachers are appointed in schools that serve poorer children (e.g. small-habitation or remote tribal children), raising the fear that poorer children are being

condemned to lower quality teachers, exacerbating social inequality. However, little is known about the relative effectiveness of para and regular teachers in class. This is a topic of investigation that deserves research.

Alternative track schooling

Children who never enrol in school or who drop out before primary school completion are more likely to be those living in remote communities or in small habitations which are not served by a school, child labourers and those who are part of seasonally migrating families. To address access to schooling for such children, many governments use alternative track schooling as a substitute for formal schooling. Alternative schooling can take the form of non-formal education (NFE) whereby the NFE is arranged at times convenient for working children, such as evenings, or it can take the form of small schools established with fewer resources than mainstream schools in small habitations. For instance, the Education Guarantee Scheme (EGS) in India ensures that all communities with at least 20 children of primary school age are entitled to an EGS school or 'learning centre' equipped with a 'para' teacher. Alternative schooling also takes the form of 'bridge courses' which are intensive, sometimes residential, courses for a few weeks or months which aim to bring back to mainstream schools children who dropped out of school for some reason. These courses aim to upgrade lost skills.

Box 7.4
Non-formal primary education in Bangladesh

In 1972, BRAC, an educational NGO in Bangladesh, established a non-formal primary education programme that targeted poor, rural children, particularly girls, who were unable to attend government schools. Today, BRAC is operating 34,000 non-formal primary schools in which 1.1 million children are enrolled.

This initiative focuses on basic education for children, particularly girls (60% of the students are girls) who have not attended or who have dropped out of government schools. BRAC's non-formal primary education schools prepare children to enter government (formal) schools starting in grade six. The percentage of students progressing to formal schools was 94.5% in 2002. This schooling complements and enhances the government systems and assists other non-governmental organizations in providing education in rural areas. The program's model has been successful in terms of high attendance (90%), low dropout rate (4%) and low teacher-student ratio (l:33 versus l:73 in government schools). The BRAC school calendar is organized around the involvement and needs of both children and parents — e.g. schools are located in villages so girls can attend more easily and classes take account of the harvest seasons when children must help at home. 97% of teachers are women from the villages.

BRAC (www.brac.net)

While NFE interventions are very successful in some contexts (such as in Bangladesh, box 7.4), they have been very unsuccessful in other countries, e.g. India. One difference seems to be that while in India the NFE scheme is run by the government, in Bangladesh, an educational NGO runs this programme. More generally, alternative track schooling is criticised on the grounds of equity. While the availability of non-formal schools and learning centres expands access to schooling, these schools are usually much less well resourced than regular schools and are often staffed with contract teachers who are less well qualified and trained than regular teachers. This leads to the argument mentioned above, namely that disadvantaged children are being provided poorer quality schools.

Abolition of user fees

Even apparently tuition free schooling involves a substantial amount of private financing, as shown in Section 5.2, due to expenditure on non-tuition fees, books, slates, clothes etc., in addition to, in some instances, various illegal school levies. Adding tuition fee can often impose a major financial burden on poor parents which may deter them from sending children to school and interfere with the achievement of the education MDGs.

The case for user fees is usually that a system of free education will in many cases lead to excess demand for school places, necessitating some form of rationing but that it is usually the rich that benefit from rationing and the poor get excluded. This argument has been used to challenge the idea that free education is more equitable than tuition fees. The case for tuition fees also exists as a way of boosting scarce resources for education. However, in light of the MDGs, at the primary level of education, governments are committed to providing school places for all children. Thus, the question of excess demand and rationing of school places does not arise. Aid agencies such as the World Bank and DFID etc. are now clearly opposed to user fees for primary education.

Other interventions to improve access

There is accumulating evidence that provision of cooked school meals raises schooling participation (Drèze and Kingdon, 2001) and that it improves achievement scores (Vermeersch and Kremer, 2004). School meal programmes attract hungry children to school and nutrition improves their concentration, leading to better learning outcomes. School feeding programmes also improve child health as well as social equity because they represent a transfer towards poorer children.

Another way of reducing the financial burden of schooling on poor people is via targeted subsidies to compensate for user fees, as is the case in Bangladesh Female Secondary School Assistance Program. In some cases, these subsidies go beyond eliminating user charges for poor people and actually provide a positive incentive for parents to send their children to school, for example, Brazil's Bolsa Escola and Mexico's PROGRESA and OPORTUNIDADES programmes (Kattan and Burnett, 2004). Evaluations of the PROGRESA have shown considerable benefits of cash subsidies (contingent on school attendance), in terms of increased school enrolment and attendance (Schultz, 2004).

Finally the provision of other incentives can help to improve access to schooling in pro-poor ways, such as the targeted provision of free school uniforms and free books and stationery to poor children.

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Appendix 1
Measuring the extent of intergenerational mobility

Methodological issues arise in measuring intergenerational mobility, e.g. the measurement of permanent and transitory income, and because parents have children at different ages from their teens into their fifties, creating important life-cycle effects. There are two frameworks for measuring the extent of intergenerational mobility commonly used: the log-linear regression model and the quantile transition matrix approach. The regression approach posits a relationship between the log of a son's or daughter's economic status in family i and the log of the same measure of economic status for his/her parents, of the form:

$$y_i^{child} = \alpha + \beta y_i^{parent} + \varepsilon_i$$

If β=0, there is complete mobility and regression to the mean economic status, where the child distribution of earning/income is completely independent of that of parents. If β=1 then there is complete immobility, i.e. the distribution of the income/earnings of parents is completely preserved in the children's generation. Usually β is intermediate between 0 and 1. Early estimates surveyed in Becker and Tomes (1986) suggest β=0.2 suggesting rapid regression to the mean, but more recent estimates suggest it is between 0.4 and 0.6 (see the literature summarized in Blanden, 2005 and Dearden et. al., 1997) i.e. mobility is a lot lower than previously thought.

The other method is the Quantile transition matrix approach which involves dividing the child and parent income distributions into n equal-sized quantiles (e.g. 4 quartiles or 5 quintiles). The two extreme positions discusses earlier can be represented in this framework using, for example, quartile groupings. In the case of complete mobility, the parental distribution of income will be irrelevant in determining the child distribution and all elements of the matrix will equal 0.25. In the case of complete immobility, everyone stays on the leading diagonal of the matrix, i.e. the diagonals will all contain a 1 and the off-diagonals will all contain a 0. An advantage of the quantile transition matrix approach is that it gives us more information than the regression approach does about the nature and direction of mobility.

Example of a quantile transition matrix

Father's wealth quintile	**Son's wealth quintile**				
	1	2	3	4	5
1	0.42	0.29	0.18	0.09	0.01
2	0.28	0.26	0.24	0.15	0.07
3	0.18	0.23	0.23	0.25	0.11
4	0.10	0.15	0.21	0.35	0.19
5	0.04	0.08	0.15	0.39	0.35

Source: Asadullah (2005).

Appendix 2
Cost benefit method of estimating returns to education

Algebraic representation

Suppose a person already has t years of schooling and is considering whether to invest in a further 's' years of schooling. Suppose also that '*w*' is the wage rate and K_t is the human capital stock corresponding to t years of schooling. Thus, the stream of extra income from s years of schooling is:

$$w\Delta K_s = w(K_{t+s} - K_t) \qquad (1)$$

where $w\Delta K_s$ is a monetary amount per year. This implies that in each and every year after s years of education, one's earnings are enhanced by $w\Delta K_s$ per year. Denote the cost of s years of schooling as C_s. To compute the internal rate of return (r_s) on the s years of schooling investment, set C_s equal to the present value of the gains discounted at rate r_s as follows:

$$C_s = w\Delta K_s / r_s$$

$$r_s = w\Delta K_s / C_s \qquad (2)$$

A further year of schooling would normally have a lower rate of return for a given individual since marginal costs rise as one invests in more education (opportunity cost is greater) and an extra year in school also slightly reduces one's earning period and thus the present value of the income gain from that year's education. If there are diminishing returns to human capital production, that would also lead to a lower rate of return to an extra year of schooling. So, the rate of return to *s+1* years of education is:

$$r_{s+1} = w\Delta K_{s+1} / C_{s+1} \qquad (3)$$

where K_{s+1} is the return and C_{t+1} the cost of *s+1* years of education. We expect that while the individual remains at school,

$$r_s > r_{s+1} > i \qquad (4)$$

where *i* is some market interest rate. Eventually by the *n*th year of schooling, we will reach equality

$$r_n = i \qquad (5)$$

The individual will then stop this form of investment and so end the period of full-time education.

Numerical example

Assume that the starting wage for a degree holder is £22,000 and for a secondary completer is £15,000 and that the £7,000 differential is perpetuated over the lifetime.

This implies that the present value of gains from college equals £7,000/*i*. If the costs of a 3 year degree course are £5,000 per year in direct costs then, together with the £15,000 per year of opportunity cost, the total cost of a 3 degree is £60,000 (ignoring the discounting of costs).

According to equation (2), the rate of return can be computed as 7,000/60,000 or about 11.7 %.

If this figure is above the long-run real interest rate in the economy (which is typically the case), then the individual would decide to enrol for a degree.

Appendix 3
Some papers using Instrumental Variable methods to estimate returns to schooling

Authors/ country	Source/ IV for schooling	Details
Esther Duflo (Indonesia)	American Economic Review, 2001 Instrument: Number of primary schools constructed in locality*age in 1974	Between 1973 and 1978, the Indonesian Government constructed over 61,000 primary schools throughout the country. Duflo evaluates the effect of this programme on education and wages by combining differences across districts in the number of schools constructed with differences across age cohorts induced by the timing of the program. The estimates suggest that the construction of primary schools led to an increase in education and earnings. Children aged 2 to 6 in 1974 received 0.12 to 0.19 more years of education for each school constructed per 1,000 children in their district of birth. Using the variations in schooling generated by this policy as IVs for the impact of education on wages generates estimates of economic returns to education ranging from 6.8% to 10.6%.
John Maluccio (Philippines)	IFPRI , FCND Discussion Paper #54 Instrument: Availability of schooling and hh resources when child	The author uses IV techniques and a large set of instruments – including indicators of availability of schooling and household resources/parental education measured at the time the schooling decisions were made. The author argues that these IVs are plausibly exogenous to the wage equation but important determinants of years of schooling and thus valid instruments for analysing returns. The results show estimated returns ranging from 6% using OLS to between 10-13% using IV.
Joshua Angrist and Alan Krueger (US)	NBER WP#4067, 1992 Instrument: Vietnam draft lottery number (natural exper.)	Between 1970 and 1973 priority for military service was randomly assigned to draft-age men in a series of lotteries. Many men who were at risk of being drafted managed to avoid military service by enrolling in school and obtaining an educational deferment. This paper uses the draft lottery as a natural experiment to estimate the return to education. The draft lottery number was correlated with S but not with ability. Estimates are based on special extracts of the Current Population Survey for 1979 and 1981-85. The results suggest that an extra year of schooling acquired in response to the lottery is associated with 6.6 percent higher weekly earnings. Criticism: the correlation between IV (draft lottery number) and years of schooling was not high enough.
Joshua Angrist and Alan Krueger (US)	Quarterly Journal of Economics, 1991 Instrument: quarter of birth (natural exper.)	The authors establish that season of birth is related to educational attainment because of school start age policy and compulsory school attendance laws. Individuals born in the beginning of the year start school at an older age, and can therefore drop out after completing less schooling than individuals born near the end of the year. Roughly 25 percent of potential dropouts remain in school because of compulsory schooling laws. Quarter of birth is correlated with S but not with ability. They estimate the impact of compulsory schooling on earnings by using quarter of birth as an instrument for education. The IV estimate of the return to education is close to the OLS estimate, suggesting that there is little bias in conventional estimates. Criticism: low correlation between IV (birth quarter) and S biases estimates towards OLS estimates – "weak-instrument bias".

David Card (2001) collates findings from about 20 studies that use the instrumental variable (IV) method of estimating the return to education, and finds that among studies using IVs (based on institutional changes in the education system) the estimated returns to schooling are 20-40 percent ***above*** the corresponding OLS estimates. Card concludes that the average marginal return to schooling is "not much below" the conventional estimates from a standard earnings function fit by OLS. This is because endogeneity bias leads to an overestimation of returns using OLS and measurement bias leads to an under-estimation using OLS, i.e. the two roughly cancel out.

Appendix 4

Measuring the causal effect of class-size on student achievement

There are three broad approaches to measuring the causal effect of class-size on student achievement:

- Randomised allocation of students to small and large class sizes and then comparing the achievement difference between 'treatment' and 'control' students.
- Instrumental variable approach – this is a mainly statistical approach whereby the endogenous variable (class-size) is first predicted on the basis of an exogenous 'instrumental variable', i.e. a variable that has its effect on student achievement only via its effect on class-size and not otherwise. This predicted class-size is then used in the achievement equation, instead of the raw class-size variable.
- Exogenous class-size approach: this involves finding a situation where class-size can reasonably be assumed to be exogenous (i.e. where parents cannot manipulate the size of class in which their offspring study, e.g. by migrating closer to schools with smaller classes). Since under apartheid South Africa, the mobility of African households was severely restricted and since they could only send their children to African schools, class-size was reasonably exogenous in that context.

Randomised Experiment approach (Krueger, 1999)

"Experimental estimates of education production functions"

This paper provides an econometric analysis of the only large-scale randomised experiment on class-size ever conducted in the US, the Tennessee Student/Teacher Achievement Ratio experiment, known as Project STAR, costing $12 million. Project STAR was a longitudinal study in which KG students and their teachers were randomly assigned to one of 3 groups beginning in the 1985-86 school year – small classes, regular classes, and regular classes with a teacher aide. Students in regular-size classes were randomly re-assigned at the end of KG, and about 10% of students moved between class types in second and third grade. Attrition was common. The main conclusions are (1) on average, performance on standardized tests increases by four percentile points the first year students attend small classes; (2) the test score advantage of students in small classes expands by about one percentile point per year in subsequent years; (3) teacher aides and measured teacher characteristics have little effect; (4) the beneficial achievement effect of small class size is larger for black students and for those on free lunch.

Instrumental Variable approach (Angrist and Lavy, 1999)

"Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement"

The twelfth-century rabbinic scholar Maimonides proposed a maximum class size of forty. This same maximum induces a non-linear and nonmonotonic relationship between grade enrolment and class size in Israeli public schools today. Maimonides' rule of forty is used here to construct instrumental variables estimates of effects of class size on test scores. The resulting identification strategy can be viewed as an application of regression-discontinuity design to the class-size question. The estimates show that reducing class size induces a significant and substantial increase in test scores for fourth and fifth graders, although not for third graders. The findings suggest that Hanushek's conclusion – that school resources have no causal effect on learning - may be premature because studies are often confounded by a failure to isolate a credible source of exogenous variation in school-inputs. The discontinuity research design overcomes problems of confounding by exploiting exogenous variation that originates in administrative rules. As in randomised trials like the STAR experiment in Tennessee, when this sort of exogenous variation is used to study class-size, smaller classes appear beneficial.

Exogenous Input approach (Case and Deaton, 1999)

"School Inputs and Educational Outcomes in South Africa"

Case and Deaton examine the relationship between educational inputs (especially pupil-teacher ratio, PTR) and school outcomes such as enrolment, grade attainment and achievement in South Africa immediately before the end of apartheid. Black households were severely limited in their residential choice under apartheid and attended schools for which funding decisions were made centrally by White-controlled entities over which they had no control. The allocations resulted in marked disparities in average class sizes. Controlling for household background variables, the authors find strong and significant effects of PTRs on enrolment, educational attainment and achievement. The results differ sharply from what is often thought to be a consensus that school resources do not matter very much. Hanushek's (1995) statement that "simply providing more inputs is frequently ineffective" is cited by South African officials in support of their current policy of class-sizes that are closer to apartheid levels for blacks than those for whites.

Appendix 5
Public education expenditure as a % of GDP and as a % of the government budget, Selected countries

HDI Rank	Country	Public expenditure on Education as a % of GDP		Public expenditure on education as a % of government budget	
		1990	1999-2001	1990	1999-2001
High human development					
40	Bahrain	4.2	..	14.6	..
43	Chile	2.5	3.9	10.4	17.5
44	Kuwait	4.8	..	3.4	..
50	Latvia	3.8	5.9	10.8	..
52	Cuba	..	8.5	12.3	16.8
53	Mexico	3.6	5.1	12.8	22.6
Medium Human Development					
64	Mauritius	3.5	3.3	11.8	13.3
77	Saudi Arabia	6.5	..	17.8	..
78	Kazakhstan	3.2	..	17.6	..
79	Jamaica	4.7	6.3	12.8	12.3
82	Armenia	7.0	3.2	20.5	..
84	Maldives	4.0	..	10.0	..
85	Peru	2.2	3.3	..	21.1
86	Turkmenistan	4.3	..	21.0	..
94	China	2.3	..	12.8	..
100	Ecuador	2.8	1.0	17.2	8.0
104	Guyana	3.4	4.1	4.4	8.6
114	Bolivia	2.3	6.0	..	18.4
116	Tajikistan	9.7	2.4	24.7	..
126	Namibia	7.6	7.9	..	21.0
127	India	3.9	4.1	12.2	12.7
130	Cambodia	..	2.0	..	15.3
131	Ghana	3.2	4.1	24.3	..
138	Bangladesh	1.5	2.3	10.3	15.8
140	Nepal	2.0	3.4	8.5	13.9
Low Human Development					
142	Pakistan	2.6	1.8	7.4	7.8
145	Lesotho	6.1	10.0	12.2	18.4
149	Yemen	..	10.0	..	32.8
151	Nigeria	0.9	..	..	..
155	Gambia	3.8	2.7	14.6	14.2
156	Eritrea	..	2.7	..	..
157	Senegal	3.9	3.2	26.9	..
164	Zambia	2.4	1.9	8.7	..
165	Malawi	3.3	4.1	11.1	..
166	Angola	3.9	2.8	10.7	..
167	Chad	..	2.0	..	..
170	Ethiopia	3.4	4.8	9.4	13.8
176	Niger	3.2	2.3	18.6	..

Source: (UNDP) 2004.