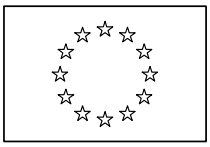

EUROPEAN COMMISSION

Directorate General Education and Culture

PROJECTS IN

"ECONOMICS OF EDUCATION"

STUDY ON

"THE RETURNS TO VARIOUS TYPES OF INVESTMENT IN EDUCATION AND TRAINING"

COMPLETED BY LONDON ECONOMICS

PRESENTATION OF THE STUDY

December 2005

STUDY ON THE "*RETURNS TO VARIOUS TYPES OF INVESTMENT IN EDUCATION AND TRAINING*"

The importance of education and training in a lifelong learning perspective for the knowledge based society and the achievement of the Lisbon goals increases the overall need for investment in human capital. Investing in human resources is indeed essential to increase employability, economic prosperity and social welfare. The Lisbon Council[1] in March 2000 called for a substantial increase in investment in human resources. However, due to tight public budgets, there is also a clear pressure to ensure a more efficient use of existing resources and a larger appeal to private investment, especially as far as higher education, vocational training and adult education are concerned. This implies the need to make better use of research findings for educative policies.

Introduction

In order to deepen the discussions that started in the meetings of Education Ministers in Athens and Milan on the use of economic analysis to draw policy recommendations in the field of education and training, the Commission has launched projects in the economics of education. Indeed, to guide their political action, policy-makers need to have reliable elements of analysis which show the contribution of education and training to the economic and social objectives of the Union. This is the objective of the project "Economics of Education". Consequently, in summer 2003 DG EAC launched a call for tender for a study in the field of economics of education on "Returns to Various Types of Investment in Education and Training". The study was completed in September 2005 by the company London Economics (United Kingdom).

Description of the project

This project is related to the follow up of the Communication on "Investing efficiently in education and training: an imperative for Europe"[2] and the activities of the Working Group responsible for the implementation of Objective 1.5 "Making best use of resources"[3] of the Work Programme "Education & Training 2010"[4]. The purpose of the study is to look at various investment scenarios for achieving the Lisbon targets in the educational field and compare investment costs with related benefits. The analysis of the investments and economic returns is done at a private and social level for the different Lisbon targets and for each Member State.

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[1] http://ue.eu.int/cms3_applications/Applications/newsRoom/loadBook.asp?target=2000&bid=76&lang=1&cmsId=347
[2] http://www.europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0779en01.pdf
[3] http://europa.eu.int/comm/education/policies/2010/objectives_en.html#making

Results of the study

Internal rates of return to the investment necessary to achieve the Lisbon education targets have been estimated with a model developed specifically for this project. Such rates of return are generally high, exceeding 7%. Yet, funding resources are finite. Therefore, to assist in the prioritisation of the potential investments, the study provides a ranking of the targets investments based on their rates of return.

In terms of private returns, completing upper secondary education yields the highest returns in most countries but increasing the number of graduates in maths, science and technology also ranks highly in several countries. There are fewer instances where social rates of return are higher than 7%. This is mainly due to the high costs of providing public education in many Member States. Overall, the social rates of return to completing upper secondary education and increasing the number of graduates in maths, science and technology remain higher than those to tertiary education and literacy.

[4] http://europa.eu.int/comm/education/policies/2010/doc/rep_fut_obj_en.pdf

The Returns to Various Types of Investment in Education and Training

Final Report

To

EC DG EAC

By

London Economics

The Returns to Various Types of Investment in Education and Training

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August 2005

This report was produced by London Economics, acting as a consultant to DG EAC of the European Commission. The views expressed in this report are those of the consultants.

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Glossary

Education terminology abbreviations

LLL	Lifelong Learning
LSE	Lower Secondary Education
MST	Mathematics Science and Technology
NMS	New Member States
TE	Tertiary Education
USE	Upper Secondary Education

Member State abbreviations

BE	Belgium	LU	Luxembourg
CZ	Czech Republic	HU	Hungary
DK	Denmark	MT	Malta
DE	Germany	NL	Netherlands
EE	Estonia	AT	Austria
EL	Greece	PL	Poland
ES	Spain	PT	Portugal
FR	France	SI	Slovenia
IE	Ireland	SK	Slovakia
IT	Italy	FI	Finland
CY	Cyprus	SE	Sweden
LV	Latvia	UK	United Kingdom
LT	Lithuania		

Executive Summary

Returns to investment in human capital: literature review

A large body of research, accumulated over decades, has firmly established that education delivers a variety of benefits at many levels. These include benefits for individuals, benefits for companies, and benefits for society as a whole.

Individuals profit from investment in education through higher wages. No less important are the lower probability of unemployment and higher rates of labour force participation for more highly educated individuals.

Firms reap benefits from education via the higher productivity of their employees. Better-educated employees are not only more productive, but also raise the productivity of their less-educated colleagues.

Societies benefit from education through the direct effect of higher productivity on growth. A number of additional benefits including better public health and greater social cohesion have also been found.

A commonly used measure to determine whether investment in education, or in any other project, is worthwhile is the internal rate of return. This measure compares the current and future value of costs and benefits arising from education. Both private and social rates of return can be calculated to judge the returns of further investment in education for individuals and governments.

The main objective of the present study is to estimate the rates of return of the investments necessary to achieve the Lisbon education targets.

The Lisbon targets

The Lisbon targets are the following:

- Number of early school leavers (Target 1).
- Number of graduates in MST and their gender distribution (Target 2).
- Population with at least upper secondary education (Target 3).
- Low-achievers in reading (Target 4).
- Participation in lifelong learning (Target 5).

The terms of reference specified two additional targets for this project:

- Number of tertiary education graduates (Target 6).
- Education quality (Target 7).

Since 2000, progress has been made with respect to all targets (except for Target 4). However, at the present time, large discrepancies in performance

are observed between Member States. Some have already reached the benchmark levels while others lag behind considerably.

Methodological approach

The achievement of the Lisbon targets necessarily requires financial investments to increase the number of students in different education streams. To achieve the targets we have assumed the following policies.

For Target 1 and Target 3 we assume that a number of early school leavers will go back to school and achieve upper secondary education after some years of education.

For Target 2 we assume that a number of graduates will increase following a rise in the number of students in mathematics, science and technology (MST).

To achieve Target 4 we assume that country-specific reading recovery programmes are implemented for the lowest achieving students. As a result of the programmes, a proportion of the students improve their literacy skills.[1]

To achieve Target 5 we assume that the number of people undertaking lifelong learning increases.

Finally, for Target 6 we assume that an increase in the intake of tertiary education students is required.

To compute the internal rate of return for each of the targets one needs to account for costs and benefits. Our calculations include direct costs of education (fees etc. net of public subsidies), ancillary costs (books, travel, accommodation etc.) and foregone earnings while in education. Benefits of education accrue from higher earnings and a lower probability of unemployment.

Rates of return to investments in various forms of education

The targets for 2010 were defined using indicators from 2000 and some of the countries have already achieved by now the EU target. The countries that would need to undertake specific investments to achieve the 2010 targets are:

- Targets 1 and 3: BE, DK, DE, EE, EL, ES, FR, IE, IT, CY, LV, HU, MT, NL, PT and UK would require action.
- Target 2: all countries would require action, except the UK.

[1] There exist a number of different ways to improve literacy rates. The assumed option allows a quantification of the cost and benefits of the policy as the costs and effectiveness of such programmes are documented in the literature. However, it has to be noted that this is not the only available option for improving literacy rates. Moreover, the literacy programmes could be complemented by additional measures, such as improving libraries and making them more accessible.

- Target 4: BE, CZ, DK, DE, EL, ES, FR, IT, LV, HU, AT, PL, PT and SK would require action (no data are available for EE, CY, LT, MT, and SI for this target).
- Target 5: BE, CZ, DE, EE, EL, ES, FR, IE, IT, CY, LV, LT, HU, MT, PL, PT and SK would require action.
- Target 6: CZ, DE, IT, CY, MT, AT and SK (no data are available for EL for this target).

The rates of return for achieving the targets have been computed for all the targets except for Target 5, for which estimates of the impact of lifelong learning on firms' productivity were not available for the different Member States.

For each of the countries that need to achieve the targets, the private rates of return are shown in Figure 1 and the social rates of return are shown in Figure 2.

Figure 1: Private rates of return for countries that require action

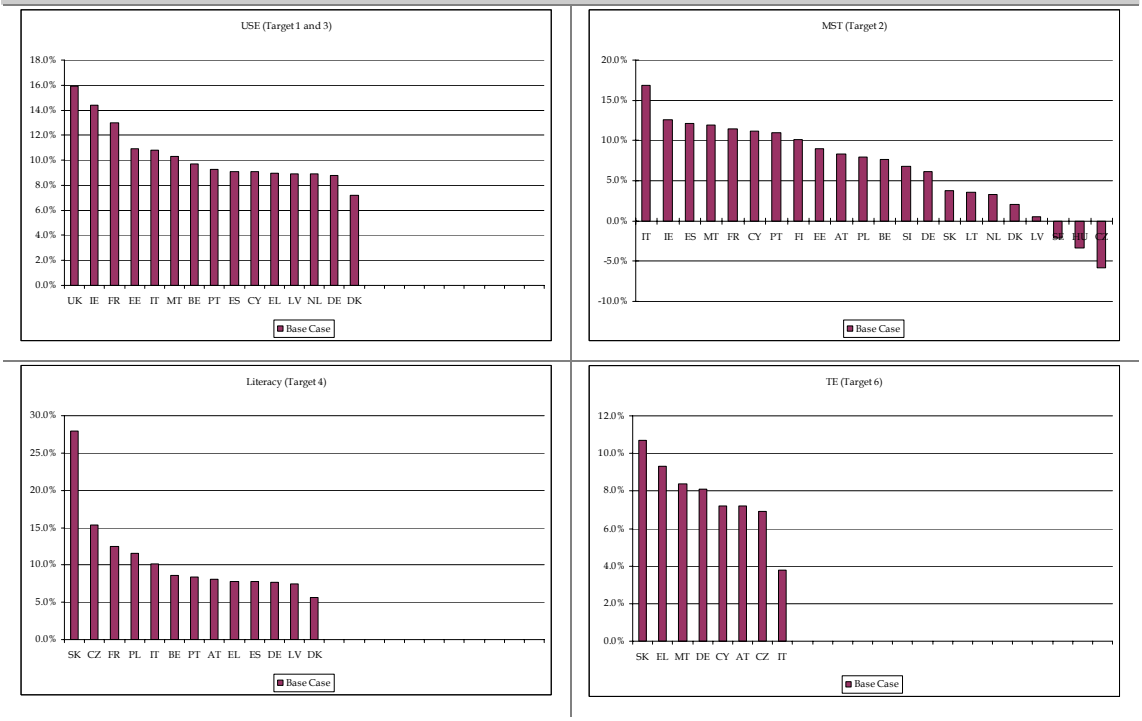
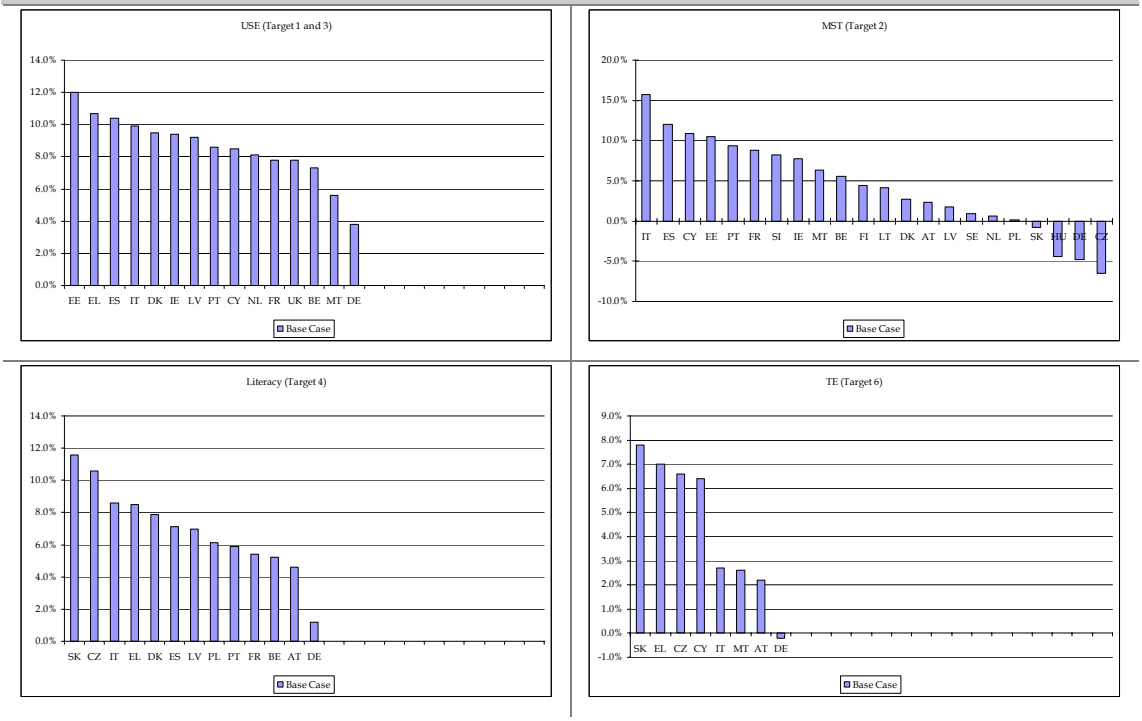


Figure 2: Social rates of return for countries that require action



The private and social rates of return outliers observed in Figure 1 and Figure 2 reflect various country-specific factors. This is reviewed in detail in Section 5.3.

The rates of return are robust to changes in some of the parameters. They exhibit only a small reduction when education costs are increased by 20% and when the effects of achieving additional education (on wages and economic growth) are reduced by 10%. However, the impact of having a higher probability of being employed derived from higher levels of education seems to be a major influence. Finally, students working part-time while in TE could have rates of return for Target 6 around 2% higher for both private and social rates.

Case study of effect of declining spending on education

In addition to reporting rates of returns of the various investments necessary to achieve the Lisbon education targets, we also document, via a case study on California, the broader impacts of spending on education.

In California, a reform of education funding following a judicial decision in 1971 led to a reduction in average funding for public schools. Average resources per pupil fell in absolute terms and relative to other states.

In the aftermath of the reform, average performance of Californian students deteriorated, while the gap between high-wealth and low-wealth districts remained as large as ever.

Subsequent research has often blamed the lack of resources for the decline in standards. However, evidence from other States has not confirmed that a causal relationship exists between resources and student performance.

Much of the evidence on the allocation of resources within schools is consistent with the hypothesis that resources matter only when they reach the classroom (as opposed to being spent on administrative costs).

Comparison with main competitors

EU Member States' expenditure on primary and secondary levels of education is comparable to that of its main competitors (the United States, Japan, Australia), but some Eastern European countries still spend relatively little.

However, expenditures on tertiary education in Member States are significantly lower than in the United States.

Conclusions and recommendations

Internal rates of return to the investment necessary to achieve the Lisbon education targets have been estimated with a model developed specifically for this project. Such rates of return are generally high, exceeding 7%.

Yet, funding resources are finite. Therefore, to assist in the prioritisation of the potential investments, in Table 1, below, we provide a summary ranking of the targets investments based on their rates of return. Rates of return greater than 7% are shown in a shaded cell in the table.

Some Member States are already above some of the targets' benchmarks or will reach them in 2010. Therefore, the ranking of the rates of return are only shown for the Member States that require additional investments to achieve each of the different targets.

In terms of private returns, completing USE yields the highest returns in most countries but MST also ranks highly in several countries. Among the various education investments considered in this study, the private rate of return to improving literacy is the highest in the Czech Republic, Poland and Slovakia.

There are fewer instances where social rates of return are higher than 7%. This is mainly due to the high costs of providing public education in many Member States. Overall, the social rates of return to USE and MST education remain higher than those to TE and literacy.

The policy implications from our analyses are that:

- Member States should focus primarily on achieving Targets 1 and 3, and Target 2.

- In general, Target 6 yields the lowest returns. This is because of the high costs involved in higher education.
- Achievement of Target 4 yields returns that lie between those shown by the investments necessary to achieve Targets 1 and 3, and Target 6.

Table 1: Private and social rates of return for targets by order of size

	Private				Social			
	Highest			Lowest	Highest			Lowest
BE	USE	Lit	MST		USE	MST	Lit	
CZ	Lit	TE	MST		Lit	TE	MST	
DK	USE	Lit	MST		USE	Lit	MST	
DE	USE	TE	Lit	MST	USE	Lit	TE	MST
EE	USE	MST			USE	MST		
EL	USE	Lit			USE	Lit		
ES	MST	USE	Lit		MST	USE	Lit	
FR	USE	Lit	MST		MST	USE	Lit	
IE	USE	MST			USE	MST		
IT	MST	USE	Lit	TE	MST	USE	Lit	TE
CY	MST	USE	TE		MST	USE	TE	
LV	USE	Lit	MST		USE	Lit	MST	
LT	MST				MST			
HU	MST				MST			
MT	MST	USE	TE		MST	USE	TE	
NL	USE	MST			USE	MST		
AT	MST	Lit	TE		Lit	MST	TE	
PL	Lit	MST			Lit	MST		
PT	MST	USE	Lit		MST	USE	Lit	
SI	MST				MST			
SK	Lit	TE	MST		Lit	TE	MST	
FI	MST				MST			
SE	MST				MST			
UK	USE				USE			

Note: Shaded cells identify internal rates of return in excess of 7%. USE upper secondary education, TE tertiary education, MST mathematics science and technology, Lit literacy rates.
Source: LE calculations

Achieving the targets raises the difficult challenge of increasing the number of graduates without reducing the quality of education in the overall system. Any quality impairment (at any level of education) will automatically reduce the rates of return.

1 Introduction

In March 2000, the Lisbon European Council set the ambitious goal for the European Union (EU) to become the most competitive and dynamic knowledge-based economy in the world by 2010. It was envisaged that education and training would play a central role in reaching this goal, as the impetus for the knowledge-based economy comes from the creation and diffusion of new information throughout society. As a result, the European Council has called for a substantial annual increase in per capita investment in human resources.[2]

The Lisbon strategy's aim of creating a more dynamic and competitive knowledge-based economy in Europe should ultimately deliver sustainable growth, generate more and better jobs and create greater social cohesion.

Although a variety of studies have shown that investment in human resources yields important benefits, this does not mean that investment in human capital should be undertaken indiscriminately. As resources are finite, it is important to know which forms of investment yield the best value for money.

In addition, many studies generally look at investment in education and training only in an aggregated way without distinguishing between the locus and type of investment in the overall education/training system. Also, training and adult learning is not considered fully in many studies.

The purpose of the present study is to look at various investment scenarios for achieving the Lisbon targets and compare investment costs with related benefits. The analysis of the investments and economic returns is done at a private or enterprise, and social level for the different Lisbon targets and for each Member State.

The structure of the report is as follows. The next chapter provides a review of the key findings of the literature on returns to investments in human capital. Chapter 3 describes the Lisbon targets, the current level of the targets and the required interventions by Member States to achieve the EU-target. Chapter 4 explains the methodological approach adopted for this study, describing the cost-benefit model used and the choices made to implement the Lisbon targets. After describing the data used in the study, Chapter 5 presents the results of the investments required to achieve each of the targets and the internal rates of return. Chapter 6 presents a case study of the implications of a reduction or low level of spending on education. Chapter 7 compares education and training funding in the European Union with its main competitors (the United States, Japan and Australia). Finally, Chapter 8

[2] At the end of 2002 the Commission issued a Communication ("Investing efficiently in education and training: an imperative for Europe"; COM (2002) 779 final), which sets out the Commission's view on the new investment paradigm in education and training in the enlarged EU within the framework of the ambitious strategic goal set in Lisbon in 2000.

presents a set of findings and recommendations, based on the analysis of the estimated costs, benefits and returns of investment in education and training.

2 Returns to investment in human capital: literature review

A number of studies have analysed the way human capital accumulation confers benefits to individuals, enterprises and societies. Some of the benefits take the form of higher earnings, productivity or economic growth. In addition, investment in human capital has also been related to a wide range of non-economic benefits arising from better-educated people and higher knowledge in society.

This chapter describes the various benefits flowing from education. The first section lists the different benefits of education that have been found in the economic literature. This includes an assessment of the benefits at an individual level; the benefits to firms from adult investment in human capital through training; and the extent to which education provides returns to society overall in the form of increases in economic growth or other non-economic benefits. The second section looks at the ways in which investment costs and benefits of education investment can be drawn together to calculate rates of return of investments in education.

2.1 Benefits of education

Investment in human capital is an important determinant of individuals' earning capacity and employment prospects, and therefore plays an important role in determining the level and distribution of income in society, firms' productivity and economic growth. Education has also been associated with various non-economic benefits, including greater social cohesion, lower crime and better health.

In this section we will review each of these dimensions.

2.1.1 Benefits accruing to individuals

The bulk of existing research finds that human capital accumulation through education and training provides employees with productivity-enhancing skills, and their wages and employment conditions typically reflect their increase in productivity.

Education can benefit individuals in three different ways. Firstly, people are more likely to participate in the labour market; secondly, education means that individuals are likely to experience less unemployment and, finally, higher skills means that workers earn, on average, higher wages than those with lower skills. We review now each of these benefits in turn.

Education and labour market participation

Participation in the labour market is closely related to education. The higher an individual's education level, the more likely it is that he or she will participate in the labour market. This effect is especially pronounced for women, whose participation rates are still comparatively low in many countries. In a cross-country OECD study (OECD, 1998), it has been shown that participation rates for women with tertiary education tend to be higher than for women with lower qualifications, especially in countries where the overall female labour market participation is already low (such as less developed countries). High rates of inactivity can also be found among men with little formal education.

Education and employment

The likelihood of being unemployed over the course of a working life is also related to education. Research by the OECD (1997) found that in some cases the percentage of the least-educated men who are outside work at the prime of life is disturbingly high: at least 30 per cent of those aged 30-44 without upper secondary education are outside employment in Poland, the United States and the United Kingdom. Youth unemployment is also particularly high for individuals with less education, and some observers see a link with poverty, crime and other social problems that are generally not considered among the costs of not being educated (OECD, 1998, and de la Fuente, 2003).

Education and wages

Education does not only increase the probability of being employed. Once in employment, better-educated individuals earn considerably more than their less-educated peers. From an economic point of view this is an unsurprising result and has been substantiated by numerous studies. In a seminal paper, Mincer (1974) estimated the effects of schooling on wages at around 10% using US census data. Similar estimates for Europe have been found in the recent research project PuRE[3], funded by the European Commission. According to this project one additional year of education yields an 8% wage increase, on average, across 15 European countries[4] ranging from a 4% in Sweden to an 11% in Ireland, and all the countries but two show percentages gains of above 7% (see also Harmon et al., 2001, and de la Fuente, 2003). In another study, using 1995 data, the OECD reported that women aged 30-44 years with higher education in the United Kingdom earn 110% more than women of the same age without upper secondary education (OECD, 1998).

[3] The Public funding and private Returns to Education (PuRE) studies the impact of different systems of public financial support on education on observed outcomes in the labour market, private returns to education and education-related inequality in earnings.

[4] Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

A variety of methods have been used to explore the education-earnings link. The most widely accepted method, going back to Mincer (1974), relates individuals' wages to the number of years they spent in education.[5] Under this approach the measured impact of schooling is the average increase in wages accruing to an individual as a result of one additional year of education. The estimates of the returns to education obtained this way are called Mincerian returns.

It is important to note that the returns to education obtained with this method are simply a marginal wage benefit of one additional year of education. However, this approach ignores any costs of education incurred by the individual, for example fees, travel costs, and earnings foregone during the time spent in education. When considering the return of one additional year of education, an individual needs to consider whether the stream of discounted benefits outweigh the stream of discounted investment costs. In other words, the individual will need to estimate the internal rate of return. The calculation of internal rates of return is explained in section 2.2.1 below.

Is education really the cause of higher wages?

The precise channel through which education impacts on earnings has been a matter of controversy, as it has proved difficult to isolate its effect from other factors. Although many studies find evidence of a strong positive relationship between educational attainment and labour market outcomes, some authors have argued that such effects are overestimated as they do not include unobserved factors, such as individuals' innate ability, family background or other social factors.

Ashenfelter and Krueger (1994) in a study of identical twins showed that the effects of controlling for ability, race, social class and family background could lower estimated returns to education by about 25 per cent. However, in another study, Ashenfelter and Rouse (1998) showed that error in the measurement of human capital acquired may lead to an under-estimation of rates of return by as much as 30 per cent (through, for example, omission of the quality of education). According to OECD (1998) these two studies suggest that the measurement error and the omission of control variables in less sophisticated estimations of returns to education may tend to roughly cancel each other out.

A human capital enhancing function of education is not completely incompatible with theories that see the role of education primarily as a device to signal desirable personal attributes to employers. Seminal papers by Arrow (1973) and Spence (1973) put forward the theory that it is not education *per se* which yields higher wages, but rather that education is used by employers as a screening device to identify better workers and

[5] Formally, it is a semi-logarithmic OLS regression using as explanatory variables the number of years of schooling, experience and experience squared (to allow diminishing returns with age increases) and individual wages as dependent variable.

analogously by workers to signal their potential high productivity.[6] A worker's level of education is thus correlated with, but not the cause of, high productivity.

To the extent that university education is being used as a screening mechanism and does not make a direct contribution to productivity enhancement, the value of education to society will be lower.

Empirical research investigating the relevance of the signalling theories has concluded that, the "signalling component" of educational qualifications accounts for a relatively small part of the wage differential associated with education (Altonji and Pierret, 1996). Other authors have also confirmed that education appears to play a significant role in human capital formation, over and above any role it plays as a screening device (Psacharopoulos, 1994). In an attempt to quantify this relationship Johnson and Wilkins (2002) estimated that higher innate ability accounts for only between 15 to 33 percent of the additional return of higher education accruing to graduates.[7]

Benefits from other forms of human capital accumulation

Literacy can also play a significant role in human capital formation. For example, some studies report a strong positive relationship between literacy, educational attainment and earnings (*International Adult Literacy Survey,* OECD, HRDC and Statistics Canada, 1997). The effect of literacy is rather indirect, though: individuals with higher literacy are likely to have more education and hence higher earnings.

2.1.2 Benefits for firms

Spillovers from education

Investment in education confers a number of benefits in addition to higher wages. The interaction at the firm level between workers with different education levels can produce *spillover* effects. These are involuntary effects from better-educated employees likely to take place within firms when workers benefit from interacting with better-qualified staff. Hence, the effects of higher education would be observed not only in higher productivity of the educated workers, but also in the form of increases in the productivity of other workers as a result of learning by imitation and improving their skills from working with them.

[6] For a more recent discussion see Weiss (1995).

[7] Heckman and Vytlacil (2001), on the other hand, have drawn attention to the difficulties involved in separately identifying the effects of education and innate ability. Weiss (1995) also points out that the screening hypothesis can explain some regularities in the data better than other models, for example that returns to education far exceed the returns to any particular set of skills learned in school.

The idea of spillovers is not a new one. Since a seminal paper by Lucas (1988), a number of studies have related the wages of individuals not only to their own education, but also to the education level of their co-workers. This approach is meant to capture productivity spilling over from educated workers to less educated ones. However, the empirical research so far has yielded ambiguous results. For example, Acemoglu and Angrist (2000) find that the effect of average schooling levels on average wages is insignificant at a US state level, whereas Moretti (2002) finds a significant impact of the share of graduates in the workforce on the wages of workers with less education. His study of US cities concludes that a one-percentage point increase in the number of graduates raises high school drop-outs' wages by 1.9%.

Effects of training

Studies that try to explicitly measure the effects of education on firm's productivity have found more consistent positive effects. Dearden et al. (2000) found training to have a significant effect on industrial productivity in a panel of British companies. Their findings are noticeable because they estimate that a five percent increase in training is associated with a four-percentage points increase in productivity and a 1.6 percent increase in wages. This implies that research focusing exclusively on individual wages has underestimated the effect of training to a significant extent.

The type of training received has also been a subject of study. According to Martins (2004), the external benefits of education and training depend on their nature. Specifically, the benefits of education are greater, the more general, non-excludable and non-reversible the acquired skills are. In a study of a panel of Portuguese firms and using Mincerian equations, Martins estimates firms' average real earnings returns of schooling at 14-23%, which are considerably larger than normal private returns estimates. More importantly, these returns are also considerably higher than social returns calculated in the conventional way (social returns are described in the next sub-section). The author also estimates Mincerian wage regressions and finds education increases wages an average of 2-3% for less educated workers, confirming the existence of externalities at firm level.

While education and training clearly confer benefits to firms, since the original research by Becker (1975), it has been argued that firms might be deterred from investing in training of workers because of fear of them being poached by other companies. A company could take advantage of gains in human capital of other companies' investments without paying for its acquisition.

In this context, a firm would only engage in training programmes in non-competitive labour markets where there is a low risk of workers drainage. In competitive labour markets with transferable and non-excludable skills, employers will want to train fewer workers because of the risk of losing them. Thus, public subsidies for worker training may be warranted because without

government intervention the level of training would be below the social optimum.

Despite these recent developments in the literature, the benefits of education to firms are still relatively little understood. Although the weight of empirical evidence suggests that training results in higher wages for workers and higher productivity for firms, further research is needed to establish the precise mechanism behind those effects. However, productivity increases from education are implicitly recognised by firms, which in many cases customarily pay for training of their employees.

2.1.3 Benefits for the macroeconomy

The impact of education at a macroeconomic level has been the subject of considerable research in the recent decades. However, so far, no firm conclusion has been reached regarding the role of the contribution of factors' contribution to growth.

The neoclassical theory tries to explain cross-country differences in levels of aggregate output by differences in the growth rates of labour and physical capital. Some early economists noted that output had grown faster than would be implied by the rate of expansion of the two main economic inputs: labour and capital. Typically, these models left an unexplained residual, which in many cases was large (for example Solow, 1957, found that six sevenths of the growth in output in the United States could not be attributed to growth in either capital or labour).

Many studies have identified this residual with increases in human capital or with technical change through increases in R&D (see for example Grilliches, 1996, for a review of research into the "residual"). However, traditionally, it was difficult to disentangle the impact of these two factors, because of the close interaction between workers knowledge and the technological or organisational environment in which they work.

Conceptual difficulties and deficiencies in the available data have meant that it has proved very difficult to implement growth models empirically. The literature usually uses proxies for human capital, initial level of GDP, physical investment ratios, geographical dummies and variables to capture the role of governments (Barro, 1991, Mankiw, Romer and Weil, 1992, Mingat and Tan, 1996).

Some US studies of the 1960s and 1970s showed that labour quality (approximated by educational attainment) could explain about 0.5 per cent of the annual growth rate of GDP (Jorgenson and Grilliches, 1967). A major study using panel data from about 100 countries (Barro and Lee, 1994) found that conditional convergence depends to a significant extent on high levels of human capital relative to initial GDP per head. Another study that analysed growth in seven OECD countries over four decades (Barro and Sala-i-Martin, 1995) found that increases in both educational attainment and total number of

persons employed were important but were partly offset by reductions in hours worked per person.

On balance, the empirical evidence suggests that education does yield tangible economic benefits for society. However, the precise magnitude of the benefits is unclear, and the quantitative estimates are very sensitive to the choice of model specification and the definition of variables used in the empirical analyses (Sianesi and Van Reenen, 2002).

A common problem with the estimation of macroeconomic impacts of education is that they generally do not distinguish between direct effects of education, and the indirect effect of education on innovation and the development and adoption of new technologies. Further criticism (Sianesi and Van Reenen, 2002) has focused on the details of empirical studies. The common assumption of linearity and homogeneity of slope coefficients, the inadequate attention paid to the possibility of reverse causality (i.e. higher income causes higher demand for education, rather than vice versa), as well as data problems and inconsistencies in using cross-country data have all been mentioned (see also de la Fuente and Doménech, 2002).

Moreover, some authors have established that the marginal macroeconomic impact of increases in various levels of education appears to vary greatly according to the state of a country's development (Mingat and Tan, 1996). According to these authors, the impact of primary and secondary education is greater in low- and middle-income countries, whereas the impact of higher education is more important in high-income countries. Acemoglu, Aghion and Zilibotti (2003) explain this phenomenon by looking at the importance of innovation in advanced economies. In their model, demand for high skills is lower in developing countries, which mainly adopt existing technologies. Though research has often focused on secondary education, some studies (for instance, Heckman, 2000, and Dearden et al., 2004) note that choices made at primary education age can be critical for later educational success.

The bottom line is that while the qualitative results are mostly robust, the estimated magnitudes of the effects described above should be treated with caution.

Spatial effects of education

Complementing these results, other studies have focused on a different aspect of the macroeconomic effects of education. Research into the spatial dimension has received some attention recently.

Some researchers have drawn attention to the fact that growth is not distributed evenly within countries. The New Economic Geography literature pioneered by Krugman posits that decreasing transport costs together with

unrealised economies of scale lead to spatial concentration of high-growth production.[8]

The emergence of regional centres (agglomerations) with permanently higher productivity and income might be accelerated when human capital is concentrated locally. This situation might arise if there are complementarities between human and physical capital and if spillovers from human capital benefit firms via localised networks.[9] Higher wages will attract skilled workers to such centres. This can be an important cause of divergence between regions, in both income and skills.

2.1.4 Other externalities

The acquisition of skills and knowledge affects individuals and societies not only with respect to their performance in the economic sphere. The benefits of education extend beyond the ones that can be observed at the individual, firm or macro level.

There exist a number of indirect channels through which better education can affect societies. The main idea is that education produces *external* effects that affect others than the ones benefiting from it. Some researchers report very high estimates of such externalities.[10]

One of these additional benefits is social cohesion, which fosters political stability, and creates safer opportunities for investment in physical capital. In the later case, this would lead to higher economic growth.

Often the debate about non-economic effects arising from investment in education has been conducted on the basis of *a priori* arguments, while the precise mechanisms through which they materialise has remained obscure. Partly this is due to the elusive nature of the benefits that have been advanced, such as the "cultural and social standards" that education helps to develop, which in turn improve the social infrastructure that underpins the harmonious working of society; or the "promotion of inquiry and dispassionate debate on public policy issues" that leads to improved public decision-making (Sianesi and Van Reenen, 2002).

In part, the existence of such externalities can be deduced from a macroeconomic analysis. Social cohesion and political stability for instance

[8] For an overview see Fujita et al. (1999).

[9] For a discussion of innovation networks see Camagni (1991).

[10] McMahon (2000) reports that externalities can be estimated to be about 57% of total market plus non-market education outcomes. Heckman and Klenow's (1997) survey of the relevant growth literature suggests externalities account for an extra 50% of the direct contribution of human capital. However, the authors themselves are sceptical about those results and they point to improvements in the quality of physical capital as the main driver of growth. A survey by Davies (2002) concludes that externalities add 1-2 percentage points to after-tax returns of education.

can be assumed to have a positive effect on national income and growth even if the precise channel for the effect is not known.

At the microeconomic level a few concrete facts have been established empirically. Among the best documented are the positive effects of education on health for educated individuals themselves and their children (Taubman and Rosen, 1982, Grossman 1975, Desai 1987). Better health, and its concomitant benefits of later retirement and more productivity in old age are going to become increasingly important objectives for public policy as the age structure of the European population changes. Similarly well established is the effect of parents' education on their children's cognitive development (Dawson, 1991, Angrist and Lavy, 1996, Lam and Dureya, 1999).

Another robust relationship has been found to exist between education and fertility rates.[11] This is an area of particular concern for developing countries, but research has also shown a negative relationship between education and the incidence of teenage parenthood in the developed world. Zill (1994), for example, found a rate of teenage pregnancy that was 12% higher for girls from less well-educated families in the United States.

Education also seems to play a role in reducing crime, although it has been argued that the effect might not be due directly to education, but to the discipline imposed by formal education programmes (Behrmann and Stacey, 1997).

In addition, a greater propensity to make charitable donations (Freeman, 1997), a greater likelihood to vote in elections (Campbell et al, 1976) a higher savings rate (Solomon, 1975), greater efficiency in making consumption choices (Rizzo and Zeckhauser, 1992, Michael 1972) and greater intra-family productivity (e.g. when a spouse's education has a positive effect on the other's earnings[12]) have all been identified as externalities arising from education.

It is clear that education externalities often work in subtle ways that do not readily lend themselves to strict economic analysis. Still, there are good reasons to believe that they exist, and that education has positive effects on individuals and societies, by changing preferences and improving information.

2.1.5 Quality of education

It seems intuitively clear that not just quantity but also quality of education matters. However, the precise effect of quality on output variables such as earnings and growth is still an issue of continuous debate. Part of the disagreement is due to the difficulties of measuring quality of education. Although several measures have been proposed, in the best cases they are

[11] Barro and Lee (1993) for example find strong support for this using panel data from 129 countries.

[12] Benham (1974).

still partial measures. We will return to quality measurement indicators in section 4.1.7.

The effect of quality of education on economic growth is investigated in Hanushek and Kimko (2000). They use results from standardised international mathematics and science tests, and find that aggregate test performance has a strong positive effect on growth.[13] They also find that the effect of quality is greater than that of mere quantity of education. These results are confirmed by Coulombe et al. (2004), who use literacy scores reported in the International Adult Literacy Survey as an indicator of quality. They find much larger effects on growth and long run levels of GDP than those obtained from regressions that use years of schooling.

Using the index based on performance in standardised tests constructed by Hanushek and Kimko (2000), Sweetman (2004) studies the effect of education quality on labour market outcomes for immigrants to Canada. He finds that among immigrant males who hold a bachelor's degree, those from countries where education quality is high earn up to 30% more than those from countries where it is low. He also finds that the quality measure is not correlated with years of schooling. In a different study, Card and Krueger (1992) find that education quality in different US states affects the earnings of graduates. In this study, education quality is proxied by student-teacher ratios, teachers' relative pay and average term length.

However, there is as yet no consensus on how quality in education is achieved. In particular, the role of schools' resources in raising quality remains contested. Krueger (1999) used an experimental approach to show that class size has a significant effect on pupils' performance in standardised tests.[14] But, studies by Hanushek (1986, 2003) and Gundlach, Wößman and Gmelin (2001) suggest that resources in general and class sizes in particular have only minimal effects on education outcomes.

2.2 Rates of return to education

So far, we have seen how education can be beneficial for individuals, firms and society overall. However, this widespread recognition of the benefits of education and other forms of learning does not mean that investment in human capital should be undertaken indiscriminately.

In an economy with finite resources, it is important to know which forms of investment produce the best value for money. The complete picture of the

[13] Hanushek and Kimko (2000) estimate that a difference of one standard deviation in test performance is related to a 1% difference in annual growth rates of GDP per capita.

[14] The research is based on the STAR experiment. A project that ran from 1985 to 1989 and involved over 11,000 schoolchildren randomly assigned to classes of different sizes in 80 public schools in the state of Tennessee.

costs and benefits of education can be obtained by calculating the internal rate of return of education.

2.2.1 How to estimate net benefits arising from education

The internal rate of return is an accounting method that permits a comparison of returns across different assets. The marginal effects of education on earnings and economic growth (i.e. the Mincerian returns) can be used to estimate the benefits of undertaking education. The stream of investment needed to achieve that education constitutes the costs.

To calculate the economic return, the discounted[15] cost of investments is examined alongside the discounted value of future benefits. The rate of return is the interest rate that makes the net present value of all cash flow (of benefits and costs) equal to zero. For an individual, the internal rate of return of education is the annual rate of return that his investment in education will yield. For society, to compare alternative investments in education on non education activities and projects (as a government institution might do), the annual rate of return can be estimated for each type of investment and one can identify the one that yields a higher return. Whereas the private rate of return influences the decision by individuals to undertake education, the social rate of return influences societies' collective choice to finance education through taxes, government debt and private contributions.

In calculating the various rates of return, one needs to differentiate the benefits and costs.

The "private" return to education takes account only of privately borne costs (including foregone earnings while in education) and private gains in terms of higher post-tax earnings.

The rate of return to firms accounts for the increases in productivity from better-trained workers. In many cases firms do not contribute directly to the education of society except in cases of specific training or learning on the job.

The "social" return to education includes both private and public costs and benefits. By looking at gross earnings, it also includes public benefits from higher income tax revenues paid by people who earn more as a result of their education.

The main components of rates of return

Table 2.1 exemplifies the main components of the social and private rates of return. As can be seen, the social benefits and costs include a private component and a component from firms and society. The private and social rates of returns are calculated from the private costs and benefits.

[15] A discounting factor is used to take account of the postponement of the benefits.

Table 2.1: Rates of return to education				
Private Benefits	**+**	**Benefits accruing to Firms and Society**	**=**	**Social Benefits**
-				**-**
Private Costs	**+**	**Costs incurred by Firms and Society**	**=**	**Social Costs**
=				**=**
Private Rate of Return				**Social Rate of Return**

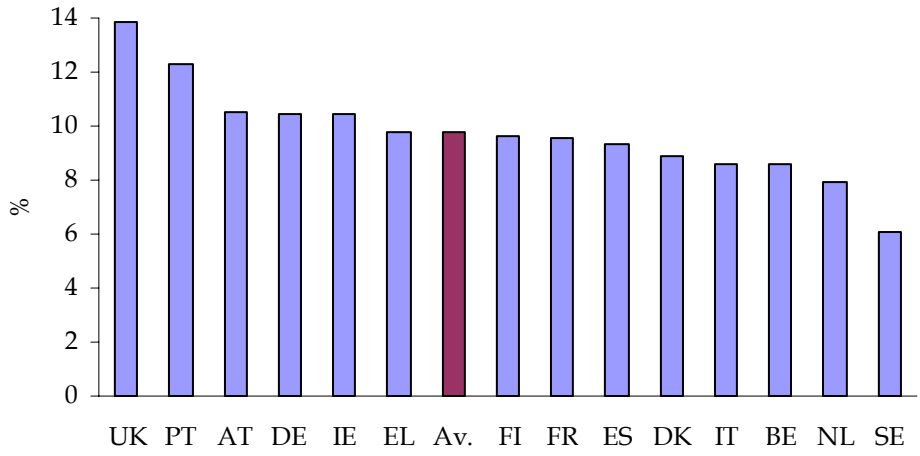
2.2.2 Estimates of the rates of return to education

There exists now a great wealth of empirical literature on the returns to education. Consequently a detailed picture has emerged on how returns are distributed across countries at different stages of development, for different levels of education and across different groups.

Overall returns

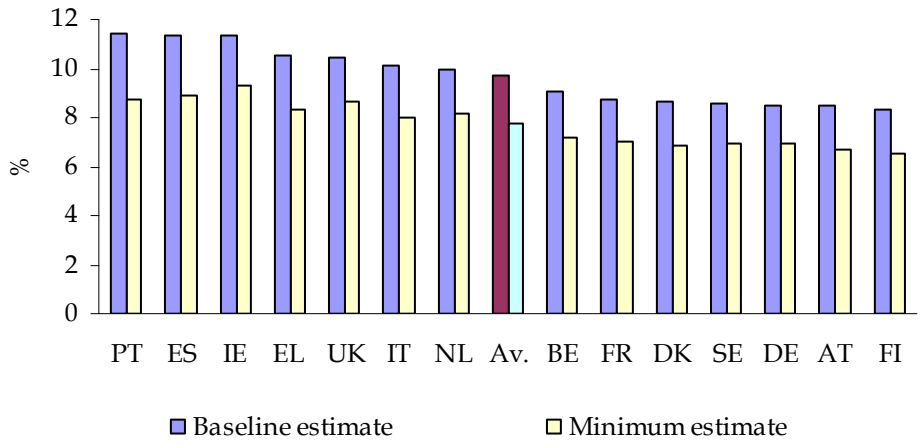
Some estimates of social rates of return show that, on average, one additional year of education yields a global average rate of return of around 10% (Psacharopoulos, 2004), which compares very favourably with alternative investments. For Europe, de la Fuente (2003) finds an average private rate of return of 9.75% and an average social rate that is between 7.8 and 9.7%. Of the two, the private rate of return is markedly more variable. Figure 2.1 and Figure 2.2 display de la Fuente's disaggregated results.

Figure 2.1: Private rate of return to education in EU15



Source: de la Fuente (2003).

Figure 2.2: Social rate of return to education in EU15



Source: de la Fuente (2003).

Psacharopoulos and Patrinos (2004) summarise the results of the internal rate of return calculations in the literature. Table 2.2 illustrates the differences between social and private returns across all levels of education for selected European countries.

Table 2.2: Estimates of returns to education

Country	Social returns			Private returns			Year of study	Author(s)
	PE*	SE*	TE*	PE*	SE*	TE*		
BE		17.1	6.7		21.2	8.7	1960	Psacharopoulos (1994)
DK			7.8			10	1964	Psacharopoulos (1994)
DE					6.5	10.5	1978	Psacharopoulos (1994)
EL		6.5	5.7		8.3	8.1	1993	Magoula and Psacharopoulos (1999)
ES	7.4	8.5	13.5				1991	Lassibille and Navarro (1998)
FR					14.8	20	1976	Psacharopoulos (1994)
IT					17.3	18.3	1969	Psacharopoulos (1994)
CY	7.7	6.8	7.6	15.4	7.0	5.6	1979	Psacharopoulos (1994)
HU		6.0	2.6		8.2	13.4	1993	Varga (1995)
NL		5.2	5.5		8.5	10.4	1965	Psacharopoulos (1994)
SE		10.5	9.2			10.3	1967	Psacharopoulos (1994)
UK	8.6	7.5	6.5				1986	Cohn and Addison (1998)
AVERAGE	**7.9**	**8.5**	**7.2**	**15.4**	**11.5**	**11.5**	--	--

Note: * PE Primary Education, SE Secondary Education, TE Tertiary Education.
Source: Patrinos and Psacharopoulos (2002).

Returns to different types of education studies

On returns specific to different types of studies, Psacharopoulos (1994) and Psacharopoulos and Patrinos (2004) report that private returns to tertiary education are highest for engineering, law and economics, and that average returns are higher for women at all levels, except primary education. Johnson and Wilkins (2002) using Australian data and looking at male graduates only, estimate a lower social rate of return for engineering (10.8%) than for business, law and economics (18.4%). According to their study, graduates in arts, humanities and social sciences, achieve returns of only 3.6%. Overall, these authors arrive at an average return of approximately 10% for all fields of study.

De la Fuente and Ciccone (2002) propose that the main reason for high returns to investment in education is its complementarity with technology. They cite numerous studies that show how the premium paid for educated workers increases in times of rapid technological change. However, Denny, Harmon and Lydon (2002) find that returns to education are negatively related to the volume of foreign direct investment in transition economies, which could suggest the existence of rigidities in adapting existing human capital to new circumstances.

Returns to different levels of education

Globally, according to Psacharopoulos and Patrinos (2002), average social returns are 18.9% for primary education, 13.1% for secondary education, and

10.8% for tertiary education. Further, returns to primary education tend to be considerably larger in less developed countries: average returns are 25.4% for Sub-Saharan Africa compared to only 8.5% in OECD countries.

Finally, it has been observed that rates of return to education have declined over time as per capita income and education levels increased (see for example Denny, Harmon and Lydon, 2002). This suggests that education behaves like other investments in that diminishing returns apply. A noticeable exception is private returns to higher education, which have continued to increase, largely because of public subsidies for the tertiary education sector.

3 The Lisbon targets

At the European Council's Spring Summits in Lisbon (2000), Stockholm (2001) and Barcelona (2002) Ministers agreed on the strategic goals for European education and training systems. A list of guidelines and benchmarks was also developed to be used as reference points for measuring the progress towards the Lisbon ambitions.

To determine the investment required to achieve each of the Lisbon targets, we need to asses how far from these European countries are currently and are likely to be in the future under their current investment plans. In the first section of this chapter we describe the targets, as defined by the European Council. In the second section we analyse the progress made so far towards these targets. Finally, in the last section we analyse the required interventions by Member States to reach the targets.

3.1 Indicators and benchmarks

In 2003, the European Council set five European benchmarks for the improvement of education and training systems in the European Union up to 2010, which would allow the European Union to achieve the Lisbon objectives.[16]

The Lisbon targets are presented in Table 3.1. These targets are the guidelines to achieve the strategic goals for European education and training systems. The indicators and data sources used to measure the progress towards the targets are also shown in the same table.

The indicator for Target 3 adopted by the Council refers to the educational achievement of the 22 year old population ("percentage of those aged 22 who have successfully completed at least upper secondary education"). However, this indicator is considered of limited validity by Eurostat, due to the relatively small sample on which it is based within the Labour Force Survey.[17] Hence, we used a structural indicator based on the educational attainment of the percentage of the population aged 20-24 having completed at least upper secondary education.

One should also note that the indicator for Target 2 refers to an increase in the absolute *number* of graduates in MST, and not to an *increase* in the share of such graduates in the overall population of tertiary education graduates. In other words, the target aims to increase the stock of MST graduates regardless of the evolution of the student population in the European Union.

[16] Council Conclusions of 5 May 2003 on "Reference Levels of European Average Performance in Education and Training (Benchmarks)" (OJ C 134, 7.6.2003).

[17] EC Staff Working Paper "Progress Towards the Common Objectives in Education and Training: Indicators and Benchmarks", January 2004.

DG-EAC specified two additional targets for the present study: one relates to the percentage of young people finishing tertiary education (TE); and another relates to improvements in the quality of education.

As agreed with DG-EAC we measure these two targets as follows. The percentage of students finishing tertiary education will be measured as "tertiary education (ISCED 5-6) graduates as a percentage of population aged 25-34".[18] It has also been agreed to take the value for this indicator in 2000 in the United States as the benchmark to be achieved by 2010 in the European Union.[19] The target for the quality of education will be assessed qualitatively (as specified in the terms of reference of the present study). These additional two targets with their indicators appear at the end of Table 3.1.

Table 3.1: European benchmarks and indicators in education and training

		EU Target	Indicator	Data Source
Lisbon targets*	Target 1	By 2010, an EU average rate of no more than 10% early school leavers should be achieved.	Share of the population aged 18-24 with only lower secondary education or less and not in education or training (structural indicator).	Eurostat (LFS)
	Target 2	The total number of graduates in mathematics, science and technology in the European Union should increase by at least 15% by 2010 while at the same time the level of gender imbalance should decrease.	Total number of tertiary (ISCED levels 5&6) graduates from the Mathematics, Science and Technology fields.	Eurostat
	Target 3	By 2010, at least 85% of 22 year olds in the European Union should have completed upper secondary education.	Percentage of those aged 20-24 who have successfully completed at least upper secondary education (ISCED 3).	Eurostat (LFS)
	Target 4	By 2010, the percentage of low-achieving 15 year olds in reading literacy in the European Union should have decreased by at least 20% compared to the year 2000.	Percentage of 15 year olds with reading literacy proficiency "level 1" and lower.	OECD (PISA)
	Target 5	By 2010, the European Union average level of participation in Lifelong Learning should be at least 12.5% of the adult working age population (25-64 age group)	Percentage of population aged 25-64 participating in education and training in 4 weeks prior to the survey.	Eurostat (LFS)
Additional Targets**	Target 6	By 2010, the percentage of young people finishing tertiary education should have increased (with respect to 2000).	Tertiary education (ISCED 5-6) graduates per 1000 of population aged 25-34.	Eurostat
	Target 7	By 2010, the quality of education should increase.	Qualitatively analysis of the benefits, and the policies and reforms that might contribute to this target.	Eurostat

Note: * Lisbon targets, as described in Council Conclusions of 5 May 2003. ** Target as described in the terms of reference.

[18] It should be noted that due to the way this indicator is recorded graduates above the age 34 will be included in this measure.

[19] The US 2000 value is 53.9%. For comparison purposes we note that this indicator stands at 57.7% in Japan.

3.2 Achievement of the targets

Progress towards the Lisbon targets is assessed on the basis of the targets' indicators and the progress towards their 2010 benchmark values. However, one should note that the European benchmarks are not concrete targets that individual countries should achieve by 2010. Rather, they are defined by the Council as "reference levels of European average performance". National governments were invited by the Council to consider, on the basis of these benchmarks, how, and to which degree, they can contribute, so that the European Union has reached the targets in 2010.

Moreover, the Commission has stressed that the benchmarks remain indicative and it is primarily up to the Member States to take the necessary actions to follow up the conclusions of the Lisbon summit. The Member States have full responsibility for the content and organisation of their education systems.[20]

In Table 3.2 we show the level of the EU-wide aggregate indicators in 2000 (column 1) and the 2010 benchmarks (column 3). As can be seen, the envisaged increase from 2000 to 2010 requires a significant effort for some of the targets.

However, some progress towards achieving the targets has already been made. This is shown in column (2) of Table 3.2, where the current levels of the indicators are also presented (using latest available data).[21]

[20] Communication from the Commission of 20 November 2002 on European benchmarks in education and training: follow-up to the Lisbon European Council [COM(2002) 629] as published by the EU summaries of legislation.

[21] A description of the progress towards targets can also be found in "Progress Towards the Common Objectives in Education and Training ", European Commission Staff Working Paper (2004).

Table 3.2: Indicators and benchmarks

Indicators	EU25 (2000) (1)	EU25 (latest)* (2)	Benchmark (2010)** (3)
Target 1: Percentage of early school leavers	17.2%	15.9% [1]	10.0%
Target 2: Number of graduates in MST	650,000	740,000 [2]	783,000
Target 3: Percentage of population with at least USE	76.4%	76.4% [3]	85.0%
Target 4: Percentage of low-achieving in reading	19.4%	19.8% [4]	15.1%
Target 5: Percentage of population participating in LLL	7.9%	9.4% [5]	12.5%
Target 6: Share of TE graduates in population (per 1000)	40.3‰	49.3‰ [6]	53.9‰

Notes: * EU25 aggregates using latest available data. ** Benchmarks as specified in EC (2005) except for Target 6, where US 2000 figure has been used. [1] 2004 data; provisional figures for DE, IE, IT, UK. [2] EC projection for 2003. [3] 2004 data; provisional 2004 figures for DE, EL, IT; provisional 2003 figures for NL, LU. [4] 2003 data, except UK (2000); EU25 figure does not include CY, EE, LT, MT, SI. [5] 2004 data, except LU (2003). [6] 2003 data, except EL, IT, FI (2002). EU25 figure does not include LU.
Sources: Eurostat (LFS), EC (2005) and PISA (OECD), US Census Bureau.

3.3 Required interventions

Because the Lisbon targets are defined at the EU level, there are different possible ways of achieving them. One option would be that all Member States achieve individually each of the targets.[22] A problem with this option is that the EU as a whole would probably exceed the benchmarks, as some of its Member States have already surpassed some of the benchmarks. An additional problem with this option arises from the fact that some countries might find it very difficult to achieve the benchmarks in the foreseen time period if they were or are currently too far below some of the benchmarks.

An alternative option would be to determine the EU-wide improvement required over 2000-2010 for achieving a certain target, and assume that an effort of this magnitude is undertaken by all Member States. The problem with this option is that it assumes that countries that are already close to meeting the EU benchmark would need to make the same effort than countries that are far below the benchmark.

We believe a more appropriate approach would be one that distinguishes between the group of countries having already achieved the benchmark from the group of countries requiring further action.

[22] Except for Target 2 that is defined as an EU aggregate.

- For those countries that have already achieved the EU benchmark, we assume that no action is required. We will refer to these countries as the "first group of countries".
- Countries that are currently still below the benchmark should aim to achieve the 2010 EU benchmark adjusted for the progress made by the first group of countries. We will call these the "second group of countries".

Because some of the countries in the first group will exceed the benchmark in 2010, the effort required collectively from the second group of countries will be less than in the previous approach and the EU 2010 benchmark will still be achieved. This is because the second group of countries will benefit from the over-achievement of the benchmarks by the first group of countries.

To account for the expected outcomes from the education strategies currently pursued or planned by Member States, we asked them to provide the projected education enrolments and graduates to 2010 under current spending plans. In response, the education authorities of Austria, Belgium, Cyprus, Denmark, Estonia, France, Germany, Ireland, Italy, Lithuania, Malta, Poland, Portugal, Slovenia, Spain, the Netherlands and the United Kingdom provided projections of student numbers and completion rates for individual levels of education (ISCED1-6), under their current policy plans.

Using the information provided by the Member States, we computed the projected 2010 value of each indicator for both groups of countries.[23] For each 2010 benchmark we then computed an adjusted benchmark that would have to be achieved collectively by the second group of countries after taking into account the over-achievement of the first group of countries.

We illustrate this in Table 3.3. In column (1) the 2010 benchmark is shown, as defined by the Lisbon European Council. Column (2) shows the projected 2010 values of the indicators for the first group of countries, and in column (3) we present the values for the second group of countries. Column (4) shows the adjusted benchmark for 2010 for the second group of countries, i.e. the effort needed by the second group of countries so that the EU 2010 benchmark is achieved.[24] Finally, in the last column of Table 3.3 we show the action required by Member States.

Taking Target 6 as an example, we observe that the first group of countries have already achieved an average of 76.7 (per thousand) by 2010, whereas the average for the second group of countries stands currently at 34.5 (per thousand). Since the EU-wide benchmark for 2010 is 53.9 this means that the first group of countries will not need to make any extra effort whereas the

[23] Except in the case of early school leavers, for which we had no information.

[24] The adjusted 2010 benchmarks in column (4) have been constructed such that the population-weighted average of columns (2) and (4) yields column (1).

second group of countries will only need to show a collective improvement in the indicator from 34.5 to 38.4 and the 2010 EU benchmark will be met.

Table 3.3: Improvements required for countries to achieve the Lisbon targets

Targets	Official EU-wide Benchmark 2010 (1)	Indicator (current level)		Adjusted 2010 benchmark	Required action (5)
		"First group of countries" (2)	"Second group of countries" (3)	"Second group of countries" (4)	
Target 1	10.0%	6.8%	18.0%	10.9%	First group of countries: No action required. Second Group of Countries: reduce by 7.1% points school leavers (from 18.0 to 10.9).
Target 2	783,000	740,000			All countries: need to increase the number of MST graduates by 43,000 (from 740,000 to 783,000)
Target 3	85.0%	88.8%	73.1%	84.0%	First group of countries: No action required. Second Group of Countries: increase by 10.9% points USE graduates (from 73.1 to 84.0).
Target 4	15.1%	11.0%	19.6%	15.5%	First group of countries: No action required. Second Group of Countries: reduce by 4.1% points low-achieving readers (from 19.6 to 15.5).
Target 5	12.5%	22.22%	6.04%	9.93%	First group of countries: No action required. Second Group of Countries: increase by 3.89% points LLL (from 6.04 to 9.93).
Target 6	53.9‰	76.7‰	34.5‰	38.4‰	First group of countries: No action required. Second Group of Countries: increase by 3.9 points of TE graduates per 1000 (from 34.5 to 38.4).

4 Methodological approach

The financial net benefits to investing in human capital, taking into account labour market benefits, financing and tax arrangements, are usually summarised in a single measure using the internal rate of return.

As already discussed, the internal rate or return is the discount rate that equalises the real costs of education during the period of study to the real gains from education thereafter.[25]

In their most comprehensive form, private costs include tuition fees and related services, and foregone earnings while in education, while private benefits include higher earnings, and a higher probability of employment.

Analysing the rates of return is particularly relevant for the purpose of this study. It will allow a comparison and ranking of the returns of the investments required to achieve each of the different Lisbon targets. In addition, for each country, one can calculate the rates of returns for individuals, firms and society overall.

The structure of the chapter is the following. In the next section we describe the policy options chosen to achieve the Lisbon targets. In section two we outline the conceptual methodological framework to estimate the internal rates of returns of education. In section three we explain our methodology for computing the private, firm-level and social internal rates of return and we describe the particular factors that one needs to take into account. Such rates of return are computed for each target and for each Member State that needs to make further investments in education to achieve the targets.

4.1 Implementation of the Lisbon targets

The achievement of the Lisbon targets will necessarily require financial investments for additional number of students that need to go through education.

Targets 1, 2, 3, and 6 require an increase in the number of entrants into the different education levels. Obviously, to determine the number of additional entrants at each education level, one needs to take into account the fact that a number of students will not complete their education, i.e. they will drop out.[26] Moreover, one also needs to account for the fact that education typically takes some years to complete. This means that the new entrants in one year will enrol as new students in subsequent years as well until they

[25] The calculation is done in real terms (i.e. constant prices) to avoid counting increases in benefits or costs due to inflation.

[26] For example, Target 3 seeks to increase the number of young people with upper secondary education. Because a number of people are not finishing school, the increase in upper secondary education enrolments will need to overshoot the target.

complete their education. Thus, the impact of additional entrants on the number of graduates will be observed with a lag of some years.

Target 5 refers to participation in lifelong learning and therefore the target is measured as enrolment in training.

Target 4, as we explain below, will also need to account for students failing to improve literacy scores.

The information on new enrolments required to reach each target will be used to compute the required financial investments. The number of graduates will then be used to compute the benefits of the additional education being provided (and achieved).

In the following sections we detail the models used to calculate the increase enrolment needed, and the associated costs and benefits. But first, we review how we translate the Lisbon targets into implementable policies.

4.1.1 Target 1: Reducing the numbers of early school leavers

Target 1 refers to the percentage of the population aged 18-24 with at most lower secondary education and not in further education or training. According to the data available from Eurostat, early school leavers are persons aged 18 to 24 with lower secondary education only and not having received any recent education or training.[27]

Target 1 states that by 2010, "an EU average rate of no more than 10% early school leavers should be achieved".

Our policy option is directed at early school leavers who leave school as soon as they are legally entitled to do so (for example, in the United Kingdom compulsory education is until 16). The policy option assumes that students leaving school after the last year of compulsory education undertake further years of education and graduate from upper secondary education (USE). As a result of higher number of students in education and higher graduates, the number of early school leavers is reduced.[28]

For example, in the United Kingdom it would mean 2 additional years of education for the early school leavers. We assume that the investment is made one and two years after the last year of compulsory education (i.e. 16 and 17 in the United Kingdom). One should note that this action will not

[27] The labour force survey defines as early school leavers persons aged 18 to 24 meeting the following two conditions: the highest level of education or training attained is ISCED 0, 1 or 2 and having declared not having received any education or training in the four weeks preceding the survey (see http://europa.eu.int/comm/eurostat/newcronos/reference/display.do?screen=detailref&language=en&product=STRIND_SOCOHE&root=STRIND_SOCOHE/socohe/sc051).

[28] This assumption has only limited impact in the calculated rates of return. Estimates of the rates of return obtained by changing the assumption to include early students that had left school before the last year of compulsory education are only slightly lower.

immediately improve Target 1 (which is defined in terms of the population aged 18-24). However, after some years, the share of people with additional education will grow and a reduction of early school leavers will be observed in the 18-24 age cohort.

Although this is our preferred option for achieving Target 1, one should note that the definition of this target implies that alternative approaches could be contemplated. A reduction in the number of early school leavers could be achieved by simply providing education or training to a certain share of the 18-24 population. We see two problems with this alternative. The first one is that it is not apparent whether there is a clear advantage of having more people in education if it is just a way of improving the figures. The second problem is that it might become difficult to re-incorporate into education 18-24 year olds who might have left education a number of years ago.

In addition, our preferred approach is efficient as it is closely linked to Target 3. Indeed, raising the number of students in USE will also increase the number of graduates, which is the objective of Target 3.

4.1.2 Target 2: Increase in graduates in mathematics, science and technology (MST), while reducing gender imbalance

Target 2 states that by 2010 "the total number of graduates in mathematics, science and technology in the EU should increase by at least 15%, while at the same time the level of gender imbalance should decrease".

We assume that an increase in the overall number of MST students is required in order to achieve the targeted increase in MST graduates. It is important to note that the increase in new MST entrants has to occur some years before the 2010 benchmark date, with the precise entry date varying across Member States depending on the duration of MST studies in each of them.

4.1.3 Target 3: Increase population with at least upper secondary education

Target 3 states that by 2010 "at least 85% of 22 year olds in the European Union should have completed upper secondary education". As already discussed, due to the weak reliability of the relatively small sample on which this indicator is based we propose analysing the attainment of the percentage of the population aged 20-24 having completed at least USE.

Having defined the new indicator for the target, the new definition is straightforward and reads as follows.

Target 3: by 2010 "at least 85% of 20-24 year olds in the European Union should have completed upper secondary education".

The proposed policy measures are the same as for achieving Target 1, namely, an increase in the number of education years of early school leavers so that they achieve USE. We also need to account for drop-outs. However, we assume that all students not dropping out will have achieved USE after those additional years of education. Again, the share of people with additional education will not be observed immediately. It will take some years before the investment in the cohorts of early school leavers will be reflected in improved educational attainments by the 20-24 age cohort.

4.1.4 Target 4: Low-achieving in reading literacy

Target 4 states that by 2010 "the percentage of low-achieving 15 year olds in reading literacy in the EU should have decreased by at least 20% compared to the year 2000".

The indicator for this variable is taken from the PISA survey and is measured as the percentage of pupils with reading literacy proficiency at level 1 and lower on the PISA reading literacy scale.[29]

There are many ways to improve literacy rates. Since some of the literacy problems might arise at the early stages of child education, some of the proposed solutions to address this problem have focused on better access to reading material (libraries, books, newspapers, etc.) and higher involvement of society in improving children's reading skills (including parents' participation or using advertising, television or new media technologies to make reading more attractive to young people).

The ability to read and understand texts is considered by DG-EAC as a basic requirement for learning and for individuals' personal development and social integration.[30] However, so far no conclusions have been reached on how best to achieve this objective.[31] Nevertheless, it seems clear that literacy should be encouraged at the early stages of children's education.

Although the interventions described above may have a positive impact, we believe that, in the absence of quantitative evidence, it would be difficult for the purpose of the present study to quantify the direct impact on literacy rates of these intervention variables (e.g. how does a higher expenditure on books and libraries translate to higher literacy rates). As an alternative, we assume that literacy rates could be improved with intervention programmes designed

[29] Within the PISA study reading literacy is defined as "understanding, using, and reflecting on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society."

[30] European Commission. Working Committee on Quality Indicators (2000): *European Report on the Quality of School Education: Sixteen Quality Indicators*.

[31] Examples of national initiatives include Germany, where daily newspapers were delivered to pupils for free and the content systematically dealt with by teachers in class; also interesting is a Swedish initiative which encouraged parents of children aged 10 to 12 to spend half an hour per day reading a good book with them. See EC (2000).

to assist children with difficulties in reading and writing. This assumed policy allows us to quantify the cost and benefits of such programmes as their costs and effectiveness are documented in the literature. However, it has to be noted that this is not the only available option for improving literacy rates and, moreover, that the chosen alternative could be complemented with additional measures (such as improving libraries and making them more accessible).

In many Anglo-Saxon countries, there exist reading recovery programmes for the lowest achieving students. These are usually early, short-term intervention programmes to assist children who are having difficulty learning to read and write. Since they were first developed in the 1970s, these programmes have been widely implemented in New Zealand, Britain, Australia, the United States and Canada.[32] A detailed description of the nature of these programmes is presented in Annex 1.

To quantify how much it will cost to achieve Target 4 we assume the following intervention: a Reading Recovery programme is implemented in every country for the 10 year olds.[33] Based on existing literature, we assume that the programme is 75% successful in accelerating students up to the level of their peers.[34] After catching up with their peers, we assume that the individual will be able to continue his education, with the same successful/drop-out rates as the average student. The estimated costs of the programme are also obtained from the literature and are described in Annex 1.

4.1.5 Target 5: Participation in lifelong learning (LLL)

Target 5 states that by 2010, "the EU average level of participation in lifelong learning should be at least 12.5% of the adult working age population (25-64 age group).

The EC views LLL as a central issue not only to competitiveness and employability but also to social inclusion, active citizenship and personal development.[35] LLL has also become a widely shared policy objective within OECD countries and beyond. It is seen as a necessary condition for

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[32] Swartz (1996). Reading Recovery Research Monograph at http://www.stanswartz.com/researchmonograph.htm.

[33] Although many of these reading recovery programmes are directed at pupils of younger ages, there exists in Australia a programme directed at students aged 10-15 years old.

[34] The policy option seems particularly appropriate as the "Special Session of the Education Committee: Pilot review of the Quality and Equity of Schooling Outcomes in Denmark" recommends that "a widespread adoption of Reading Recovery could make a difference in Denmark. In our experience, the sooner those children who have made a poor start can be rehabilitated, so that they proceed along a similar trajectory of progress to their peers, the better the outcome is likely to be" (see OECD, 2004a).

[35] Communication from the Commission of 21 November 2001 on making a European area of lifelong learning a reality [COM(2001) 678] as published by the EU summaries of legislation.

individual success in the labour market and social well-being, as well as a basis for democracy and citizenship.[36]

LLL encompasses learning for personal, civic and social purposes as well as for employment-related purposes. It takes place in a variety of environments in and outside the formal education and training systems.

The aim of this target is to provide people of all ages with equal and open access to high-quality learning opportunities, and to a variety of learning experiences, throughout the European Union. Education systems have a key role to play in making this vision a reality. Indeed, the Commission stresses the need for Member States to transform formal education and training systems in order to break down barriers between different forms of learning.[37]

To implement this target we need to estimate the number of people undertaking LLL that is required to achieve the objective for the 25-64 year olds age group. Our proposed policy option is to increase the number of individuals between 25 and 65 years old that undertake extra LLL to achieve the target of 12.5% of the adult working age population. The total number of additional lifelong learners is allocated equally across the 25-65 cohort.

4.1.6 Target 6: Increase graduates in tertiary education (TE)

Target 6 states that by 2010, "the percentage of young people finishing tertiary education should have increased".

As already noted, this is one of the targets DG-EAC has specified especially for this study.

The corresponding indicator is computed from available Eurostat data and is defined as the total number of graduates divided by the population aged 25-34 years. Because no specific benchmark has been proposed, we benchmark this indicator against the value of the indicator for the United States in 2000.

Our proposed policy measure increases the intake of TE students at the starting university age so that they graduate with a first level post-secondary degree. The starting university age is taken as the year of finishing USE and one year after (for example, at the age of 18 and 19 in the France). Again, because of the likelihood that some of the students will drop out, a higher intake of additional students is required to be able to achieve the target.

4.1.7 Target 7

Target 7 states that by 2010, "the quality of education should increase".

[36] OECD: "The Role of National Qualifications Systems in Promoting Lifelong Learning", http://www.oecd.org/document/16/0,2340,fr_2649_201185_32165840_1_1_1_1,00.html.

[37] Education, Training, Youth: Cooperation Between Member States (http://europa.eu.int/scadplus/leg/en/s19000.htm).

The concept of quality in the education literature is elusive, and no consensus exists among experts about what constitutes quality, nor about how it can be achieved. For this reason, we limit ourselves to a descriptive account of current approaches frequently used in studies focusing on education quality. However, it is important to note that given the inconclusiveness of the current academic debate on the issue of education quality it is not possible to reach firm conclusions about what needs to be done to improve the quality of education in the European Union.

The need for quantitative indicators has meant that the academic literature on the quality of education has usually focused on variables measured at the input or the output stages of education.

Output measures usually include two variables: performance in standardised aptitude tests and labour-market performance of graduates as measured by earnings.[38]

The two input factors that have been at the centre of attention in much of the academic literature are: [39]

- Student-teacher ratio, and
- Class size.

The student-teacher ratio is used as a proxy for the intensity of supervision and student-teacher contact, something at the heart of education success. A lower ratio implies more teaching resources devoted to each student. While the precise manner by which teachers affect education outcomes is not specified, an argument along the lines that the larger the number of teachers, the better they can concentrate on individual students' needs is intuitively attractive.

Class size measures intensity of education in a similar way. Smaller classes allow closer contact between students and teachers and promote participation and interaction. While closely related to student-teacher ratio, class size is arguably a better indicator of education quality. This is because a student-teacher ratio does not capture the distribution of teachers' time between teaching in the classroom and administrative duties, whereas class size provides a more direct measure of the intensity of student-teacher interaction in the classroom.

Increasing the intensity of education as measured by student-teacher ratio and class size should lead to some corresponding increase in the quality of education. Following this line of reasoning, the European Commission lists

[38] See for example Altonji and Dunn (1996), Betts (1995, 1996), Card and Krueger (1992, 1996), Grogger (1996), Gundlach et al. (2001), Hanushek (1986, 2003), and Krueger (1999). Other indicators are occasionally used, usually alongside wages or test scores. For example, Betts (1996) also uses socio-economic status.

[39] Another variable frequently used in empirical studies is expenditure per pupil. However, the link between expenditure and quality has been the object of intensive debate and even criticism (see Hanushek, 1986, 2003).

both measures among its performance indicators for the Lisbon target of "improving the quality of teachers and trainers" (see EC, 2005).

4.2 The internal rate of return

Education is an investment. As we have already seen, the decision to undertake extra education generates costs at the time education is undertaken and subsequently yields a stream of future benefits upon entry to the workforce.

For example, for an individual undertaking a university degree, there is the cost of school fees (and related costs such as books, transport and other expenses) and foregone earnings during the period of study, and the benefit of higher expected net earnings during the individual's subsequent period in the workforce. The relative magnitude of the costs and benefits from acquiring additional education determines the net benefit from the investment.

As already noted, the summary statistic that is generally used to measure the net benefit from investment in education is the internal rate of return. In the present context, this is the rate of interest that equates the present discounted value of the costs and benefits from an investment in education.

Knowing the rate of return to education is useful for several reasons:

- From an individual point of view, information on the private rate of return can assist individuals in deciding whether it is optimal to undertake additional education.
- From a company point of view, the returns in terms of improved skills and higher productivity will identify the benefits of education to companies. Estimates of the rates of return for lifelong learning and learning-on-the job will allow an assessment of whether it is worth for a company to engage in this type of investment.
- From a policy point of view, the social rate of return to education provides one measure that can be applied to assess the relative value of providing extra funds for education. This is particularly relevant in a context with scarce resources which have to be allocated between competing priorities.

To analyse the investments required for achieving the Lisbon targets, we compute private and social rate of return for each of the targets.

The rate of return (r) can be expressed formally as:

$$\sum_{t=1}^{n} C_t /(1+r)^t - \sum_{t=n+1}^{m} B_t /(1+r)^t = 0, \qquad (1)$$

where C_t are the costs during year t of undertaking an education requiring n years of education; B_t are the benefit flows obtained during the m-n years in the work force (m being the retirement age).[40]

The estimation of such rates of return allows us to identify the targets yielding the highest returns.

4.3 Model to estimate benefits and costs of investment in education

A very important aspect of the investment in human capital is the life-span effects of such investment. Implementing the Lisbon agenda might in the near term require a significant increase in government (and also private) spending to be able to reach the targets by 2010. However, such investment will have a lasting impact on wages/productivity/growth, extending well beyond 2010. This is because the qualifications of individuals will be raised permanently and the benefits will accrue as long as the better educated and trained workers are in the labour force.

Our model takes into account the duration of the effects by quantifying (a) the investment required to reach the 2010 targets and sustain them thereafter and (b) the impacts over time of having achieved higher qualifications.

To do this, one needs to project the costs and benefits into the future. For the purpose of this exercise we compute costs and benefits to 2050.

Our model consists of three separate but interlinked modules. The main role of each module is described below (the modules and their interaction with each other is depicted in Figure 4.1):

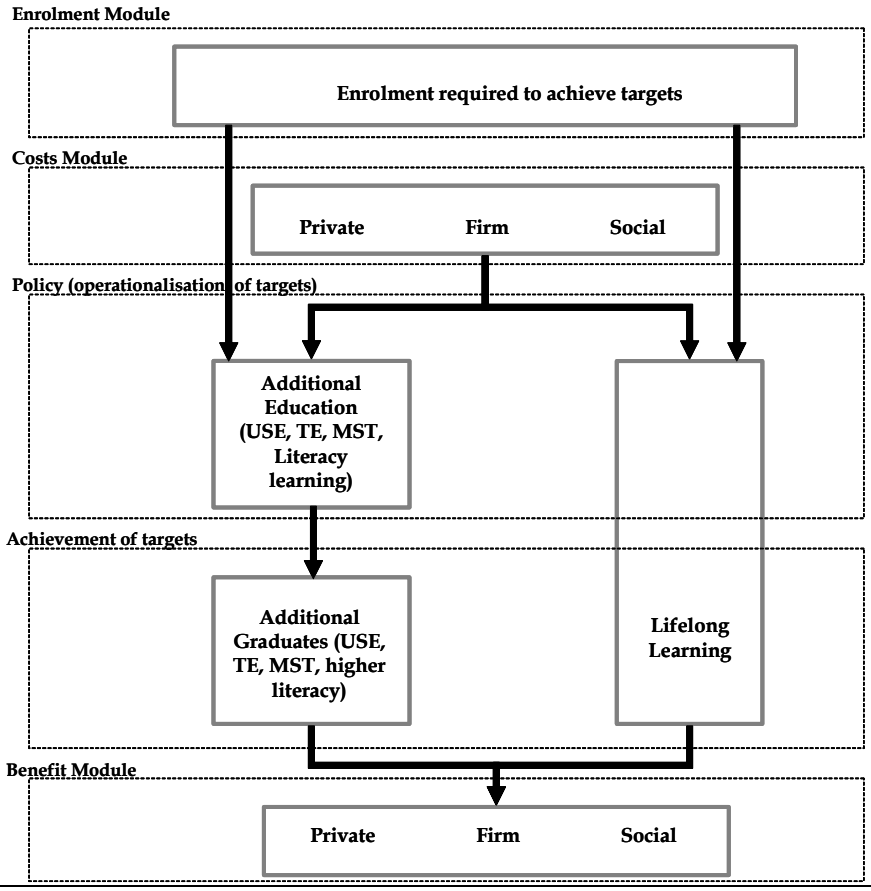
- Enrolment module: is used to project the new entrants, i.e. the increases in education enrolment required to achieve the Lisbon targets, and also to generate the resulting changes in the labour force.

- Cost module: is used to estimate the costs of different achievements of the Lisbon targets. This module quantifies the private, firm and public level financial investments needed to achieve the targets.

- Benefit module: is used to compute the private, firm and social level benefits of different achievements of the Lisbon targets.

[40] It is assumed that there are no costs or benefits before starting education.

Figure 4.1: The population, cost and benefit modules and their interaction



We now describe each of these modules in turn.

The enrolment and labour force module

This module is used to project the additional students that will need to be in education to achieve the Lisbon targets. Our model uses a two-step approach.

First, we construct enrolment projections for the outlook under unchanged policies to account for the current stream of students and graduates. These projections are based, when possible, on forecasts obtained from the education ministries from the Member States.

The additional entrants are then calculated by comparing the current outlook for enrolment levels under unchanged policies with the levels required to achieve each of the Lisbon targets.

There are a number of considerations to take account of in such an exercise. First, one needs to account for the probability of new entrants dropping out

from education. This means that the intake of additional entrants needs to be higher than the one required by indicators targeting graduation.

A further complication arises from the fact that interventions that raise the education enrolment at a certain education level will also raise subsequently enrolment at higher levels of education. For example, if the secondary education enrolment is increased, some of the additional graduates will spontaneously go on to TE. Thus, a scenario increasing the number of students in upper secondary education will necessarily have to take account of the costs from additional students going to TE, and the benefits from the additional TE graduates.[41]

Costs and benefits from undertaking education

There is a wide range of costs and benefits associated with the decision of undertaking education. These are summarised in Table 4.1, overleaf, distinguishing between individual, enterprise and broader economy-wide costs and benefits.

A distinction needs to be made between the private and social rates of return to education. The private rate of return takes into account the costs and benefits to the individual undertaking the education, whereas the social rate of return encompasses the costs and benefits for society as a whole, including the private costs and returns. For an individual, the private rate of return to education will depend on the extra after-tax income gained by investing in extra education, whereas the social rate of return depends on the gain in both after-tax income and tax revenues, and also in spillovers (or in other words, the increase in the value of output in society). A second source of benefits relates to an individual's likely change in labour market activity: acquiring education may also increase an individual's probability of employment (or weeks of employment each year).

We will also compute the rate of return to firms. Firms benefit from society's education attainments, particularly from training and enterprise-specific learning. This helps firms become more productive. Firms also incur some costs of providing education, especially lifelong learning and on-the-job training.

[41] We should note that in some education systems where there is a ceiling on overall enrolment an increase in USE graduates might not have any impact on tertiary enrolment. In our analysis we are implicitly assuming that the tertiary education system is able to absorb these additional USE graduates.

Table 4.1: The costs and benefits of education

	Individuals		Enterprises		Society	
	Costs	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**
LSE	Direct costs of education (tuition fees, and related services)	Future productive and social capabilities Better quality of life	--	Improved skills Behavioural attributes of workers	Costs of provision of education	Higher skill levels Social cohesion Economic Growth Tax returns
USE TE (MST)	Direct costs of education (excluding government subsidies and student benefits) Foregone earnings during education	Skills and qualifications Higher net earnings Higher employability Higher labour market participation Better quality of life	--	Improved skills Increased productivity Behavioural attributes of workers	Costs of provision of education Student subsidies Foregone tax contributions during education	Higher skill levels Social cohesion Economic Growth Tax returns Overall employment Externalities (knowledge spillovers, technological innovation…)
Lifelong learning	Costs of training Foregone earnings during education	Skills and qualifications Higher net earnings Improvement in job tenure	Training levies Lost production time due to learning	Improved skills Enterprise-specific knowledge Increased productivity	Costs of provision of training programmes Foregone tax contributions during education Lost production time due to learning	Higher skill levels Social cohesion Economic Growth Tax returns Overall employment Externalities (knowledge spillovers, technological innovation…)
Literacy	--	Future education and academic success Higher earnings	--	Improved skills Workers with higher qualifications	Costs of training specialised teachers Costs of continuing training for teachers Specialised teachers salaries	Workforce with higher qualifications Higher growth, employment, and externalities.

Source: LE calculations and OECD (1998).

The cost module

As seen, in general, the costs of education include any fees that would have to be paid by the additional students, the ancillary education costs (transport, books, etc) and the opportunity costs of the foregone earnings.

Because we are interested in targets aimed at different education levels, we need to compute costs separately for each of the education streams (LSE, USE, TE, and LLL) and for increasing literacy rates. In the next paragraphs we describe the costs that we include in our model for the various education levels.

The detailed set of private costs is the following.

- For LSE, USE, and TE the costs include: education fees (net of Government subsidies); costs of housing due to education[42], etc.; ancillary education costs (transport, books, etc); and foregone annual labour market earnings during the individual's period of study. The costs are estimated for the time an individual will take to complete each degree.

- For improving literacy the private costs are assumed to be nil as reading recovery programmes are usually fully funded by governments.

The detailed set of costs to firms is the following.

- For LSE, USE, and TE the costs are assumed to be zero for companies, i.e. we assume that the costs of increasing the education population is supported entirely by private individuals and governments.[43]

- For LLL the costs include: the direct costs of training supported by companies and the lost value of production, if learning is undertaken while at work.[44]

The costs to society are the following:

- For LSE, USE, and TE the costs include: total cost of education (including Government subsidies and benefits), ancillary education costs and foregone earnings during the period of study. The duration of education is also taken into account.

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[42] Costs of housing should only cover the extra cost incurred by students due to being in education. However, in many instances, housing will be an extra cost. This is because university education often involves displacement and paying for housing that otherwise could have been free, if the individual had remained at his parents' home.

[43] In our analysis we abstract from any tax increases that may be required to finance the additional education.

[44] This will depend on whether full wage is paid during training periods.

- For LLL the costs include: the total costs of training (supported by individuals and companies) and the lost value while at training (foregone earnings and lost production).

- For improving literacy the social costs include: the costs of specialised teachers for one-to-one lessons and of their intensive professional development, which involves apprenticeship training for one year and continuing training afterwards.

An interesting issue is whether the additional students undertaking education are able to work part-time during their studies and thus reduce their foregone employment income.[45] We have assumed that the additional students will not be working while they are in education. However, later on we provide some sensitivity analysis of changing this assumption.

Another issue arises from the fact that enticements may be required to ensure that the desired increase in the number of people in education materialises. Such enticements could include monetary incentives or non-monetary incentives that, however, will have a monetary cost. As no comprehensive data on such incentives exist at the present time, the costs of these incentives have not been included as part of the total costs in the model.

The benefits module

The private benefits include obviously the expected lifelong additional net earnings that will accrue to the additional students. This is usually referred to as the Mincerian return, and has been estimated by some authors for a number of different countries (see Harmon et al., 2001, for European estimates and Psacharopoulos, 1994, for a worldwide review of returns). To compute this expected gross return, one has to also take account of the increased probability of being employed due to being better educated.

The benefits at the enterprise level include higher productivity, increased profitability and enhanced competitiveness.

Finally, estimates of the social benefits are based on macro-type estimates which include all private benefits, the externalities, the enterprise benefits, the public benefits in terms of higher tax revenues, lower welfare and social-security payments, etc.

Additional, non–monetary private benefits include better personal health, a greater capacity to enjoy leisure, a greater efficiency in making personal choices (Haveman and Wolfe, 2001). Furthermore, private and public benefits of education can also include a later retirement age and a longer productive career thanks to better health and the incentive of higher earnings.

[45] The Eurostudent Report (2005) covers a limited number of EU Member States and shows that, in some cases, a significant number of students work part-time.

These additional private benefits are discussed qualitatively but we do not quantify a related monetary benefit in the model.

The detailed set of private benefits is the following:

- For LSE, USE, and TE the benefits include: the expected lifelong additional earnings - Mincerian returns (i.e. the effect of having additional education relative to not having that additional education for each year during which an individual is in the labour force) net of taxes; an increase in the probability of being employed; and additional non–quantified private benefits of additional education (better personal health, a greater capacity to enjoy leisure, a greater efficiency in making personal choices). Benefits are computed over the working life of the individuals.

- For LLL the benefits include: the increase in the net average salary of the worker over his/her remaining working life; and a higher job tenure probability.

- For improving literacy the benefits are evident but hard to measure. The literature results shows that children with low reading skills are able to progress at the same pace as their peers after participating in reading recovery programmes. It is uncertain how much this literacy improvement contributes to their future academic success, but it is likely that it can be an important stimulus. Each individual would benefit not only from the pleasures of reading and being more able to cope with their daily duties, but the participation will enable them to achieve higher education and hence obtain higher earnings.

The detailed set of benefits to account for in the firm-specific benefits is the following:

- For LSE, USE, and TE the benefits include: the expected increase in productivity due to higher skills.

- For LLL the benefits include: the expected increase in productivity due to a higher enterprise-specific knowledge.

The detailed set of social benefits is the following.

- For LSE, USE, and TE the benefits include: higher economic growth; increased overall employment; and externalities such as knowledge spillovers and technical innovation.

- For LLL the benefits will include: similar benefits as those arising from general education, including higher economic growth.

- For improving literacy the social benefits accrue indirectly from

individuals achieving higher levels of education. The benefits materialise in the form of economic growth, employment, and externalities.

In addition to these benefits, it is important to note two externalities that affect all those in the labour force (current and future).

First, for a given demand for certain skills, an increase in the supply of this type of skills will result in a lower real wage for all the workers with these skills. In contrast, the real wage of the sub-group of workers with the skills of those taking up additional education will go up as the supply of such skills set decreases. In brief, everything else being equal, the achievement of the Lisbon targets will increase the real wage of the low-skilled workers and decrease the real wage of the workers with higher skill levels relative to the outlook under unchanged policies. We will call this effect of additional education on the wages of all workers the "labour market externality".

However, a number of studies have suggested a positive link between human capital and business productivity in the long run. This long-term increase would be explained by the contribution of human capital to the adoption of new technologies and innovation for the continuous improvement of existing production processes (de la Fuente and Cicone, 2002). As a result, in the longer term there would be an increase in the demand for workers with technological skills. These effects could counteract the fall in the real wages caused by the increase in the number of high-skilled workers.

There exists a second, positive externality whereby a worker's schooling enhances not only her/his own productivity but also that of her/his co-workers (Lucas, 1988). This arises from learning by imitation, etc. Hence, an increase in the number of individuals with a particular level of education will also increase the productivity of people with different education levels.

The internal rate of return

To obtain the private, firm-level, and social internal rates of return, we solve equation (1) after inclusion of all private, firm-level and social costs and benefits, as described in the previous paragraphs.

In the next chapter we present the detailed results of the model that has been described in the present chapter.

5 Rates of return to investments in various forms of education

In this chapter we report the estimated rates of return of the different investments required to achieve the Lisbon targets. But first, we present for each type of education our estimates of the number of additional entrants required to achieve each of the Lisbon targets, and the associated costs and benefits of these additional enrolments. These estimates are then used to calculate private and social rates of return for the different financial investments.

The model used for the computations of the costs and benefits takes into account the specific characteristics of each Member States' education system, such as length of education, years of compulsory education, and probability of dropping out from education. The model also incorporates the positive effects of education on employment and takes account of taxes in the computation of the private returns. Details on the data and assumptions used in the model are provided in Annex 2.

The structure of this chapter is the following. In the first section, we report the size of the additional entrants required to meet the different benchmarks in 2010. In the next section, the costs associated with the number of additional entrants are reported for their subsequent years of education. Our estimates of the rates of return are presented in the last section for all Member States except Luxembourg (for which much of the required data was unavailable).

5.1 Additional number of students required for achieving the targets

As already seen in Chapter 3, not all countries need to take action to meet the targets, as some of them have already exceeded the 2010 benchmark or will likely do so in the near future. In Table 5.1 we separate the countries in two groups depending on whether or not they will need to take action to achieve the different targets.

We observe from Table 5.1 that most countries require policy action to achieve Target 2. As already explained, in our study the additional number of mathematics, science and technology (MST) graduates required in the EU to achieve Target 2 has been shared across all Member States (using population weights). In the United Kingdom no action is required as the number of MST graduates will already increase by at least the number required for achieving the 2010 target without any additional policy action (see also Table 5.3).

Table 5.1: Actions required to achieve the targets.

Targets*	No action required	Action required
Target 1-3	CZ, LT, HU*, AT, PL, SI, SK, FI, SE	BE, DK, DE, EE, EL, ES, FR, IE, IT, CY, LV, MT, NL, PT, UK
Target 2	UK	All countries except UK
Target 4	IE, NL, FI, SE, UK	BE, CZ, DK, DE, EL, ES, FR, IT, LV, HU, AT, PL, PT, SK
Target 5	DK, NL, AT, SI, FI, SE, UK	BE, CZ, DE, EE, EL, ES, FR, IE, IT, CY, LV, LT, HU, MT, PL, PT, SK
Target 6	BE, DK, EE, ES, FR, IE, LV, LT, HU, NL, PL, PT, SI, FI, SE, UK	CZ, DE, IT, CY, MT, AT, SK

Note: * Target 1: Early school leavers; Target 2: MST graduates per 1000 of the corresponding population aged 20-29; Target 3: Youth education attainment level – total ; Target 4: Reading proficiency of 15-year-olds ; Target 5: Lifelong learning ; Target 6: Graduates (ISCED 5-6) of all ages per 1000 of the population aged 25-34. No data available for Target 2 for EL. No data available for Target 4 for EE, CY, LT, MT, SI. No data available for Target 6 for EL. * As a result of a recent change in Hungary students will remain in education until the end of the school year in which they turn 18 years of age (see footnote 60). Presumably, this will make Hungary achieve Targets 1 and 3 in 2010.

The additional entrants required to achieve the different targets are presented in Table 5.2 to Table 5.5 for each country.[46]

The number of entrants in upper secondary education (USE) has to rise in fifteen countries in order to meet Targets 1 and 3 (see Table 5.2). Europe-wide, more than a million additional entrants are required every year up to 2010. The bulk of those will have to come from the most populous countries. Spain will have to train the highest additional students, more than a quarter of a million each year. Similar increases will be required in Germany. On the other hand, a number of smaller countries, such as Belgium, Cyprus, Denmark, Estonia, Hungary, Ireland and Malta, only have to train a few thousand each.

It is important to note that, in some countries, the required number of additional entrants is close to 100% of the early school leavers in the age cohorts that require additional education. This is due to the fact that the target is measured in terms of the performance of a cohort different from the one targeted by the policy action. For example, Target 3 is defined for the 20-24 cohort: improving the education of early school leavers in the 15-17 cohort in 2005 will only increase the number of graduates in the 20-22 cohort after 5 years.

Moreover, we have found that in some Member States it is not possible to reach the benchmark in time. For Target 3, this is because the benchmark is defined in terms of the population aged 20-24, and the policy option assumes

[46] For Targets 1 and 3, Target 5 and Target 6, the policy action assumes that through 2005 and 2009 the same proportion of population enters education. Similarly, a constant proportion is used from 2010 onwards.

that the investments are made in students in one and two years after the last year of compulsory education. As a result, for some countries, the share of additional USE graduates achieved in 2010 is not sufficient to reach the benchmark even if a 100% of students in one and two years after the last year of compulsory education are put into education (a similar argument applies to Target 1). For example, in Portugal Target 1 can only be achieved in 2011, and Target 3 in 2013. In Malta, although Target 1 can be achieved in 2010, Target 3 can only be achieved in 2011. In Italy, Target 3 can be achieved in 2012.

Finally, in Table 5.2we note that an important effort will be needed up to 2010, but from 2010 onwards a lower number of entrants will be required to sustain the target in the future. This is also a consequence of the definition of the indicator. Once Target 3 is met for the 20-24 cohort, sustaining the indicator in subsequent years will require maintaining a share of new graduates in the cohort of the 20-year old population.

Table 5.2: Number of additional entrants in USE required to achieve Targets 1 and 3. (2005-2010).

Member State	2005	2006	2007	2008	2009	2010
BE	8,984	9,134	9,291	9,284	9,074	2,921
DK	9,215	9,615	9,970	10,184	10,466	5,505
DE	226,877	226,712	225,398	217,026	203,622	111,379
EE	3,425	3,391	3,227	2,909	2,655	1,265
EL	11,510	11,402	11,493	11,272	11,053	5,311
ES	263,518	261,367	260,830	259,189	256,246	122,245
FR	68,488	68,439	68,261	67,888	66,979	33,520
IE	2,115	2,056	2,055	2,049	1,997	1,245
IT	149,881	150,585	151,336	150,967	148,351	81,912
CY	2,447	2,408	2,430	2,508	2,533	1,261
LV	10,332	9,959	9,480	8,874	7,929	2,093
MT	5,135	5,253	5,263	5,184	5,110	2,669
NL	55,863	56,142	57,718	58,946	58,647	31,435
PT	91,509	91,299	91,285	89,854	87,793	63,452
UK	146,941	147,172	148,029	149,088	147,459	72,086
Total	**1,056,240**	**1,054,934**	**1,056,066**	**1,045,222**	**1,019,914**	**538,299**

Note: no action required by AT, CZ, FI, HU, LT, PL, SK, SI, SE. * Target 3 can be achieved in 2012. ** Target 1 achieved in 2010 and Target 3 achieved in 2011. *** Target 1 achieved in 2011 and Target 3 achieved in 2013.
Source: LE calculations.

In Table 5.3 we show the number of entrants required to achieve the benchmark of graduates in MST. We note that the target is defined in terms of total stock of MST graduates to be achieved in 2010 and maintained in the future. Hence, in cases where a country's population is in decline it might mean an increase in the proportion of people undertaking MST studies.

The results of two countries are noteworthy. First, in the case of Lithuania, we observe that no additional entrants are required for all the years up to 2010 but that in 2010 118 entrants are required. This is because this country does only need an additional number of MST graduates from 2015 onwards. Since higher education in Lithuania takes 5 years, this means that additional entrants will be required in 2010 to reach the number of graduates in 2015.

The situation in Sweden is different. This country requires additional MST graduates in 2009 and 2010 but not afterwards. This means that additional entrants in MST studies will be required only in 2005 and 2006, since Target 2 will be achieved in 2011 without any further action.

Table 5.3: Number of additional entrants in MST studies required to achieve Target 2. (2005-2010).

Member State	2005	2006	2007	2008	2009	2010
BE	1,248	1,482	1,435	1,361	1,264	1,193
CZ	3,716	4,387	4,603	4,750	4,957	5,122
DK	1,439	1,508	1,402	1,213	962	681
DE	4,282	5,356	5,123	5,754	6,740	7,631
EE	63	81	82	111	147	209
ES	24,400	27,683	30,473	32,841	34,794	36,370
FR	3,200	4,419	5,662	7,098	8,697	9,796
IE	1,047	1,493	1,855	2,207	2,561	2,863
IT	28,984	30,267	31,376	32,334	33,280	34,184
CY	40	58	58	59	54	58
LV	48	77	70	98	156	284
LT	0	0	0	0	0	118
HU	2,839	2,980	3,079	3,155	3,229	3,309
MT	54	66	66	65	65	66
NL	1,818	1,651	1,458	1,238	1,018	841
AT	784	905	877	855	852	816
PL	6,127	7,157	8,272	9,981	12,147	14,319
PT	4,615	5,522	6,092	6,605	7,124	7,576
SI	508	657	767	883	1,008	1,118
SK	1,087	1,387	1,520	1,655	1,820	1,986
FI	756	702	669	666	720	732
SE	349	8	0	0	0	0
Total	**87404**	**97846**	**104939**	**112929**	**121595**	**129272**

Notes: no data available for EL; no action required by UK.
Source: LE calculations.

Fourteen Member States have to take special measures to improve low-achieving in reading among 15-year-olds (Table 5.4). The number of pupils that need reading recovery training varies between less than one thousand every year (in Denmark and Latvia) to around 75,000 (in Germany). Current figures on low-achieving 15-year-olds are not available for Cyprus, Estonia, Lithuania, Malta and Slovenia.

Table 5.4: Number of students required to take reading recovery programmes to achieve Target 4. (2005-2010).

Member State	2005	2006	2007	2008	2009	2010
BE	3,732	3,713	3,751	3,754	3,711	3,694
CZ	5,592	5,016	4,720	4,709	4,688	4,621
DK	996	994	961	958	939	938
DE	73,484	72,859	75,440	77,087	75,144	73,935
EL	14,481	14,508	14,190	13,990	13,523	13,571
ES	31,902	31,488	31,330	31,262	31,552	32,324
FR	19,571	19,964	20,151	20,004	20,160	20,568
IT	61,737	61,282	61,547	61,245	61,562	62,327
LV	765	699	640	609	596	629
HU	7,670	7,511	7,077	6,665	6,492	6,330
AT	6,715	6,512	6,554	6,265	6,096	5,879
PL	8,205	7,757	7,549	7,203	6,929	6,735
PT	9,329	9,504	9,470	9,359	9,427	9,942
SK	8,268	7,666	7,530	7,266	7,082	6,988
Total	**252,447**	**249,473**	**250,910**	**250,376**	**247,901**	**248,481**

Notes: no data available for EE, CY, LT, MT, SI; no action required by IE, NL, FI, SE, UK.
Source: LE calculations.

The number of additional lifelong learning (LLL) participants necessary to achieve Target 5 is shown in Table 5.5. The additional number of workers under LLL is close to 8 million at the EU level. This extra effort could be achieved by gradually increasing the number of LLL participants about 1.3 million each year from 2005 to 2010.

Table 5.5: Number of additional LLL participants required to achieve Target 5. (2005-2010).

Member State	2005	2006	2007	2008	2009	2010
BE	3,970	7,981	12,055	16,156	20,243	24,325
CZ	35,561	71,433	107,419	143,453	179,057	214,434
DE	192,069	382,114	570,963	761,800	951,981	1,142,377
EE	3,802	7,604	11,364	15,160	19,053	22,979
EL	61,309	123,477	187,309	252,129	317,942	383,195
ES	194,810	397,818	607,165	817,120	1,028,425	1,239,586
FR	111,115	223,995	338,869	454,848	570,905	687,955
IE	9,749	19,936	30,529	41,463	52,647	64,068
IT	169,306	338,625	508,570	678,628	848,463	1,018,334
CY	407	833	1,276	1,735	2,216	2,712
LV	1,685	3,354	5,008	6,669	8,358	10,065
LT	10,224	20,439	30,583	40,729	51,058	61,612
HU	49,848	99,906	150,120	199,948	249,609	298,620
MT	1,805	3,673	5,610	7,630	9,664	11,665
PL	151,052	305,083	462,203	623,830	790,094	959,269
PT	49,205	99,362	150,364	201,880	253,486	305,090
SK	26,335	53,215	80,593	108,468	136,789	165,385
Total	**1,072,252**	**2,158,848**	**3,260,000**	**4,371,646**	**5,489,990**	**6,611,671**

Note: no action required by DK, NL, AT, SI, FI, SE, UK.
Source: LE calculations.

The required number of additional entrants taking up tertiary education (TE) is shown in Table 5.6. Overall, additional TE entrants at the EU-level have to increase by more than 300,000 every year to reach the benchmark. Many countries have already surpassed the benchmark and action is required by only a relatively small number of countries. Italy is to provide half of these additional enrolment and Germany another third. The remainder is split between five countries: Austria, Cyprus, Czech Republic, Malta, and Slovakia. Malta requires very few additional enrolments.

Table 5.6: Number of additional entrants in TE required to achieve Target 6. (2005-2010).

Member State	2005	2006	2007	2008	2009	2010
CZ	26,493	26,274	25,754	25,399	25,667	27,481
DE	97,183	89,157	98,640	104,581	100,100	100,638
IT	174,008	183,243	176,073	172,167	176,027	168,434
CY	1,137	1,125	1,134	1,128	1,110	1,330
MT	30	30	31	32	32	31
AT	19,294	20,061	20,235	20,482	20,644	23,391
SK	872	868	840	808	800	775
Total	**319,017**	**320,758**	**322,707**	**324,597**	**324,380**	**322,080**

Notes: no data available for EL; no action required by BE, DK, EE, ES, FR, IE, LV, LT, HU, NL, PL, PT, SI, FI, SE, UK.
Source: LE calculations.

Gender imbalance

Target 2 also specifies that gender imbalance should be reduced among MST graduates. Table 5.7 shows the percentage share of MST female graduates in total MST graduates in column (1). We observe that in some countries the share exceeds 40% (Estonia, Latvia, Lithuania, and Portugal). The change in the share required for Member States to achieve a perfect balance is shown in column (2). For example, in Austria, the share of females MST graduates has to increase by 29% points to achieve a 50% balance. Column (3) displays the change required to achieve a 1/3 balance. In this later case, we observe that in some countries the share of female MST graduates already exceeds 1/3 and therefore no action would be required.

Table 5.7: Reduction of gender imbalance in MST graduates

	Female MST as % of total graduates		
Member State	**2005 (1)**	**Required improvement to achieve 1/2 (2)**	**Required improvement to achieve a 1/3 (3)**
BE	24%	26%	9%
CZ	29%	21%	5%
DK	29%	21%	5%
DE	23%	27%	10%
EE	41%	9%	No action required
ES	31%	19%	2%
FR	30%	20%	3%
IE	35%	15%	No action required
IT	36%	14%	No action required
CY	29%	21%	5%
LV	40%	10%	No action required
LT	37%	13%	No action required
HU	29%	21%	5%
MT	39%	11%	No action required
NL	18%	32%	15%
AT	21%	29%	12%
PL	35%	15%	No action required
PT	41%	9%	No action required
SI	25%	25%	9%
SK	33%	17%	No action required
FI	28%	22%	6%
SE	34%	16%	No action required
UK	33%	17%	0%*

Notes: no data available for EL, LU. * The UK gender imbalance is 33.0%, hence only a very slight increase is required to achieve a one-third female share of total MST graduates.
Source: LE calculations.

5.2 Expenditure

Table 5.8 to Table 5.13, below, show the total costs that would need to be incurred by countries to achieve the Lisbon targets. The amount each country would need to spend is determined by the required additional enrolments and the characteristics of the national education system (such as the cost per student, the length of education and the probability of students dropping out from education).[47]

[47] Estimates of the direct financial costs of education are based on data on private and government expenditure on secondary education taken from the OECD's *Education at a Glance*. The OECD figures provide average (total and private) cost per student and are used in our model as an approximation of the marginal costs caused by the new enrolments required to achieve Target 1.[47] A detailed description of the data and assumptions is presented in Annex 2.

We note that in all the countries the costs show an increasing trend for some years and then stabilise. This reflects the length of education. Students entering education in one year will remain in education for subsequent years until they finish. Hence, in 2005, the total costs will only include the costs of the first year of additional entrants, but, in 2006, the total costs will include the first year of additional entrants plus the costs of the second year of the students from the previous year.

Private costs

Private costs are separated into the costs borne by individuals and their families, and foregone earnings during the time spent in education. These costs are shown in Table 5.8 for Targets 1 and 3.

The total private costs of achieving Targets 1 and 3 for the EU amount to €1.1 and €2.2 billon in 2005 and 2006 and around €2.8 billion for the remaining years up to 2010. From 2010 onwards, the investment required is slightly lower as some of the graduates will already be observed for the 18-24 age cohort. The amount of foregone earnings is much higher, reaching a peak of about €23 billion in 2009.

Table 5.8: Private costs of achieving Targets 1 and 3 (USE). Private expenditure in € thousands (foregone earnings in parentheses)

Member State	2005	2006	2007	2008	2009	2010
BE	5,465 (64,234)	10,714 (125,441)	15,766 (186,727)	16,091 (189,365)	16,199 (190,721)	12,300 (145,077)
DK	14,041 (50,020)	28,977 (103,118)	44,762 (159,763)	46,730 (166,520)	48,546 (173,004)	41,881 (149,324)
DE	521,309 (2,122,621)	1,045,978 (4,233,196)	1,571,347 (6,351,376)	1,563,789 (6,338,988)	1,524,549 (6,170,725)	1,265,362 (5,121,839)
EE	605 (6,038)	1,186 (12,009)	1,720 (17,430)	1,646 (16,587)	1,533 (15,500)	1,192 (12,045)
EL	2,941 (77,771)	5,820 (153,914)	8,691 (228,558)	8,716 (230,074)	8,711 (229,790)	7,143 (188,283)
ES	256,394 (1,790,683)	488,488 (3,395,503)	490,930 (3,417,395)	493,713 (3,438,909)	494,184 (3,439,108)	359,404 (2,502,129)
FR	50,653 (522,941)	99,582 (1,027,265)	100,408 (1,026,875)	100,999 (1,039,170)	101,037 (1,038,386)	75,370 (773,629)
IE	993 (34,505)	1,904 (65,799)	1,897 (65,238)	1,912 (66,095)	1,903 (65,666)	1,527 (52,684)
IT	37,727 (1,228,662)	75,747 (2,464,135)	114,075 (3,714,282)	152,427 (4,961,919)	153,537 (4,997,317)	136,909 (4,456,889)
CY	1,041 (25,354)	1,975 (48,038)	2,840 (68,755)	2,897 (70,388)	2,976 (72,237)	2,474 (60,034)
LV	1,881 (15,680)	3,638 (31,457)	5,254 (45,094)	6,709 (57,171)	6,345 (54,466)	4,936 (42,268)
MT	2,156 (41,299)	4,175 (79,266)	4,266 (80,651)	4,279 (81,363)	4,258 (80,773)	3,194 (60,572)
NL	29,951 (563,735)	59,801 (1,117,698)	61,409 (1,149,095)	63,548 (1,190,977)	64,682 (1,210,506)	49,831 (932,980)
PT	5,706 (546,084)	10,638 (1,008,374)	14,920 (1,412,439)	14,966 (1,422,655)	14,903 (1,413,384)	13,275 (1,259,186)
UK	149,445 (1,563,354)	288,035 (2,990,456)	292,021 (3,058,929)	296,866 (3,099,123)	299,128 (3,120,576)	219,973 (2,298,475)
Total	**1,080,308 (8,652,981)**	**2,126,658 (16,855,669)**	**2,730,306 (20,982,607)**	**2,775,288 (22,369,304)**	**2,742,491 (22,272,159)**	**2,194,771 (18,055,414)**

Notes: no action required by CZ, LT, AT, PL, SI, SK, FI, SE.
Source: LE calculations.

The private costs of achieving the MST target are shown in Table 5.9. As in the case of the previous table, the costs show in general an increasing trend, reflecting the length of education. For example, in 2006 total costs are due to additional entrants and to students progressing from the previous year. The cost profile for Lithuania and Sweden reflect the special pattern of the number of additional entrants.

The EU-wide total private costs of achieving Target 2 are smaller than for Targets 1 and 3, mainly because Target 2 requires a smaller amount of entrants. The total private costs start at €24 million in 2005 and reach €116 million in 2010. The foregone earnings reach €6 million in 2010.

Table 5.9: Private costs of achieving Target 2 (MST graduates). Expenditure in € thousands (foregone earnings in parentheses).

Member State	2005	2006	2007	2008	2009	2010
BE	288 (14,938)	602 (30,898)	873 (44,980)	1,100 (56,718)	1,102 (56,702)	1,053 (54,244)
CZ	183 (17,279)	382 (35,856)	573 (53,553)	754 (70,740)	811 (75,997)	851 (79,703)
DK	1,478 (25,876)	2,925 (51,024)	4,162 (72,594)	5,114 (89,307)	4,674 (81,558)	3,914 (68,312)
DE	832 (65,199)	1,821 (141,686)	2,700 (209,258)	3,648 (284,135)	4,128 (320,900)	4,608 (358,048)
EE	4 (204)	9 (459)	13 (718)	20 (1,054)	25 (1,334)	33 (1,769)
ES	4,940 (274,994)	10,396 (578,633)	16,258 (905,769)	22,435 (1,249,158)	28,835 (1,605,661)	31,381 (1,747,678)
FR	591 (38,804)	1,347 (88,235)	2,259 (147,206)	3,351 (219,243)	4,274 (279,365)	5,179 (338,267)
IE	474 (24,724)	1,143 (59,510)	1,964 (102,390)	2,933 (152,819)	3,631 (189,180)	4,279 (222,982)
IT	12,899 (454,025)	24,545 (868,489)	35,063 (1,248,047)	44,567 (1,577,331)	53,214 (1,886,801)	55,463 (1,967,869)
CY	4 (560)	9 (1,338)	14 (2,044)	18 (2,708)	19 (2,874)	19 (2,905)
LV	3 (119)	8 (311)	12 (474)	18 (707)	24 (985)	38 (1,523)
LT	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (297)
HU	343 (16,453)	692 (33,131)	1,042 (49,823)	1,391 (66,657)	1,739 (83,260)	1,809 (86,616)
MT	5 (643)	11 (1,371)	16 (2,058)	21 (2,631)	22 (2,760)	22 (2,802)
NL	635 (30,035)	1,178 (55,512)	1,623 (76,557)	1,967 (92,818)	2,213 (104,378)	1,924 (90,756)
AT	79 (11,448)	162 (23,535)	233 (33,795)	295 (42,826)	301 (43,824)	297 (43,095)
PL	224 (18,131)	482 (39,010)	775 (63,137)	1,127 (91,402)	1,553 (126,142)	1,864 (151,477)
PT	278 (38,709)	570 (79,007)	856 (118,997)	1,132 (157,321)	1,261 (175,078)	1,373 (190,839)
SI	52 (3,024)	115 (6,662)	184 (10,669)	259 (15,028)	306 (17,783)	351 (20,418)
SK	50 (3,274)	113 (7,477)	180 (11,931)	252 (16,556)	287 (18,915)	317 (20,890)
FI	372 (13,623)	703 (25,731)	1,006 (36,841)	1,298 (47,521)	1,607 (58,827)	1,617 (59,214)
SE	309 (8,261)	267 (7,087)	224 (5,938)	189 (5,013)	4 (108)	0 (0)
Total	**24,043** **(1,060,323)**	**47,480** **(2,134,962)**	**70,030** **(3,196,779)**	**91,889** **(4,241,693)**	**110,030** **(5,132,432)**	**116,399** **(5,509,704)**

Note: no data available for EL; no action required by UK.
Source: LE calculations.

Reading Recovery programmes are provided by the government for free to individuals. Thus, no private costs are incurred for Target 4, and there are no foregone earnings, as the programme is offered as part of compulsory education.

LLL training is provided by firms and no costs are incurred by individuals.

Finally, private costs and foregone earnings are shown in Table 5.10 for Target 6. The total private costs for the EU amount to almost €1 billion in 2005. The private costs rise steadily to €3.5 billion in 2010 and stabilise thereafter. The amount of foregone earnings grows to about €14 billion.

Table 5.10: Private costs of achieving Target 6 (TE). Expenditure in € thousands (foregone earnings in parentheses)

Member State	2005	2006	2007	2008	2009	2010
CZ	11,875 (111,304)	22,512 (209,741)	31,903 (295,903)	40,253 (375,227)	40,373 (375,654)	41,442 (385,432)
DE	171,751 (1,308,029)	317,932 (2,402,886)	471,768 (3,550,624)	626,591 (4,741,183)	637,908 (4,816,354)	660,425 (4,984,685)
IT	703,970 (2,021,787)	1,345,871 (3,892,509)	1,868,247 (5,446,574)	2,302,325 (6,661,012)	2,693,946 (7,813,066)	2,692,147 (7,815,068)
CY	979 (15,120)	1,861 (28,778)	2,674 (41,316)	3,411 (52,713)	3,423 (52,907)	3,643 (56,298)
MT	26 (330)	49 (634)	71 (931)	91 (1,188)	93 (1,217)	95 (1,240)
AT	17,620 (264,061)	34,102 (512,377)	49,038 (733,873)	62,679 (939,705)	64,284 (963,889)	67,995 (1,018,835)
SK	367 (2,259)	721 (4,520)	1,052 (6,606)	1,359 (8,470)	1,343 (8,410)	1,319 (8,254)
Total	**906,588** **(3,722,890)**	**1,723,048** **(7,051,445)**	**2,424,753** **(10,075,827)**	**3,036,709** **(12,779,498)**	**3,441,370** **(14,031,497)**	**3,467,066** **(14,269,812)**

Note: no data available for EL; no action required by BE, DK, EE, ES, FR, IE, LV, LT, HU, NL, PL, PT, SI, FI, SE, UK.
Source: LE calculations.

Public costs

Public costs have been broken down by public expenditure (government expenditure only) and the foregone tax revenue from people who are in education and would have been working otherwise. Public costs for USE can be seen in Table 5.11.

The total public costs of achieving Targets 1 and 3 for the EU as a whole amount to €18.6 billion in 2008 and 2009. But, from 2010 onwards, the investment required is slightly lower because the indicator is already improving, as some of the new enrolments of previous years are already graduating. In the same table we also show the foregone tax revenues, which are the foregone taxes of people undertaking education who would have been working otherwise. The amount of foregone taxes reaches a peak of about €10 billion in 2008.

Table 5.11: Public costs of achieving Targets 1 and 3 (USE). Expenditure in € thousands (foregone tax revenue in parentheses)

Member State	2005	2006	2007	2008	2009	2010
BE	65,128 (52,204)	127,678 (101,949)	187,893 (151,758)	191,760 (153,902)	193,051 (155,003)	146,580 (117,907)
DK	105,304 (35,010)	217,327 (72,174)	335,716 (111,821)	350,475 (116,550)	364,091 (121,089)	314,107 (104,515)
DE	1,844,940 (1,442,763)	3,701,768 (2,877,338)	5,561,076 (4,317,083)	5,534,328 (4,308,662)	5,395,457 (4,194,293)	4,478,181 (3,481,357)
EE	4,805 (1,832)	9,419 (3,644)	13,663 (5,288)	13,071 (5,033)	12,174 (4,703)	9,464 (3,655)
EL	31,298 (15,505)	61,941 (30,686)	92,492 (45,567)	92,762 (45,869)	92,704 (45,813)	76,021 (37,538)
ES	1,493,870 (421,337)	2,846,151 (798,942)	2,860,381 (804,093)	2,876,595 (809,155)	2,879,337 (809,202)	2,094,052 (588,736)
FR	574,976 (190,559)	1,130,371 (374,335)	1,139,751 (374,192)	1,146,459 (378,673)	1,146,895 (378,387)	855,541 (281,910)
IE	12,387 (6,402)	23,758 (12,208)	23,663 (12,104)	23,855 (12,263)	23,743 (12,183)	19,058 (9,775)
IT	1,082,424 (472,995)	2,173,218 (948,612)	3,272,881 (1,429,879)	4,373,233 (1,910,178)	4,405,066 (1,923,805)	3,928,015 (1,715,758)
CY	10,442 (1,705)	19,813 (3,231)	28,481 (4,624)	29,059 (4,734)	29,847 (4,858)	24,819 (4,037)
LV	14,940 (6,289)	28,890 (12,616)	41,721 (18,085)	53,277 (22,928)	50,388 (21,844)	39,200 (16,952)
MT	21,623 (8,221)	41,879 (15,779)	42,793 (16,055)	42,918 (16,196)	42,713 (16,079)	32,040 (12,058)
NL	341,618 (295,044)	682,083 (584,973)	700,421 (601,406)	724,818 (623,326)	737,758 (633,547)	568,370 (488,297)
PT	416,297 (108,761)	776,141 (200,833)	1,088,550 (281,308)	1,091,964 (283,343)	1,087,331 (281,497)	968,543 (250,786)
UK	813,524 (505,188)	1,567,959 (966,347)	1,589,659 (988,474)	1,616,034 (1,001,462)	1,628,345 (1,008,394)	1,197,453 (742,738)
Total	**6,833,576 (3,563,815)**	**13,408,396 (7,003,667)**	**16,979,141 (9,161,737)**	**18,160,608 (9,692,274)**	**18,088,900 (9,610,697)**	**14,751,444 (7,856,019)**

Notes: no action required by CZ, LT, AT, PL, SI, SK, FI, SE.
Source: LE calculations.

The public costs of achieving the MST target are shown in Table 5.12. The pattern for Lithuania and Sweden is similar to the one described for the private costs (see Table 5.9).

The total public costs of achieving Target 2 for the EU amount to €232 million in 2010. The foregone tax revenues are the foregone taxes of people undertaking education that would have been working otherwise and grows to about €3.7 billion in 2010.

Table 5.12: Public costs of achieving Target 2 (MST). Expenditure in € thousands (foregone tax revenue in parentheses).

Member State	2005	2006	2007	2008	2009	2010
BE	1,055 (19,601)	2,204 (40,696)	3,197 (59,166)	4,027 (74,577)	4,033 (74,608)	3,855 (71,349)
CZ	770 (11,903)	1,607 (24,773)	2,411 (37,081)	3,170 (48,861)	3,411 (52,539)	3,579 (55,114)
DK	3,420 (39,799)	6,769 (78,633)	9,630 (111,875)	11,833 (137,540)	10,815 (125,662)	9,057 (105,244)
DE	3,489 (70,887)	7,632 (154,437)	11,314 (228,409)	15,290 (309,586)	17,302 (349,896)	19,310 (390,446)
EE	14 (179)	32 (402)	49 (626)	72 (922)	91 (1,165)	121 (1,545)
ES	10,510 (149,684)	22,118 (314,982)	34,591 (492,805)	47,731 (679,852)	61,349 (873,841)	66,766 (951,055)
FR	2,208 (32,251)	5,034 (73,450)	8,441 (122,892)	12,517 (182,586)	15,969 (232,810)	19,348 (282,000)
IE	954 (12,458)	2,297 (29,998)	3,949 (51,582)	5,896 (77,009)	7,299 (95,333)	8,602 (112,355)
IT	15,348 (269,171)	29,206 (513,951)	41,722 (737,038)	53,030 (933,345)	63,320 (1,115,759)	65,995 (1,163,419)
CY	14 (165)	34 (393)	52 (601)	69 (796)	73 (844)	74 (854)
LV	11 (136)	28 (354)	44 (543)	65 (808)	90 (1,124)	139 (1,740)
LT	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	26 (315)
HU	897 (12,809)	1,811 (25,830)	2,729 (38,884)	3,644 (51,961)	4,555 (64,931)	4,739 (67,555)
MT	19 (294)	41 (626)	61 (934)	79 (1,200)	82 (1,257)	83 (1,275)
NL	1,697 (28,122)	3,146 (52,051)	4,336 (71,767)	5,254 (86,983)	5,912 (97,845)	5,139 (85,068)
AT	763 (11,284)	1,565 (23,164)	2,256 (33,335)	2,854 (42,201)	2,920 (43,182)	2,873 (42,479)
PL	1,083 (17,253)	2,327 (37,091)	3,746 (59,859)	5,446 (86,846)	7,508 (119,795)	9,009 (143,798)
PT	1,525 (21,072)	3,131 (43,165)	4,697 (64,851)	6,214 (85,776)	6,921 (95,508)	7,538 (104,053)
SI	197 (3,074)	436 (6,779)	697 (10,849)	981 (15,281)	1,162 (18,087)	1,334 (20,764)
SK	243 (2,976)	547 (6,719)	871 (10,711)	1,217 (14,931)	1,385 (17,012)	1,530 (18,793)
FI	788 (11,607)	1,491 (21,941)	2,134 (31,413)	2,751 (40,510)	3,407 (50,156)	3,429 (50,484)
SE	490 (6,901)	422 (5,936)	355 (4,981)	299 (4,197)	6 (90)	0 (0)
Total	45,495 (721,626)	91,878 (1,455,371)	137,282 (2,170,202)	182,439 (2,875,768)	217,610 (3,431,444)	232,546 (3,669,705)

Note: no data available for EL; no action required by the UK.
Source: LE calculations.

Table 5.13 shows the direct public cost of reading recovery programmes to improve literacy skills. The total public costs of achieving this EU target are around €1 billon every year. The programme only lasts one year and therefore costs are quite similar for all the years. Moreover, since students

undertaking the programme are below the legal working age, their foregone earnings (and foregone tax revenues) are zero.

Table 5.13: Public costs of achieving Target 4 (Reading Recovery programmes). Total in € thousands.

Member State	2005	2006	2007	2008	2009	2010
BE	15,035	15,108	15,414	15,579	15,558	15,639
CZ	11,749	10,645	10,117	10,194	10,250	10,205
DK	4,486	4,523	4,416	4,444	4,401	4,441
DE	379,492	380,028	397,425	410,162	403,822	401,299
EL	47,371	47,933	47,354	47,151	46,036	46,660
ES	168,052	167,532	168,359	169,672	172,958	178,963
FR	82,218	84,709	86,359	86,583	88,133	90,814
IT	245,383	246,012	249,548	250,805	254,624	260,367
LV	913	841	778	749	740	789
HU	10,529	10,414	9,910	9,426	9,274	9,133
AT	28,843	28,252	28,718	27,728	27,246	26,542
PL	8,487	8,104	7,966	7,676	7,458	7,321
PT	37,587	38,673	38,923	38,848	39,522	42,100
SK	6,678	6,253	6,204	6,046	5,952	5,931
Total	**1,046,823**	**1,049,027**	**1,071,491**	**1,085,063**	**1,085,974**	**1,100,204**

Notes: no action required by IE, NL, FI, SE, UK. No data available for EE, CY, LT, MT, and SI.
Source: LE calculations.

Public expenditure and the foregone tax revenue for Target 6 can be seen in Table 5.14. For the EU as a whole, the total public costs of achieving Target 6 start at €1.8 billion in 2005 and increase to €6.8 billon in 2010. The foregone tax revenues grow to €6.8 billion by 2010.

Table 5.14: Public costs of achieving Target 6 (TE). Expenditure in € thousands (foregone tax revenue in parentheses)

Member State	2005	2006	2007	2008	2009	2010
CZ	49,931 (34,920)	94,656 (65,804)	134,143 (92,837)	169,253 (117,723)	169,757 (117,857)	174,253 (120,925)
DE	719,790 (889,078)	1,332,414 (1,633,261)	1,977,126 (2,413,388)	2,625,969 (3,222,621)	2,673,397 (3,273,716)	2,767,765 (3,388,132)
IT	837,658 (778,323)	1,601,459 (1,498,490)	2,223,036 (2,096,755)	2,739,548 (2,564,274)	3,205,540 (3,007,777)	3,203,399 (3,008,548)
CY	3,716 (1,017)	7,065 (1,935)	10,150 (2,779)	12,948 (3,545)	12,994 (3,558)	13,828 (3,786)
MT	97 (66)	186 (126)	269 (185)	347 (237)	355 (242)	361 (247)
AT	170,706 (106,927)	330,375 (207,479)	475,075 (297,170)	607,237 (380,518)	622,780 (390,311)	658,732 (412,560)
SK	1,775 (612)	3,485 (1,225)	5,085 (1,790)	6,569 (2,295)	6,493 (2,279)	6,376 (2,237)
Total	**1,783,673 (1,810,943)**	**3,369,640 (3,408,320)**	**4,824,884 (4,904,904)**	**6,161,871 (6,291,213)**	**6,691,316 (6,795,740)**	**6,824,714 (6,936,435)**

Note: no data available for EL; no action required by BE, DK, EE, ES, FR, IE, LV, LT, HU, NL, PL, PT, SI, FI, SE, UK.
Source: LE calculations.

Firm's costs

The firms' costs of achieving Target 5 are shown in Table 5.15. Since the target is defined in terms of participants (not graduates), only additional expenditures in 2010 would be required to achieve the target. However, we have assumed that the number of LLL participants grows gradually towards the target participation level. As a result, the expenditures increase as well to their steady state level in 2010. The total expenditures for Target 5 amount to €13 billion in 2010 for the EU as a whole.

Table 5.15: Firms' costs of achieving Target 5 (LLL). Total in € thousands.

Member State	2005	2006	2007	2008	2009	2010
BE	7,851	15,942	24,321	32,918	41,660	50,561
CZ	10,844	22,000	33,413	45,068	56,816	68,722
DE	383,367	770,324	1,162,544	1,566,619	1,977,300	2,396,486
EE	2,342	4,729	7,139	9,619	12,209	14,872
EL	91,381	185,883	284,797	387,187	493,136	600,288
ES	293,458	605,260	933,007	1,268,194	1,612,107	1,962,543
FR	214,708	437,156	667,962	905,540	1,147,959	1,397,154
IE	18,455	38,117	58,955	80,871	103,710	127,471
IT	391,603	791,069	1,199,961	1,617,222	2,042,172	2,475,545
CY	554	1,144	1,770	2,431	3,135	3,876
LV	650	1,308	1,972	2,652	3,357	4,084
LT	2,901	5,858	8,854	11,909	15,078	18,377
HU	37,592	76,096	115,487	155,358	195,883	236,689
MT	2,454	5,045	7,782	10,691	13,676	16,672
PL	53,316	108,760	166,420	226,861	290,198	355,858
PT	60,486	123,364	188,553	255,685	324,256	394,169
SK	9,730	19,859	30,377	41,292	52,594	64,225
Total	**1,581,692**	**3,211,914**	**4,893,314**	**6,620,117**	**8,385,246**	**10,187,592**

Note: no action required by DK, NL, AT, SI, FI, SE, UK.
Source: LE calculations.

5.3 Internal rates of return

5.3.1 Analysis of the base case

Figure 5.1 shows the private rates of return for the required investments in USE, TE, MST and Literacy to achieve the targets. Social rates of return are presented in Figure 5.2. The analysis has been conducted for countries that require action to achieve the targets.[48]

Following presentation of the results, we investigate the outlying values of the rates of return of certain targets in some Member States.

[48] See Table 5.1.

Private rates of return

For Targets 1 and 3, we observe that the private rates of return are in the range between 6% and 16% for countries that would need to make investments to achieve the targets. There are no outliers.

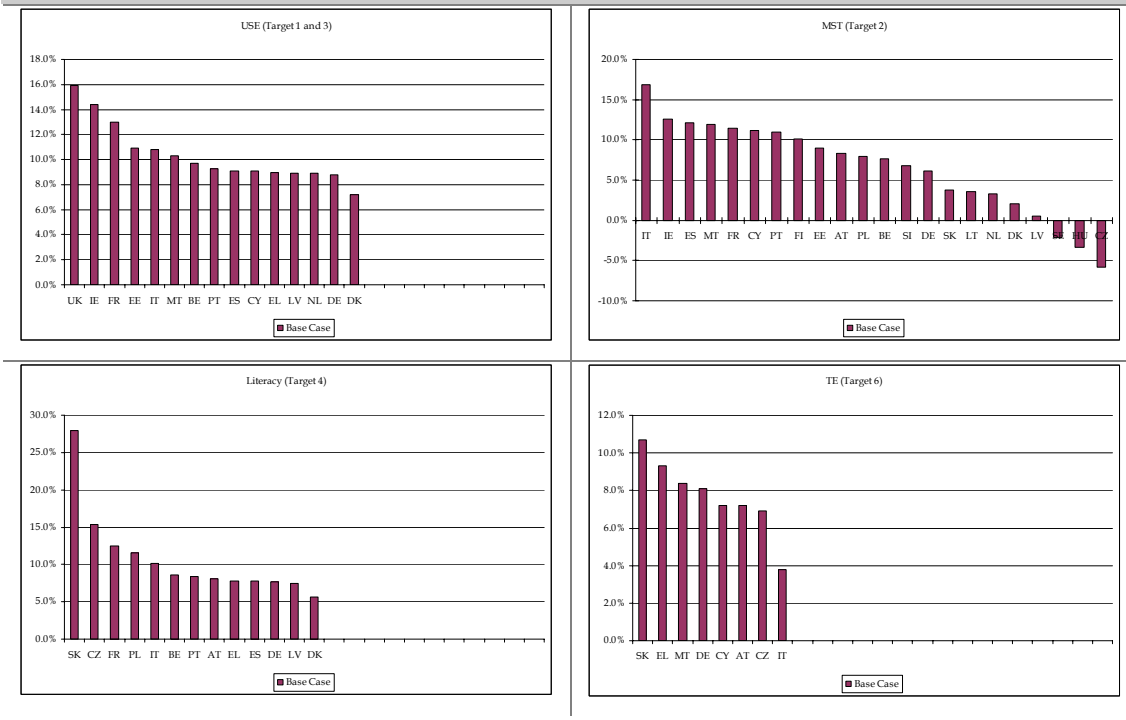
For Target 2 we find rates of return ranging between 2% and 15% for the majority of countries. The main exceptions are Italy, with a value above 15%, and Latvia, Sweden, Hungary and the Czech Republic, all of which show very small or even negative values.

We should also note that the positive returns found for Target 2 do not necessarily imply that MST yields higher returns than other TE courses. Indeed, in some countries, earnings of MST graduates are lower than the earnings of workers with other TE studies (see Table A.4 in Annex 2). Given that MST costs are generally higher than other TE studies, this would mean that the graduates from other disciplines achieve higher returns than graduates from MST.

The private rates of return for Target 4 show values that range between 5% and 15% for all countries except for Slovakia. The high values of this country are due mainly to the difference between employment probabilities of USE and LSE graduates (this is discussed further below, as part of Scenario 1).

The private rates of return for Target 6 show values between 6% and 11% (with the exception of Italy that shows a value of 4%).

Figure 5.1: Private rates of return for countries that require action



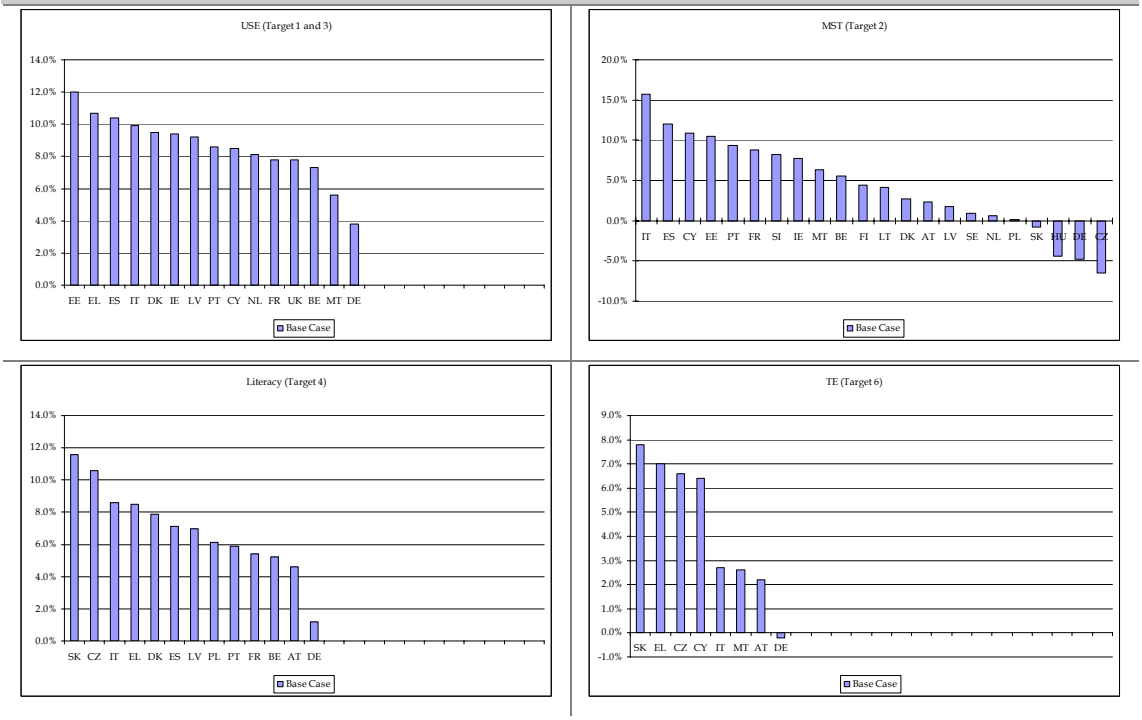
Social rates of return

For Targets 1 and 3, we observe social rates of return in the range between 4% and 12%. The rates of return for Target 4 are within a similar range, with the exception of Germany, which has the lowest social rates of return in both cases.

As with the private case, we found some negative social rates of return for Target 2.

There is a stark split in the rates of return amongst the Member States that require policy action to achieve Target 6. Four Member States have rates of return between 6% and 8%, but the rest have rates of return much lower than 3%: Italy, Malta and Austria have rates of return of between 2% and 3%, whilst Germany actually has a negative social rate of return.

Figure 5.2: Social rates of return for countries that require action



Analysis of outliers

As seen, in some instances we have found rates of return that appear to be outliers when compared to the ones of the other countries. In this section we investigate the factors that can explain these differences.

Column (1) in Table 5.16 shows the outliers for the private rates of return found for Target 2 (in Italy, Latvia, Sweden, Hungary and the Czech Republic), Target 4 (in Slovakia) and Target 6 (in Italy). Column (2) shows new values for the rates of return computed after changing one single determinant of the private rate of return: for Target 2 the new rates of return have been computed using an EU median wage mark-up; the values for Slovakia for Target 4 have been computed using the probability of employment from the Czech Republic; and the values for Italy for Target 6 have been calculated using the EU median cost of education.

For Target 2 we can see that the high private rate of return observed for Italy is mainly due to an MST wage mark-up close to 104% (see Table A.4 in Annex 2). When the EU median MST wage mark-up is used, the Italian rate of return is 4.8%. Similarly, the small or negative returns found in some Member States are a consequence of the very small or negative MST wage mark-up in these countries. Using the EU median for the MST wage mark-up we observe that the new private rates of return for Latvia, Hungary and the Czech Republic increased to 6.8%, 7.4% and 8.6%, respectively. The rate of return for Sweden remained negative at -0.3%, but increased to 2.2% when, in addition, EU median MST costs were used in the calculation.

The high values of private rate of return for Slovakia for Target 4 are mainly due to the higher employment probabilities of USE graduates over LSE graduates. This can be seen in a variety of ways. Using the employment probabilities of the Czech Republic reduces the rate of return to 17.1%, and using Polish employment probabilities reduces it to 8.9%. Ignoring the employment effect altogether in Slovakia results in an estimated social rate of return of 9.4% (this is analysed as part of Scenario 1, below).

The low private rates of return for Target 6 in Italy are mainly due to the high costs of education. When an EU median of TE costs is used the rate of return increases to 5.7%.

Table 5.16: Analysis of outliers (private rates of return).

	Member State	Estimated Values (%) (1)	New Values[1] (%) (2)
Target 2	**IT**	16.9	4.8
	LV	0.5	6.8
	SE	-2.1	-0.3[2]
	HU	-3.4	7.4
	CZ	-5.8	8.6
Target 4	**SK**	28.0	17.1[3]
Target 6	**IT**	3.8	5.7

Note: [1] the EU median wage mark-up has been used for Target 2; data on probability of employment from CZ has been used for Target 4; the EU median cost has been used for Target 6. [2] The rate of return for SE increases from -0.3% to 2.2% if, in addition, the EU median MST costs are used in the calculation. [3] The rate of return for SK falls to 8.9% if data on employment probabilities from PL are used in the calculation.
Source: LE calculations

We now turn to the analysis of outliers for the social rates of return. Outliers for the social rates of return have been found in Austria, Italy, Poland, Slovakia, Hungary, Germany, Malta, and the Czech Republic, for Target 1 and 3, Target 2, Target 4, and Target 6 and are shown in Column (1) of Table 5.17. The new values for the rates of return are shown Column (2), computed after changing one single determinant. The new values for Targets 1 and 3 have been computed using the EU median annual cost of USE; for Target 2, the EU median social mark-up has been used to compute the new rates of return; for Target 4, the EU median cost of a reading recovery programme has been used; and the new rates of return for Target 6 have been computed using the EU median annual cost of TE.

For Targets 1 and 3, the social rate of return for Germany rises from 3.8% to 5.8% when the EU median cost of USE is used in the calculation.

For Target 2 the EU median MST social mark-up is used for the new calculations. The new rate of return for Italy is 3.0%, and the remaining four countries' social rates of return increase from low or negative values to values between 5% and 9%. The value for Germany remains negative, at -0.6%.[49]

For Target 4, using the EU median cost of reading recovery programmes increases the social rate of return for Germany from 1.2% to 1.5%. By using the EU median annual course costs of USE the rate of return increases to 3.9%.

[49] The MST social mark-ups (shown in Table A.4) in the five Member States for which the rates of return change dramatically are outliers themselves, when compared to the EU median value of 4.4%. Italy has a very high mark-up of 96.5%, whilst Poland, Slovakia, Hungary and the Czech Republic have negative mark-ups, ranging between -10% and -17%. Germany, on the other hand, has a social MST mark-up of -0.6%, which explains why the new value for its estimated social rate of return is not much higher.

Outliers for Target 6 can be explained mainly by the high annual course costs of TE education in the corresponding Member States. Using the EU median costs gives a social rate of return of 4.5% in Italy, 4.2% in Austria, and 1.6% in Germany. In Malta the rate of return did not increase, but fell very slightly to 2.5% (the analysis for Malta is done separately in Table 5.19, below).

Table 5.17: Analysis of outliers (social rates of return)

	Member State	Estimated Values (%) (1)	New Values[1] (%) (2)
Targets 1 and 3	**DE**	3.8	5.8
Target 2	**IT**	15.7	3.0
	PL	0.2	6.1
	SK	-0.8	8.5
	HU	-4.4	5.7
	DE	-4.8	-0.6
	CZ	-6.5	7.6
Target 4	**DE**	1.2	1.5[2]
Target 6	**IT**	2.7	4.5
	MT	2.6	2.5
	AT	2.2	4.2
	DE	-0.2	1.6

Note: [1] EU median cost has been used for Targets 1 and 3; EU median MST social mark-up has been used for Target 2; EU median cost of a reading recovery programme has been used for Target 4; EU median cost has been used for Target 6. [2] The rate of return for DE increases from 1.5% to 3.9% if EU median USE costs are used in the calculation.
Source: LE calculations

A common finding from our analysis of outliers is that the German social rates of return do not change significantly when using EU median values. We investigate this further by using the parameters of a comparator country in the calculation for Germany's rate of return. The parameters used for the computation of the social rate of return include: the MST social mark-up, reading recovery programmes costs, education costs, probability of employment, Mincerian return, duration of education, drop-out rates, the level of earnings, and GDP per capita. Starting from the original parameter values for Germany, one parameter is changed at a time.[50] For each additional change a new rate of return is calculated. In the process, we can

[50] We use Austria as the comparator country for all the targets, except for Targets 1 and 3, for which we use Denmark.

observe which are the parameters with higher influence on the social rates of return obtained.

Table 5.18 shows our results. For all five targets, the foregone earnings while in education have a major impact on the rates of return (replacing Germany's gross earnings data with those of the respective comparison Member State results in a major change). The substitutions of the comparison Member States' GDP per capita[51] and Mincerian returns values also have a significant effect. Other effects are minimal in their impact.

Table 5.18: Decomposition of the social rates of return for Germany (all targets)

		New rate of return using comparator country* (%)			
		Target 1 and 3	**Target 2**	**Target 4**	**Target 6**
Original rate of return		**3.8**	**-4.8**	**1.2**	**-0.2**
Change in parameter values	+ MST social mark-up	--	-0.4	--	--
	+ reading recovery programme costs	--	--	1.3	--
	+ education costs	3.1	-0.7	1.8	-0.5
	+ probability of employment	3.4	-0.8	2.4	-0.6
	+ Mincerian return	4.3	0.8	3.9	1.0
	+ duration of education	4.3	0.8	3.9	1.0
	+ drop-out rate	4.5	-0.7	1.9	-0.2
	+ gross earnings (foregone earnings)	6.8	1.2	3.7	1.4
	+ GDP per capita	9.5	2.3	4.6	2.3

Note: * Austria is used as a comparator country for all the targets, except for Targets 1 and 3, for which Denmark is used.
Source: LE calculations

Malta has an unusually low social rate of return to tertiary education (Target 6). We investigate now the influence of the other factors that affect the social rate of return for Target 6.

Using the same method as for Germany above (see Table 5.18), the effect of using various parameters of a comparator country in the calculation of the social rate of return is analysed. We have chosen Cyprus as the comparator country.

[51] The social rate of return includes the costs and benefits for society as a whole, and the benefits of education are obtained by applying the social Mincerian returns to GDP per capita.

It is immediately apparent from Table 5.19 that the driver of the low social rate of return to TE in Malta is the level of GDP per capita. No other factor has a comparably big positive effect on the outcome.

Table 5.19: Decomposition of the social rate of return for Malta (Target 6)

		New rate of return using comparator country* (%)
Original rate of return		2.6
Change in parameter values	+ education costs	2.6
	+ probability of employment	2.1
	+ Mincerian return	2.1
	+ duration of education	2.1
	+ drop-out rates	2.1
	+ gross earnings (foregone earnings)	2.2
	+ GDP per capita	6.4

Note: * Cyprus is used as a comparator country.
Source: LE calculations

To summarise, we have seen that the outliers of the private rates of return found for Target 2, Target 4 and Target 6 can be explained by the outlying MST wage mark-ups, the employment probabilities and the high costs of education, respectively.

The outliers found for the social rates of return found for Targets 1 and 3, Target 2, and Target 6 can be explained by the costs of USE, the social MST mark-up, and the costs of TE education, respectively, for all countries except Germany and Malta. The unusual rates of return found in Germany for all targets can be explained by the level of gross earnings (foregone earnings), the GDP per capita and the Mincerian returns in this country. The low rate of return for Target 6 in Malta comes from its level of GDP per capita.

5.3.2 Sensitivity analysis: analysis under different scenarios

The rate of return calculations presented so far have been based on available data and utilise a number of assumptions. In some cases there exists a certain degree of uncertainty about the precise values assumed for different variables in the model, or how these could change in the future. In others, the results can be affected by the quality of the available data. Finally, the estimates of

the rates of return are also influenced by the estimates used for the costs of education and Mincerian returns to education.

Therefore, to provide an indication of the sensitivity of our rate of return estimates to various assumptions, in this section we report the results of a number of different scenarios. These scenarios focus on three key drivers of the model, namely, the higher probability of being employed with a higher level of education, the level of the various costs to education, and the size of the Mincerian returns.

Scenario 1: The impact of higher probability of being employed

The first scenario analyses the impact of the employment effect on the rates of return. By comparing Scenario 1 with the base case we show how much of the rate of return can be attributed to a change in earnings and how much to a change in the probability of being employed as a result of increasing the years of education.

For comparative purposes, we present the base case returns compared to the returns without the effect of employment (i.e. assuming that additional education increases earnings but not the probability of being employed). In Figure 5.3 and Figure 5.4 the bars represent the returns to the levels of education derived from higher earnings only. In the same figures, the dots represent the returns after taking account of the higher probability of being employed from achieving higher levels of education.

We observe that in some countries there are noticeable benefits from a higher probability of being employed. This is particularly relevant for Targets 1 and 3. The large effect found in the case of the Literacy target in Slovakia results from a large difference between the unemployment rates for individuals (particularly youngsters) with and without USE. Greece shows the opposite situation (in Targets 1 and 3), where individuals below 30 have a lower probability of being employed if they have achieved USE instead of only LSE. This surprising finding could be a result of labour markets valuating experience more than education qualifications in young workers, or of a mismatch between the skills demanded by employers and supplied by graduates.

Figure 5.3: Private rates of return under Scenario 1

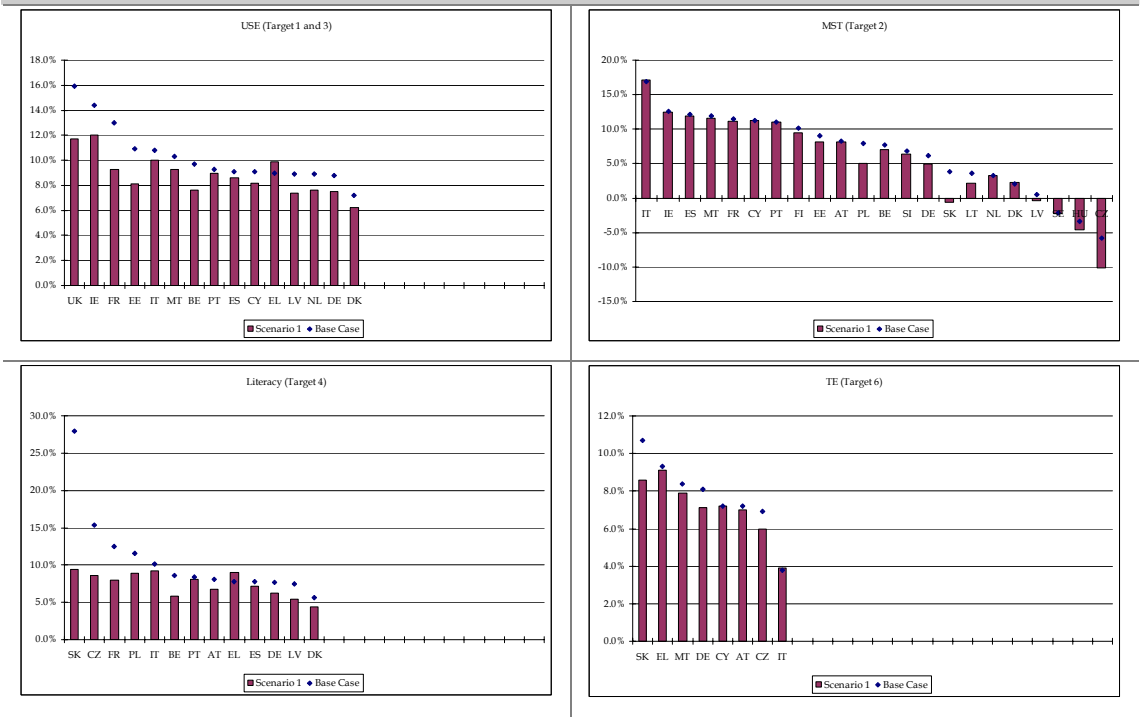
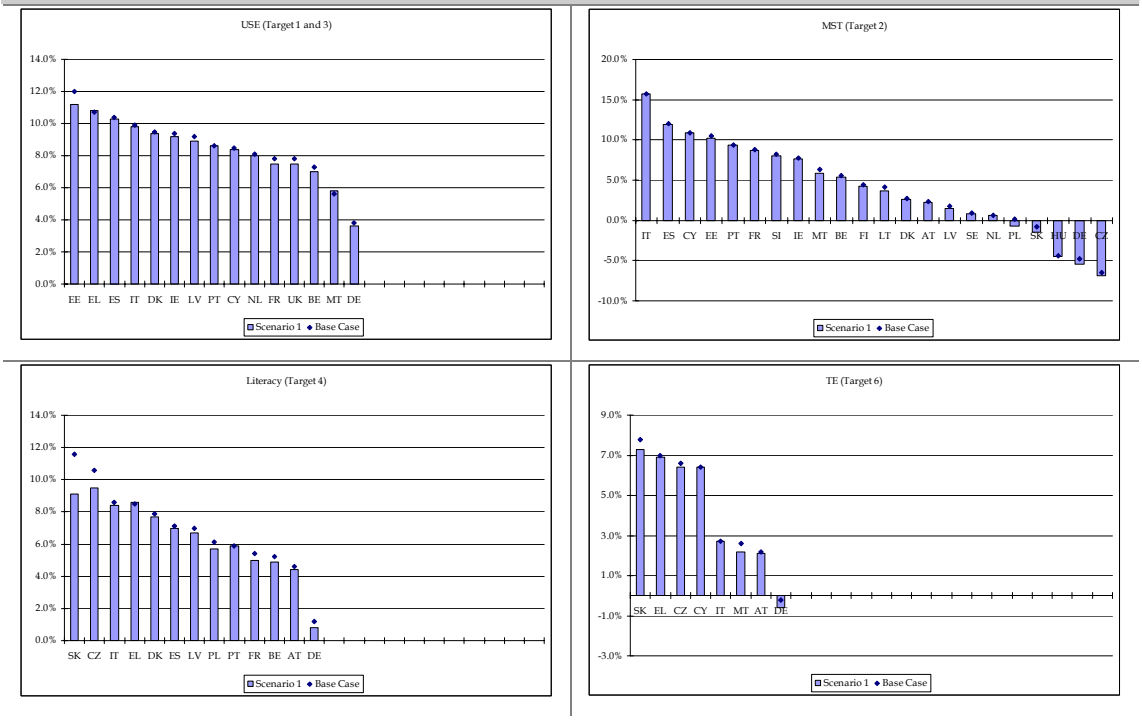


Figure 5.4: Social rates of return under Scenario 1



Scenario 2: The impact of costs

In the second scenario we analyse how much the costs of education impact on the rates of return. In this scenario we increase the private and total costs by 20% to quantify the impact on both private and social returns. As Figure 5.5 and Figure 5.6 show, higher costs reduce the rates of return but the impact is not substantial.

Figure 5.5: Private rates of return under Scenario 2

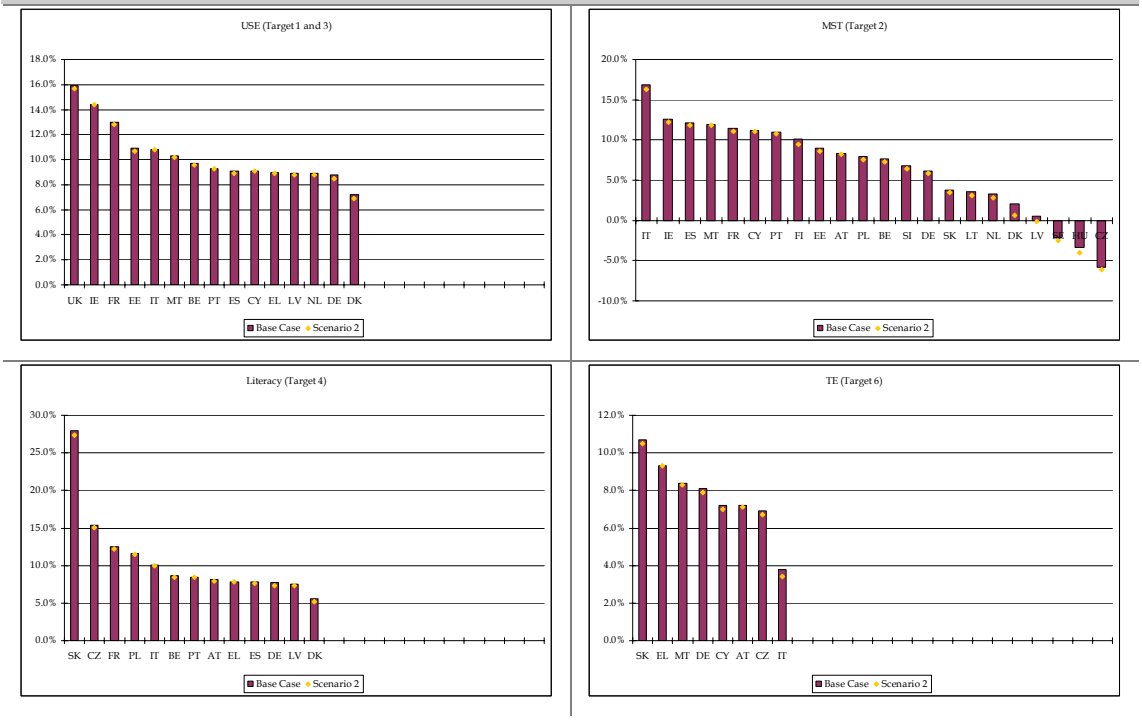


Figure 5.6: Social rates of return under Scenario 2

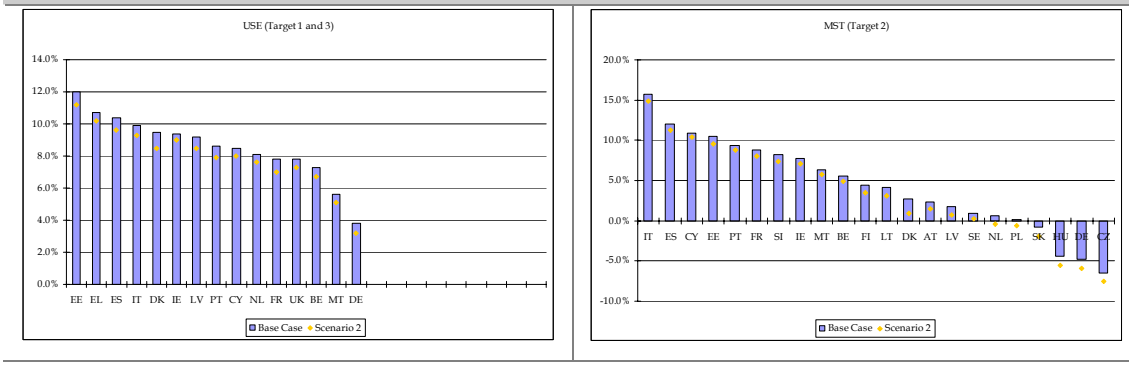
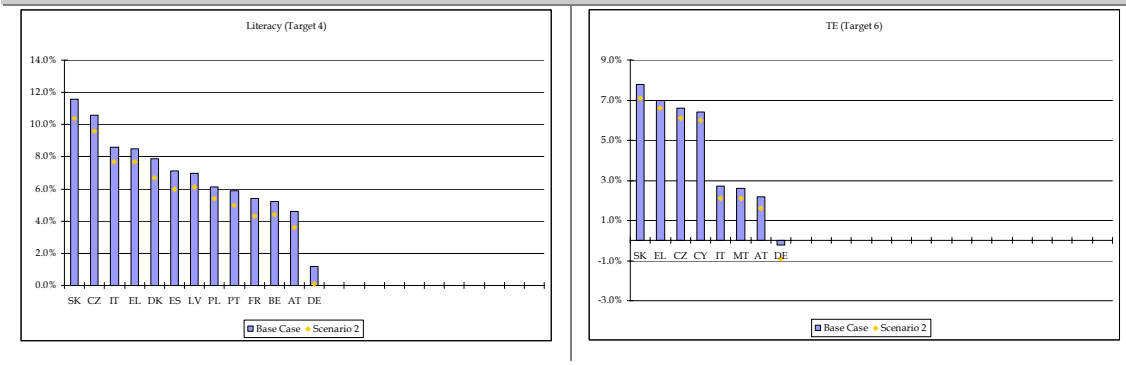


Figure 5.6: Social rates of return under Scenario 2



Scenario 3: The impact of Mincerian rates of return

To appreciate the influence of this parameter on the rates of returns, we have rerun the models with Mincerian returns that are 10% lower than in the base case.

Figure 5.7 and Figure 5.8 show that lower Mincerian returns reduce the rates of return but by a small amount only.

Figure 5.7: Private rates of return under Scenario 3

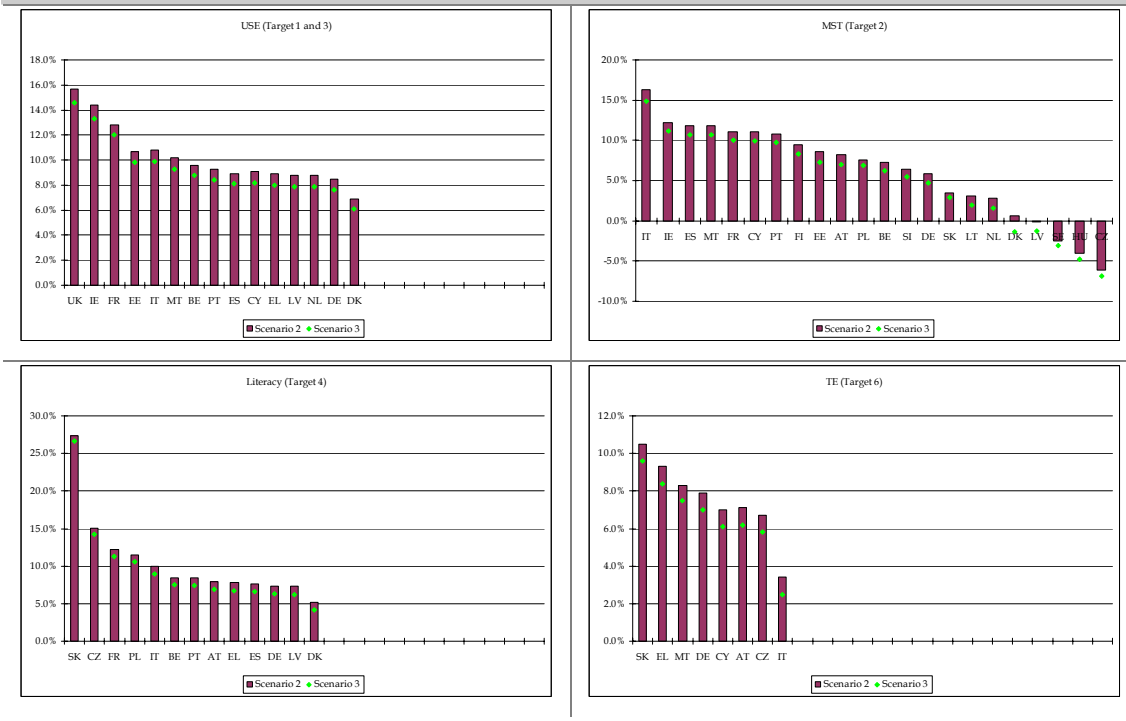
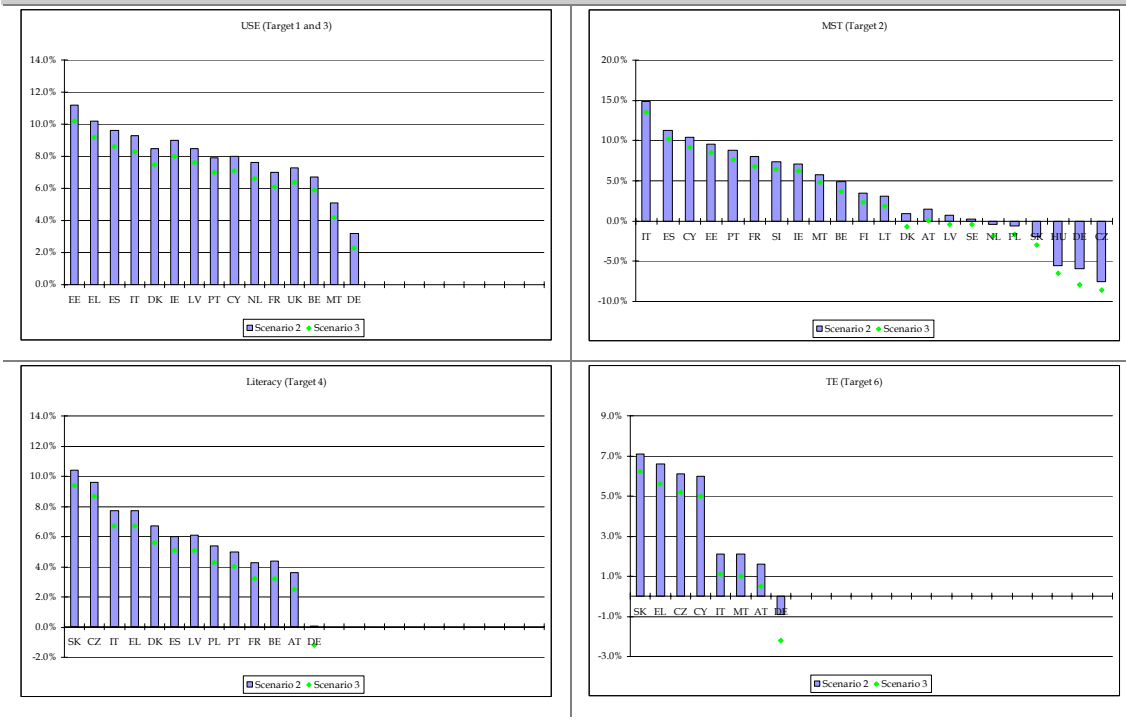


Figure 5.8: Social rates of return under Scenario 3



Scenario 4: The impact of students in part-time work during their studies

In our base case results we assumed that the additional students undertaking education would not be working while in education.

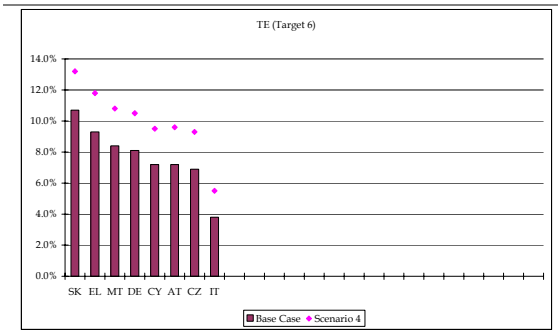
This last scenario provides some sensitivity analysis of changing this assumption for Target 6. To appreciate the impact of part-time work on the reported private and social rates of return we have allowed students in TE to earn 25% of the earnings they are foregoing from not working full-time.[52]

Figure 5.9 shows that the impact of part-time work would increase the rates of return by about 2% in all countries.

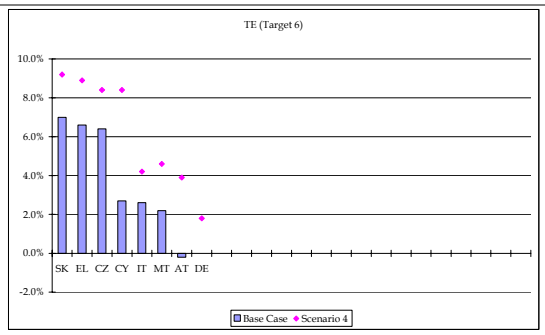
[52] This is equivalent of having 50% of students in part-time earning 50% of the expected earnings. The percentage is similar to the one used in De la Fuente (2003), where it is assumed that the average student uses 0.8 of his time in school attendance (and 0.2 for part-time working).

Figure 5.9: Rates of return for Target 6 under Scenario 4 (private and social).

Private rates of return



Social rates of return



Main conclusions of the analysis of scenarios

The results of the analysis of the different scenarios yield some interesting findings:

- In general, the rates of return are not substantially influenced by the costs of education. As seen, an increase in the costs of 20% yields similar returns to the returns of the base case. The implication of this is that if a programme of enticements was required to attract the new entrants the rates of return would not differ noticeably from the ones presented in this report, provided the cost of such programme is not too significant.
- In general, the Mincerian rates of return used in the analysis do not influence noticeably the estimated returns. Reducing the Mincerian rates of return a 10% yields broadly similar results to the base case results.
- One of the important drivers of our rate of return estimates is the effects of a different employment probability from having achieved additional education. As seen, this can have a very important effect on some countries' private rates of return, but the effects are limited for the social rates of return.
- The part-time work has an effect in rates of return of around 2% for both private and social rates.

6 Case study of the effect of declining or low spending on education

This chapter presents case study evidence on the impact of declining or low levels of spending.

It focuses on the decline in spending that occurred in California from the late eighties to the mid-nineties. Developments in some other US states are also addressed in the context of this case study.

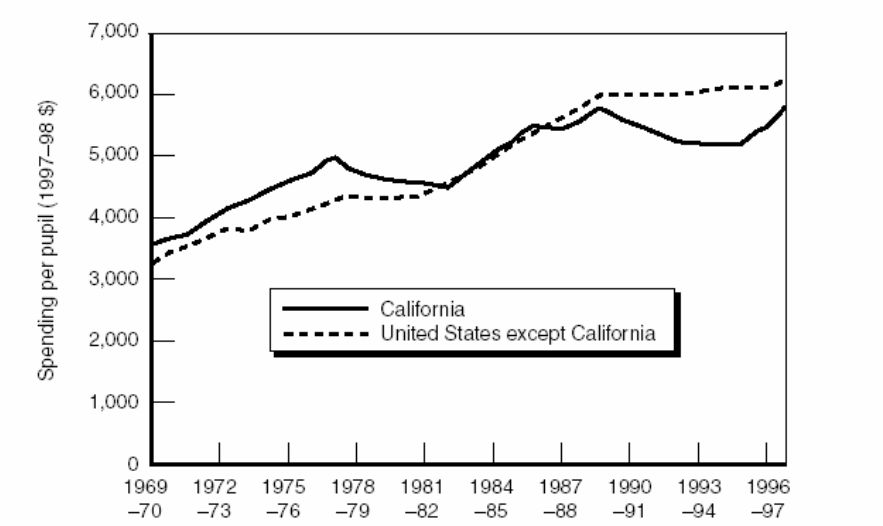
The case study considers the experience of the education system in California since 1970. This case study is particularly useful because it represents an instance of sea change in the way school financing was organised. This change arose out of two separate legal amendments: one due to a lawsuit and the other to a ballot proposition.

The lawsuit *Serrano v. Priest* was brought in 1971 with the plaintiffs arguing that the state's school finance system was in violation of the equal protection clause of the Fourteenth Amendment, since there were large disparities between school districts in per pupil spending. The courts ruled in favour of the plaintiffs and the result was that the state was forced to equalise revenue across school districts. Seven years later, the second legal amendment came from the June 1978 Proposition 13 which redirected property tax revenues from school districts to the state level. Taken together, the *Serrano* decision and Proposition 13 transformed school finance from a locally funded system to one in which the state allocates the bulk of school revenues.

After changes to California's state law, spending per student fell both in absolute terms and in comparison to the average of spending in other states (shown in Figure 6.1). Between 1970 and 1997, spending per pupil in California fell more than 15% against the average of the other states.

The decline in spending per pupil is attributed by most authors to the effects of implementing Proposition 13. After Proposition 13, state finance equalised revenue by levelling down high-spending districts rather than raising low-spending ones. The result was a decrease in average per pupil spending from 1978. In addition, as districts chose to hire fewer teachers, this led to a large increase in the pupil-teacher ratio. It is estimated that in 1970, California's pupil-teacher ratio was 8 percent above the average for other states; by 1997, it was 38 percent above that average (Sonstelie, Brunner and Ardon, 2000).

Figure 6.1: Real spending per pupil in California and other states



Source: Sonstelie, Brunner and Ardon (2000).

In the 1970s and early 1980s, California's students performed as well as students in the rest of the country, based on standardised tests. However, since that time, they performed worse (Bedard and Brown, 2000; Sonstelie et al., 2000; New York Times, 1996).

One of the reasons given by some authors (Sonstelie et al., 2000) for that poor performance includes the high pupil-teacher ratio.

Other authors (Bedard and Brown, 2000) have found a positive and significant relationship between total expenditures and student outcomes in California. Their results suggest that the relationship between educational spending and student outcomes is not only statistically significant but also relatively large. Thus, according to these two authors, the poor performance of Californian students is largely due to the decrease in education funding.

In a different type of study, Downes (1992) evaluates the convergence of spending and performance across schools. He finds that there is compelling evidence of equalization in per pupil expenditure, but there is no sign that relative increases in funding in poorer districts translated into improved relative performance, or that constraints inherent in the finance reforms altered the relative standing of high-wealth districts. The author considers as possible explanations the actions undertaken in high-wealth districts to neutralise the expenditure limitations, and the demographic changes observed in poorer districts that potentially countered their funding gains.

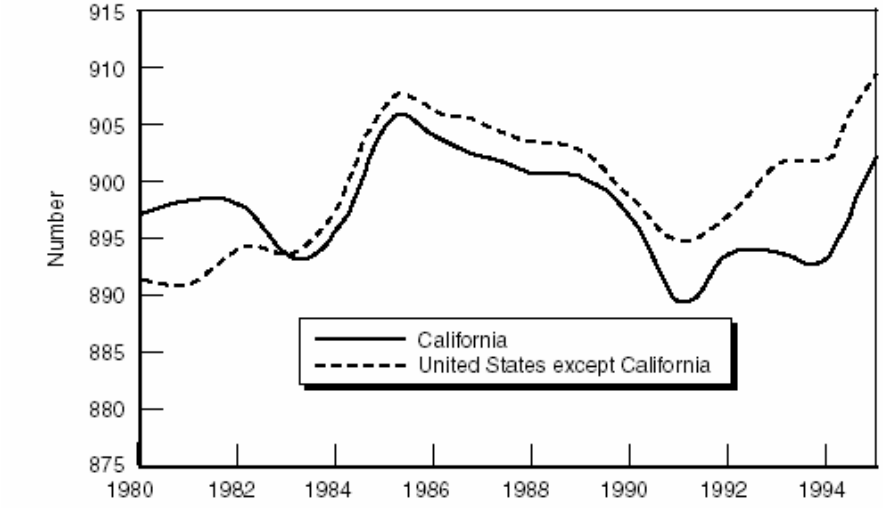
Increases in private school enrolment and voluntary contributions to public schools suggest that California parents were increasingly dissatisfied with public education (Sonstelie et al., 2000). In fact, Downes (1992) argues that

the increased use of funds from other resources (grants from outside agencies directly to classroom teachers, monetary donations by parents to teachers for the purpose of buying supplies, use of volunteer time,…) neutralised the effects of the reform and enabled high-wealth districts to maintain their relative position.

However, some authors have noted that the drop in student performance occurred in tandem with an increase in the share of students whose native language was not English. An article in the New York Times (1996) noted that the influx of students who speak English as a second language coincided with the drop of California's fourth graders to last place in the US reading test (in a tie with Louisiana). Hence, differences in participation rates and demographics (ethnic mix) could have had an effect on the tests scores.

Sonstelie et al. (2000) analyse data on the backgrounds of students and conclude that demographic differences account for only some of the performance gap between California's students and those in other states. The authors adjust the test results for these demographic differences and show that the adjusted standardised tests scores dropped quickly from substantially above those of the rest of the United States in the early 1980s to below from 1983 onwards until 1995. Even when scores in California improved in the latter part of the sample period the performance gap remained as scores also improved in other states (see Figure 6.2). Although the authors note that this poorer performance cannot necessarily be blamed on the state finance reform, they maintain that the timing of the drop is suggestive.

Figure 6.2: Adjusted standardised tests scores



Source: Sonstelie, Brunner and Ardon (2000).

Overall, the evidence suggests that the drop in student performance did coincide with the reduction in expenditures resulting from the *Serrano* and Proposition 13 reforms. However the precise quantitative estimate of the impact remains still uncertain as a number of other factors were at play during the same period, such as an influx of students who spoke English only as a second language. Nevertheless, the general findings are that the reform did worsen California students' performance.

Other evidence and evidence from other US states

Whilst the evidence that reducing education expenditure impairs student performance is relatively strong in the Californian case, it nevertheless appears to be an exception rather than the rule among the findings of US studies on the effects of education reforms.

In Michigan, spending was also equalised as a result of a reform in 1994. However, unlike in California, the spending was levelled-up rather than levelled-down (Papke, 2004).

The Michigan case provides a good illustration of the division of academic opinion. Wolfram (2003) finds that "per-pupil general fund spending by public school districts rose to $8,213 per pupil in 2001-02 from $4,757 in 1991-92, a rise of nearly 73 percent". Despite this, "there is little indication that this noticeably has improved the quality of schooling." He blames this lack of impact on the system of public education (K-12). Incentives to improve performance are said to be low because parents have no choice in selecting schools, and therefore cannot exert directly or indirectly pressure on schools to improve performance.

In contrast, Papke (2004), looking at almost the same period (in this case, 1992 to 1998), finds that the increase in expenditure did have an effect in Michigan. A key difference to note between Papke and other authors is that she uses disaggregated data with information at school level (rather than at state level). Using a variety of econometric methods, her models suggest a positive effect of spending on pass rates of math tests (for Michigan 4th graders). Her results suggest that, overall, a 10% increase in real spending increases the pass rate by between one and two percentage points (the results are even higher for initially under-performing schools).

That being said, Eric Hanushek, one of the most influential American authors studying the relationship between resources and education outcomes, has produced a large body of research criticising the positive effects of education spending found in various studies. In a review of the literature (Hanushek, 2003), he argues that the amount of money spent is generally not observed to be effective because schools have poor incentives to improve students' achievement. However, he argues that it could be possible for resources to make a difference if they were targeted appropriately. He also warns against generalising the findings of one single study that concludes that there exists a

positive relationship between education spending and performance since he finds that, on balance, empirical findings do not show such a positive link.

Similarly, Picus (1995) thinks that the US experience shows that "despite considerable research on the matter, there is still a great deal of debate as to whether or not money makes a difference in education".

Along the same lines, Gundlach, Wößmann and Gmelin (2001) report that, in many OECD countries, even substantial increases in schooling resources did not boost schooling quality. Their findings belong to the literature that fails to identify a positive relation between additional schooling inputs and student performance.

The performance of students is also evaluated by the Programme for International Student Assessment (PISA). In commenting on the results of the second PISA, Green and Laitner (2004) conclude that high spending on schools was not linked to educational success. The authors also report other factors such as "a climate of high expectations, decentralised decision-making and motivated staff and students, produced the most knowledgeable and skilled young people in the 41 countries […] taking part in the two-hour tests".

A possible explanation

In short, the current body of research findings does not provide a clear picture of the impacts of increased education spending. A possible explanation for this situation may be the fact that the allocation of funding to different types of school expenditures may account for the divergence of the results obtained by the various studies.

Indeed, the literature on student performance and administrative spending suggests that policy makers should not only be concerned with the *level* of resources only, but also with the *allocation* of resources. More precisely, "increased educational expenditures [would] only matter if they make it to the classroom" (Bedard and Brown, 2000).

In the case of California, Bedard and Brown (2000) find that teaching expenditures have a positive effect on student performance while non-teaching expenditures have a negative effect. More importantly, their estimates suggest that the relationship between educational spending and student outcomes is not only statistically significant but also quantitatively relatively large. Their results show that either a reallocation of $100 from administrative to classroom spending, with no change in overall expenditures, or an $100 increase aimed directly at the classroom "moves the average California high school approximately 5 percentage points higher in the state test score rankings". Hence, their results suggest that both current and future educational expenditures should be targeted towards the classroom.

A number of other studies support this argument. For example, Picus (1995) finds that, although expenditure per pupil varies substantially between US

school districts (subdivisions within each state), there is a lack of variation in the share of total spending allocated to pupil instruction. This lack of variation in the pattern of resource allocation "may be part of the reason links between spending and student outcomes have been hard to find, and may well offer possibilities for making the allocation of resources more productive in the future" (Picus, 1995).

In a similar vein, Stansel and Moore (1998), using US Department of Education data, argue that the reason education spending has skyrocketed without observable improvements in performance is that a huge proportion of the money has been subsumed into administration, or what has become known as the "education blob". The authors report that, although between 1970 and 1996 enrolment in America's public schools shrank by nearly 2 percent, over that same period "non-instructional staff grew by 53 percent". The authors believe that part of the problem is that the government's educational monopoly "inflates the cost of public education", so that per pupil spending in the US public school system is nearly double the average tuition at America's private schools. There is additional evidence that the level of administrative costs impacts negatively on the performance of US schools. Using 1984 US data at the state level, Anderson, Shughart and Tollison (1991) find that a large educational bureaucracy is associated with lower student achievement.

Gundlach et al. (2001) focus on OECD countries over the period 1970-1994. Their findings corroborate the view that resources alone are not effective, and that student performance was not boosted by even substantial increases in education financing. The study concludes that the education sector can be regarded as inefficient in many countries, and a more productive use of given resources seems to be a much more pressing issue for schooling reform than increasing the educational budget.

Finally, one should note that there is still disagreement about the impact of increases in various education inputs. A number of studies have concluded that computers (Betts, 1995), teachers (Brewer, 1996), teacher qualifications (Goldhaber and Brewer, 1997), smaller classes (Figlio, 1997), and school year length (Eide and Showalter, 1998) each have a positive impact on student achievement. In contrast, Ehrenberg and Brewer (1995) find little evidence that measurable school inputs have an impact on student achievement and Hoxby (1998) finds no evidence that smaller classes have a positive effect on test scores.

The "allocation of resources" explanation is in line with Hanushek's arguments, since he has also expressed the view that additional resources could make a difference if they were directed correctly.

7 Education and training in the EU and its main competitors

In this chapter we undertake a comparative analysis of education and training funding and quality in the EU and its main competitors. We analyse the current situation and recent trends in the EU, the United States, Japan, Australia and New Zealand, using existing data.

The chapter is structured as follows. In the first section we compare education financing in different countries. In the next section, we compare the progress of the EU25 towards achieving the Lisbon targets in comparison with that of its main competitors. Finally, in Section 3, we focus on education quality in the EU and its main competitors.

7.1 Funding of education in the EU and its main competitors

Trends in public education financing

In this section we examine the recent evolution of public spending on education in the EU and compare it with the situation observed in Australia, Japan, New Zealand, the United States and Canada. We use three indicators: total public education expenditure (as a percentage of GDP), public expenditure per student (as a percentage of GDP per head), and public expenditure per student.

In each case, we constructed the EU average from country-level data. This involved imputing values for missing data points.[53]

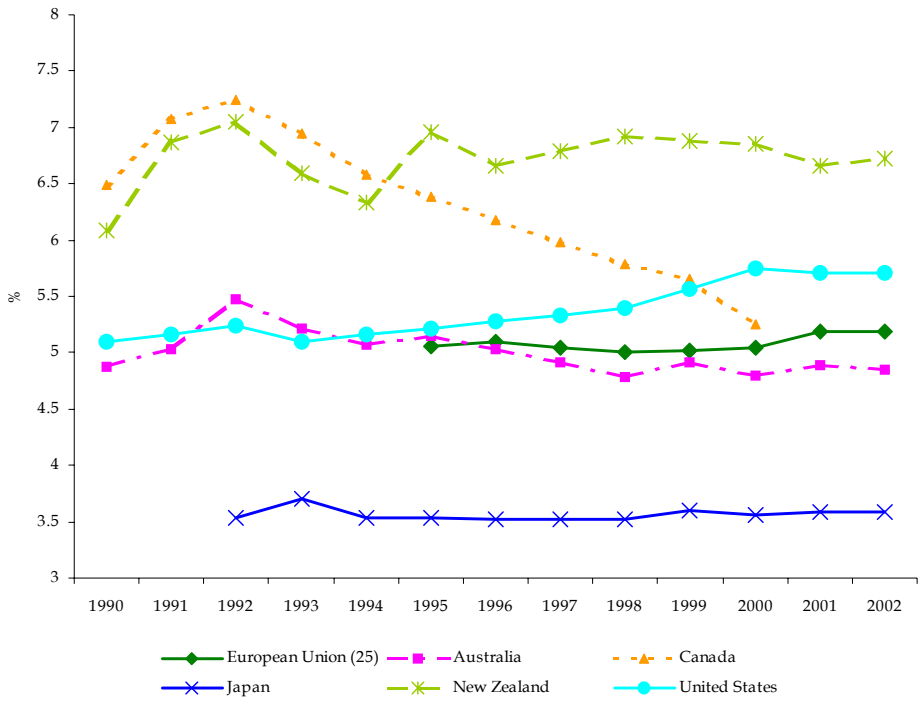
The proportion of GDP spent on education is shown in Figure 7.1. We observe that this proportion is similar in the EU, Australia and the United States. The EU has lost ground to the United States since the mid-1990s, but more recently the gap started to narrow again and now stands at approximately half a percentage point. The EU devotes a much larger share of income to education than Japan, and a slightly larger share than Australia.

Governments in Canada and New Zealand spent a significantly higher proportion of GDP on education in the early 1990s, but expenditure (as a percentage of GDP) in both countries began to drop sharply in 1992. However, while spending in New Zealand has recovered since 1994, the downward trend has continued in Canada until spending reached a level

[53] Where individual observations were missing, the average of the two adjacent years was used. Missing values at the end of the series were replaced by the last available data. Where two or three consecutive observations were missing, imputed values were constructed by interpolation. Countries with incomplete series or large amount of missing values (i.e. Lithuania, Luxemburg, Malta and Slovenia) where excluded from the EU average.

similar to that observed in the EU in 2000. Expenditure figures in Japan are the lowest in the sample and remained stable throughout the 1990s.

Figure 7.1: Total public expenditure on all levels of education (% of GDP)



Note: EU data available from 1995 only; LT, LU, SI not included in EU average.
Sources: Eurostat, World Bank (Edstats). LE calculations for EU average.

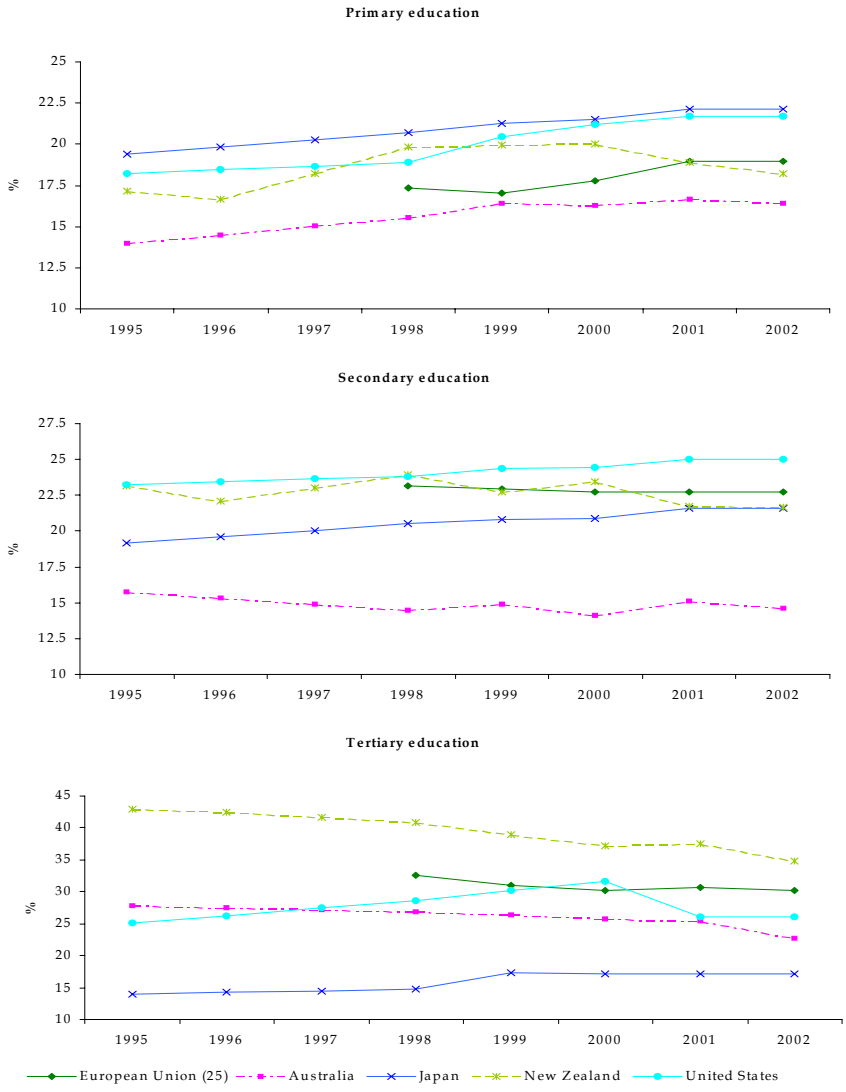
Figure 7.2 shows the expenditure per student (as % of GDP per capita) for different levels of education. We observe that average EU public spending is within a range delimited by its main competitors, in the case of primary and secondary education. It is higher than in Australia (for all levels of education); higher than in Japan (for secondary and tertiary education); and higher than in New Zealand (for primary and secondary education).

Compared with other countries, the average EU expenditure on tertiary education students measured as share of GDP per head is among the highest, only below New Zealand.

With the exception of primary education, where there is a slight but steady increase, the EU's expenditure per head shows no clear trend over recent years. Over the same period, Japan and the United States show an upward trend in expenditure per student at all levels of education. In Australia, expenditure per pupil is rising at primary level and falling at tertiary level,

while at secondary level no clear trend is discernable. In New Zealand the trend in expenditure at all levels of education points downward.

Figure 7.2: Public expenditure per student (% of GDP per capita)



Note: EU data available from 1998 only; LT, LU, MT and SI (for secondary education) not included in EU average.
Sources: Eurostat, IMF (World Economic Outlook, April. 2005), UNESCO, World Bank (Edstats). LE calculations for EU average.

In order to assess how well the EU's education systems are placed in terms of actual resources, Figure 7.3 shows education spending in absolute terms, i.e. in Purchasing Power Standards (PPS). Due to the disparities in GDP levels

within the EU, especially between older and newer members, the countries that acceded to the Union in 2004 (EU10) are presented separately.

Figure 7.3 shows that, on average, the level of public funding per student in the EU is comparable to its main competitors, with the only exception of the United States, where all education levels benefit from higher funding. However, the EU average figure masks large differences between Member States. As a group, EU15 come second behind the United States (and Japan, for primary education) in terms of spending per pupil.

Figure 7.3: Public expenditure per student (PPS).

Note: * PPS (purchasing power standard) is an artificial currency that reflects differences in national price levels that are not taken into account by exchange rates. EU data available from 1998 only; LT, LU, SI and MT (for secondary education) not included in EU average.
Sources: Eurostat, IMF (World Economic Outlook, April. 2005), UNESCO, World Bank (Edstats). LE calculations for EU average.

Current situation

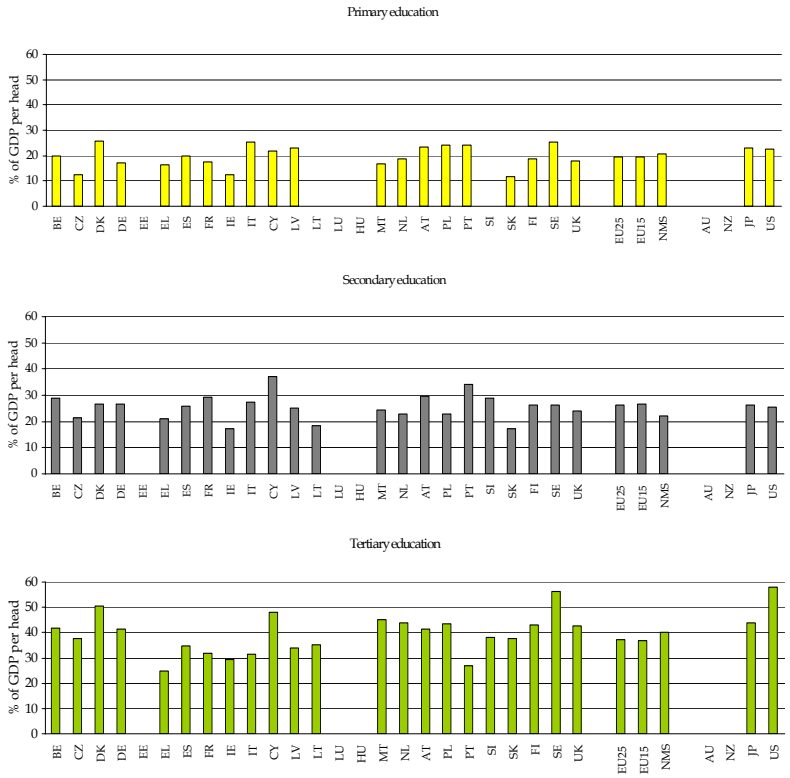
We now turn to the current levels of total expenditures (public and private) on education and training in the EU for individual countries compared with the levels observed in its main competitor nations (time series data were not available for the variables analysed in this section).

Figure 7.4 shows expenditures for different levels of education as a percentage of GDP per capita. The data include public and private funds received by educational institutions, but exclude other expenditures associated with education (for example cost of books, or accommodation for students living away from home).

We observe that the level of primary and secondary education expenditures in the EU is comparable to the levels in the United States and Japan. However, within the EU there are significant differences: while some countries report very low expenditures per head (e.g. the Czech Republic, Ireland, and Slovakia), a number of Member States provide proportionally more resources per head at the primary and secondary levels than either Japan or the United States (for example Austria, Denmark, Italy, Latvia, Portugal and Sweden, at both primary and secondary level, and Belgium, Cyprus, France, Finland and Germany at a secondary level).

Significant differences in funding levels exist at the tertiary level. Tertiary education enjoys the highest level of funding in the United States, although countries like Sweden and Denmark come close to matching US expenditure (in GDP per capita terms). Cyprus, Denmark, Malta, the Netherlands and Sweden all spend proportionally more per tertiary education student than Japan.

Figure 7.4: Annual public and private expenditure per student, by levels of education (2002). (% of GDP per capita).



Primary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
19.8	12.5	25.7	17.1		16.4	19.9	17.4	12.5	25.2	22	23.1				16.6

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
18.6	23.4	24	24.3		11.7	18.7	25.5	18.1	19.3	19.5	20.5			22.9	22.6

Secondary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
28.9	21.4	26.6	26.8		21.1	26	29.2	17.2	27.4	37.2	25.3	18.5			24.4

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
22.8	29.7	22.7	34.2	28.8	17.4	26.2	26.2	23.9	26.1	26.7	22.3			26.1	25.6

Tertiary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
42	37.6	50.5	41.4		24.9	34.7	32	29.4	31.3	48	33.9	35			45.1

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
43.9	41.4	43.4	26.7	38.2	37.7	43.2	56.1	42.7	37.1	36.9	40.1			43.9	57.8

Source: Eurostat

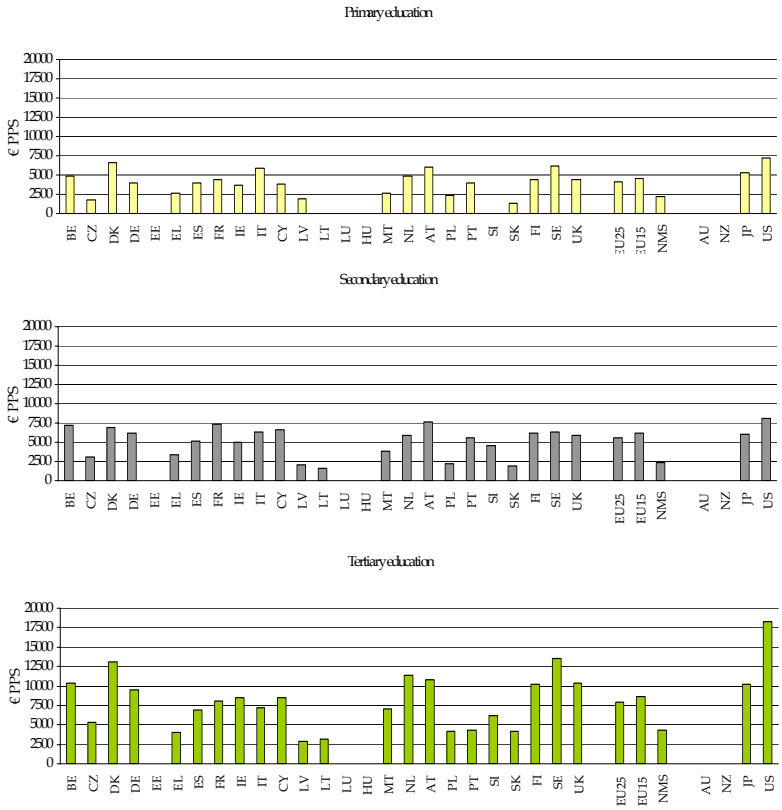
The absolute amount of funds allocated to various levels of education is shown in Figure 7.5. Expenditure is expressed in Purchasing Power Standard (PPS).[54]

[54] Purchasing Power Standard (PPS) is an artificial common currency for the EU25. National currencies are converted into PPS by using bilateral conversion rates (PPPs). Using PPS eliminates exchange rate fluctuations and differences in price levels between countries, thus allowing cross-country comparison of expenditure volumes.

As can be seen from Figure 7.5, per student expenditures in PPS in the United States and Japan are higher than the EU average for all levels of education. It is worth noticing that the difference between the EU average and the United States is particular pronounced in the case of tertiary education.

Looking at individual countries one observes that some Member States are not far from matching US funding levels for primary and secondary education. At primary level, Denmark and Sweden are close to the US expenditure per head, while at the secondary level Austria, France and Belgium are not far behind the US figure. Nevertheless, the differences are noticeable between Member States and the United States in tertiary education.

Figure 7.5: Annual public and private expenditure per student (2002). (PPS*).



Primary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
4891	1793	6671	3917		2690	3965	4346	3609	5821	3892	1926				2590

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
4799	6057	2308	3939		1270	4392	6167	4422	4168	4522	2180			5354	7154

Secondary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
7142	3064	6910	6161		3455	5189	7311	4963	6314	6577	2108	1690			3820

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
5887	7713	2182	5549	4616	1894	6148	6345	5838	5608	6203	2396			6084	8086

Tertiary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT
10377	5384	13109	9496		4084	6925	8009	8469	7226	8487	2829	3199			7048

NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	EU15	NMS	AU	NZ	JP	US
11311	10747	4174	4329	6138	4106	10160	13568	10430	7946	8562	4311			10253	18260

Note: * PPS (purchasing power standard) is an artificial currency that reflects differences in national price levels that are not taken into account by exchange rates.
Source: Eurostat.

7.2 Progress towards the targets

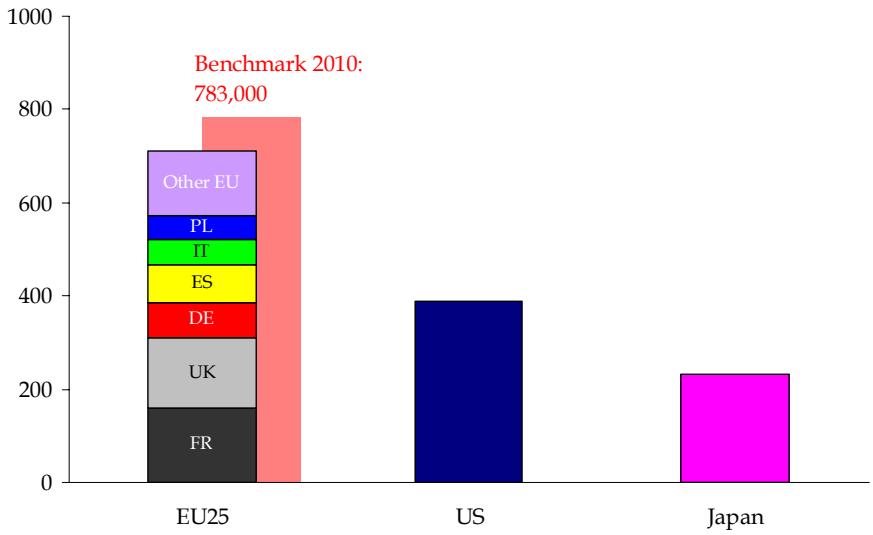
In this section we compare the EU's performance in terms of progress towards Lisbon Target 2 and Target 4 with that of its main competitors. A comparative analysis of the remaining targets was not possible due to lack of comparable data from the EU competitors.

With regards to Target 2 and Target 4 the overall impression is that the European Union is performing well, with many Member States outperforming its international competitors. Noteworthy is the fact that good performers can be found among New Member States as well as the EU15.

Target 2: Increase in graduates in mathematics, science and technology, while reducing gender imbalance

Overall, the 25 EU countries already have more than 740,000 graduates in MST. This is considerably more than either Japan or the United States. We can see in Figure 7.6 that the larger EU countries contribute most to this total, reflecting their large populations.

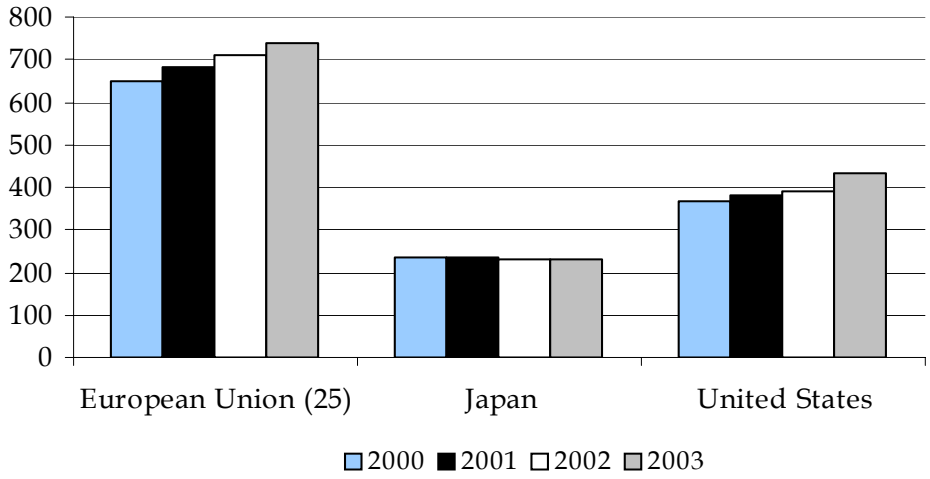
Figure 7.6: Number of MST graduates (Target 2), thousands (2002)



Note: EU25 total does not include Greece. FR data: 2001.
Source: Eurostat, EC (2005).

Compared with Japan and the United States, the European Union also shows the fastest increase in the number of MST graduates (Figure 7.7). In 2003 more than 700,000 students graduated from MST studies, this is an increase of 90,000 from 2000 to 2003. In contrast, in the United States around 400,000 MST students graduated in 2003, which is a 60,000 increase from 2000 to 2003. In Japan the number of MST graduates has remained constant at around 200,000 over recent years.

Figure 7.7: Number of MST graduates 2000-2003, thousands



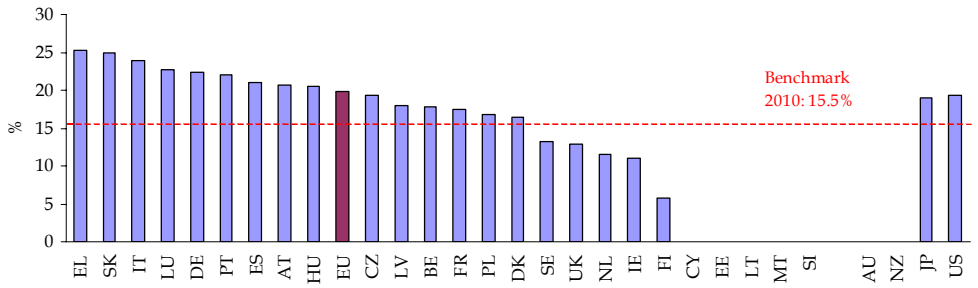
Source: EC (2005).

Target 4: Low-achieving in reading

The OECD PISA survey shows that more than 20% of 15-year-olds across the European Union do not achieve minimal reading standards. Very high rates are reported in countries as diverse as Germany (22%), Greece (25%), Luxemburg (23%) and Slovakia (25%). Some countries managed to reduce their rates significantly since the last PISA exercise in 2000 (most notable Luxembourg, Latvia, Poland), while others (Finland, Ireland, the Netherlands, Sweden, the United Kingdom) are among the world leaders in adolescent literacy.

A comparison with similar figures for Japan and the United States shows that the EU is doing better than its direct competitors.

Figure 7.8: Percentage of population aged 15 at reading literacy proficiency level 1 and lower (Target 4)



Note: 2003 data; except UK (2000); EU figure is the weighted average based on number of pupils enrolled and data for 16 countries.
Sources: Eurostat, EC (2005), PISA (OECD).

7.3 Analysis of education quality

As discussed in Chapter 2 there is no agreement on how to measure education quality, nor on ways to increase it. Using quantifiable inputs as a proxy for education quality can be misleading. For example, Scandinavian countries, which are often cited as exemplary by education experts, do not always show the best performance in terms of these input indicators.

Below, we compare the performance of EU with that of the United States and Japan in terms of three commonly used input quality measures. The indicators we use are the student-teacher ratio, the average class size, and teachers' salary compared with GDP per capita.

Student-teacher ratios are smaller for the EU average than in the United States, New Zealand and Japan, especially in primary and lower secondary education (see Figure 7.9).

At primary level, fourteen Member States (Belgium, Denmark, Estonia, Greece, Spain, Italy, Latvia, Lithuania, Hungary, Austria, Poland, Portugal, Slovenia and Sweden) show a lower student-teacher ratio than Japan, New Zealand or the United States. With the exception of the United Kingdom, which reports the highest ratio in the sample, all Member States have fewer students per teacher in primary education than Japan and New Zealand.

At lower secondary level all EU Member States except Germany and the United Kingdom show a lower student-teacher ratio than the United States, and only the United Kingdom has a higher ratio than New Zealand.

At upper secondary level, only Finland, the Netherlands and the United Kingdom have more students per teacher than the United States, while a

further three Member States (Slovenia, Slovakia and Sweden,) have more students per teacher than Japan and New Zealand. Germany falls between Japan and New Zealand.

Figure 7.9: Students per teacher (2003)

Primary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU
13.1	18.3	14.7	18.7	10.8	12.1	14.3	19.4	18.7	10.9	19.1	15.9	12.1	10.8	10.6

MT	NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	AU	NZ	JP	US
18.4	16.0	14.4	11.9	11.0	12.8	19.4	16.6	12.3	20.0	15.0		19.6	19.9	15.5

Secondary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU
10.6	14.3	11.2	15.6	10.3	8.7	13.3	13.8	13.9	10.3	12.8	13.1	9.0	9.0	10.6

MT	NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	AU	NZ	JP	US
10.0		9.8	12.6	9.3	13.0	13.9	9.8	12.1	17.4	13.7		19.4	15.7	15.5

Tertiary

BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU
9.6	12.6	10.3	13.7	13.4	8.6	7.9	10.7		10.8	12.0	12.2	8.3		13.2

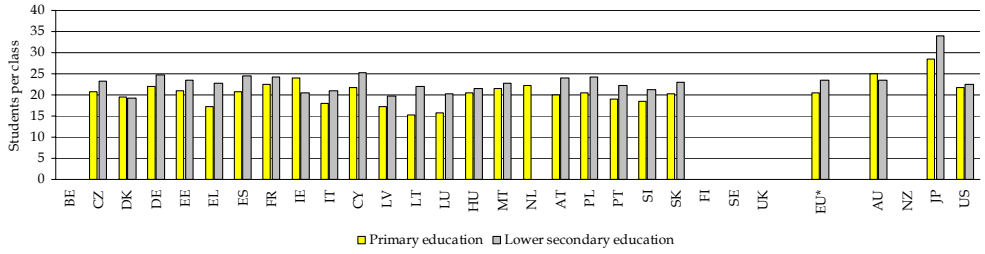
MT	NL	AT	PL	PT	SI	SK	FI	SE	UK	EU25	AU	NZ	JP	US
10.1	15.7	10.3	13.5	7.5	14.6	14.0	15.9	14.1	20.3	13.2		13.8	13.5	15.6

Note: 2003 data, except AT, PT, NZ: 2002 data, and EE: 2001 data.
Source: Eurostat, OECD. LE calculations for EU average.

Figures on average class sizes confirm the previous findings. Again, the EU average is broadly similar to those of its main competitors, particularly the United States (see Figure 7.10). Primary school classes in the EU are, on average, smaller than those in Japan, New Zealand or the United States. In lower secondary schools the average in the EU is equal to that in Australia, slightly larger than in the United States, but still significantly smaller than in Japan.

At Member State-level, the picture is as follows. Primary school classes in France, Germany and the Netherlands are larger than those in the United States, but classes in all Member States are smaller than in either Australia or Japan. Classes in lower secondary schools in the European Union are larger than in the United States in twelve countries (the Czech Republic, Germany, Estonia, Greece, Spain, France, Cyprus, Lithuania, Malta, Austria, Poland and Slovakia), but in Germany, Spain, France, Cyprus and Poland classes are also larger than in Australia.

Figure 7.10: Average class size (2003)



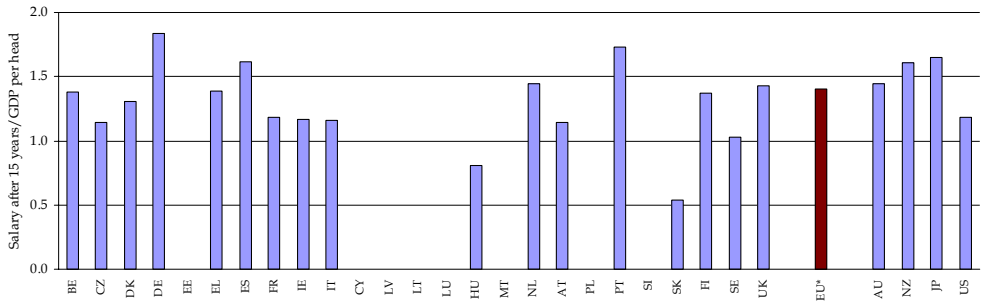
Note: 2003 data. * BE, NL, FI (for LSE), UK are not included in the EU average: no data available.
Source: Eurostat. LE calculations for EU average.

On the assumption that high wages attract people of a high calibre, teachers' salary relative to GDP per capita is sometimes used as a proxy for the quality of teaching staff. Figure 7.11 shows that the average EU teachers' salaries are higher (relative to GDP per capita) than in the United States, but lower than in Japan and New Zealand, and slightly lower than in Australia.[55]

[55] Because data is based on teachers' salaries relative to GDP per capita, one cannot draw any conclusions from the analysis above about the ranking of teacher's salaries in absolute terms.

Figure 7.11 reveals further that, while nine countries in our sample pay relatively higher salaries than the United States, only two, Germany and Portugal, have higher salaries relative to GDP than Japan and New Zealand.

Figure 7.11: Teachers' salary relative to GDP per capita (PE, LSE, USE) (2002).



Note: 2002 data. * EE, CY, LT, LU, LV, MT, PL, SI are not included in the EU average: no data available.
Source: OECD.

8 Conclusions and recommendations

Internal rates of return to the investment necessary to achieve the Lisbon education targets have been estimated with a model developed specifically for this project. Such rates of return are generally high. Yet, funding resources are finite. Therefore, to assist in the prioritisation of the potential investments, we present a summary ranking of the rates of return of these investments. We also make some comments on possible improvements to the data used for such analysis.

Achieving the targets and rates of returns to the necessary investments

In Table 8.1, below, we provide a summary ranking of the targets investments based on their rates of return. Rates of return greater than 7% are shown in a shaded cell in the table. Some member states are already above some targets' benchmarks or will achieve them in 2010 under their current policies. Therefore, the rates of return are only shown for the Member States that require additional investments to achieve each of the different targets.

In terms of private returns, completing USE yields the highest returns in most countries but MST also ranks highly in several countries. Among the various education investments considered in this study, the private rate of return to improving literacy is the highest in the Czech Republic, Poland and Slovakia.

There are fewer instances where social rates of return are higher than 7%. This is mainly due to the high costs of providing public education in many Member States. Overall, the social rates of return to USE and MST education remain higher than those to TE and literacy.

The policy implications from our analyses are that:

- Member States should focus primarily on achieving Targets 1 and 3, and Target 2.
- In general, Target 6 yields the lowest returns. This is because of the high costs involved in higher education.
- Achievement of Target 4 yields returns that lie between those shown by the investments necessary to achieve Targets 1 and 3, and Target 6.

Table 8.1: Private and social rates of return for targets by order of size

	Private				Social			
	Highest			Lowest	Highest			Lowest
BE	USE	Lit	MST		USE	MST	Lit	
CZ	Lit	TE	MST		Lit	TE	MST	
DK	USE	Lit	MST		USE	Lit	MST	
DE	USE	TE	Lit	MST	USE	Lit	TE	MST
EE	USE	MST			USE	MST		
EL	USE	Lit			USE	Lit		
ES	MST	USE	Lit		MST	USE	Lit	
FR	USE	Lit	MST		MST	USE	Lit	
IE	USE	MST			USE	MST		
IT	MST	USE	Lit	TE	MST	USE	Lit	TE
CY	MST	USE	TE		MST	USE	TE	
LV	USE	Lit	MST		USE	Lit	MST	
LT	MST				MST			
HU	MST				MST			
MT	MST	USE	TE		MST	USE	TE	
NL	USE	MST			USE	MST		
AT	MST	Lit	TE		Lit	MST	TE	
PL	Lit	MST			Lit	MST		
PT	MST	USE	Lit		MST	USE	Lit	
SI	MST				MST			
SK	Lit	TE	MST		Lit	TE	MST	
FI	MST				MST			
SE	MST				MST			
UK	USE				USE			

Note: Shaded cells identify internal rates of return in excess of 7%. USE upper secondary education, TE tertiary education, Lit literacy rates.
Source: LE calculations

Achieving the targets raises the difficult challenge of increasing the number of graduates without reducing the quality of education in the overall system. The number of graduates could be increased by simply reducing the qualification requirements and/or making tests easier for every student. However, it is important to note that any quality impairment (at any level of education) will automatically reduce the amount of human capital accumulated by graduates and, hence, the level of benefits accruing from education. As a result, the rates of return would be lower than the ones reported in this study.

While small changes in the costs of education and the Mincerian returns do not have a substantial impact on the estimated rates of return, large differences on these two factors across Member States explain the diversity in the rates of return obtained for similar type of investments. From a policy perspective, country differences on these two factors would warrant further analysis as they are an important input in the estimates of the rates of return.

Improving availability of data

The indicator for Target 4 is based on the performance in literacy tests from the Programme for International Student Assessment (PISA). The PISA is conducted by the OECD and this means that for some New Member States this indicator is not available. It would be worthwhile considering expanding the PISA project to all Member States.

The data on education expenditure used in this study was obtained from the OECD. This meant that for some of the EU New Member States data was not available. We believe that it would be worthwhile considering constructing a data bank for all Member States that provides comparable data on education expenditures for different education levels, and for both public and private sources.

The data on the theoretical duration of education used by this and other studies could differ from the actual time it takes to complete a course. Furthermore, there is little information about dropout rates, and these are available for OECD countries only. We believe that the research on the economics of education in Europe would benefit greatly from having better data on the completion time and success rates of undertaking various levels of education.

Data on costs of MST studies and earnings of MST professionals are not very precise. To quantify better the economic effects of undertaking MST studies, it would be beneficial to have more precise estimates of the costs of such studies and the earnings of MST graduates across the EU25.

Mincerian returns used in this project are based on empirical findings in the literature. However, Mincerian returns are not available for New Member States. This is an important issue for any study that tries to identify the benefits of education in those countries. From a policy development perspective, it would be beneficial to provide the community of researchers with Mincerian returns for different Member States using a methodology that is robust and comparable across countries. In this regard, it would be worthwhile for DG-EAC to intensify the work initiated in the research project PuRE and, to the extent possible, expand it to the New Member States.

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Annex 1 Reading Recovery programmes

In New Zealand, *Reading Recovery* is an early intervention programme designed to assist children in first grade (i.e. around the age of 6), who are having difficulty learning to read and write. The programme aims to move children in a short time from the bottom of their class to the average, and subsequently enable them to participate and benefit from regular classroom instruction.

Children that have inadequate reading and writing skills receive a supplementary, short-term, individually designed programme of instruction that allows them to catch up with the rest of the class. The programme consists of one-to-one tutoring by a specially trained teacher for 30 minutes per day, five days a week. The sessions continue until children can read at or above the class average and can learn without remedial help. On average the private tutoring continues for 12-20 weeks.

The success of *Reading Recovery* has been carefully documented since its inception. Pilot studies in New Zealand and in the United States demonstrated that the programme provides children in the lowest 20 percent of their class with the skills necessary to read at or above grade level in an average of 12-20 weeks. Follow-up studies in both countries further showed that *Reading Recovery* children continue to read at an average level or better some years after receiving the intervention, reducing the need for long-term remediation. An extended series of studies of the *Reading Recovery* programme as implemented in Ohio for first-grade children found that the programme is successful in accelerating 3 out of 4 students up to the level of their peers (Sensenbaugh, 1996, Pollock, 1994). However, other authors have suggested that these studies may greatly overestimate the effectiveness of *Reading Recovery* (Costantino et al., 1999).

In Victoria, Australia, the *Middle Years Literacy Research Project* programme was designed to improve literacy outcomes for students in the middle years experiencing literacy difficulties[56]. The programme focuses on literacy education in mainstream classroom practice in the grades 8-15 (pupils aged 10-15).

Schools were provided a small research grant to enable them to implement the programmes. The policies and practices that supported successful literacy interventions included identification of students with low levels of literacy achievement and providing explicit support to address their particular literacy learning needs. For instance, the interventions allowed for one to one sessions or small group settings, which give students regular opportunities over time to work on specific literacy needs.

[56] See Middle Years of Schooling, Department of Education and Training. Victoria. Australia (http://www.sofweb.vic.edu.au/mys/index.htm).

Case studies have shown that the programme has improved literacy learning outcomes, which is in line with findings for similar programmes in the US. In fact some studies in the United States indicate that recovery programme students outperformed control students in almost all assessment measures (Slavin, 2005).

Other programmes in Victoria, Australia, give an indication of the length of the programme to be effective. For example Bridging the Gap (Department of Education, Goulburn North-Eastern Region) is a ten week (at minimum of three sessions per week) one-to-one literacy intervention programme that is designed for students in Years 5-8 who are experiencing difficulty in reading and writing.

Annex 2 Data and assumptions used in the model

For each Member State, data for the Lisbon target indicators is produced by Eurostat. A summary of the latest available figures for the indicators, as included in the model, is provided in Table A.1.

Table A.1: Lisbon target indicators used in the model (latest available data)

Member State	Target 1	Target 2			Target 3	Target 4	Target 5	Target 6
		Total	Females	Males				
	2004[1]	2003[2]	2003[2]	2003[2]	2004[1]	2003	2004	2003[3]
BE	11.9	10.5	5.2	15.7	82.1	17.8	9.5	53.6
CZ	6.1	6.4	3.8	8.8	90.9	19.4	6.3	27.6
DK	8.1	12.2	7.1	17.3	76.1	16.5	27.6	56.0
DE	12.8	8.4	4.0	12.7	72.5	22.3	6.0	29.6
EE	13.7	6.6	5.4	7.9	82.2	..	6.7	53.5
EL	15.3	..	..	..	81.7	25.2	3.7	..
ES	30.4	12.2	7.7	16.5	62.5	21.1	5.2	41.3
FR	14.2	22.2	13.6	30.7	79.8	17.5	7.8	72.3
IE	12.9	24.2	16.8	31.5	85.3	11.0	7.2	85.0
IT	23.5	7.4	5.4	9.4	69.9	23.9	4.7	27.6
CY	18.4	3.8	2.1	5.6	80.1	..	9.3	31.7
LV	15.6	8.6	6.6	10.5	76.9	18.0	9.1	65.6
LT	9.5	16.3	11.8	20.8	86.1	..	6.5	73.2
LU	17.0	1.8	..	..	69.8	22.7	6.3	10.3
HU	12.6	4.8	2.6	6.9	83.4	20.5	4.6	42.3
MT	45.0	2.1	1.7	4.5	47.9	..	5.0	37.3
NL	15.0	7.3	2.7	11.7	73.3	11.5	16.5	39.0
AT	9.2	8.3	13.0	3.5	85.3	20.7	12.0	26.2
PL	5.7	9.0	6.1	11.8	89.5	16.8	5.5	87.5
PT	39.4	8.2	6.9	9.5	49.0	22.0	4.8	41.7
SI	4.2	8.7	4.6	12.5	89.7	..	17.9	47.1
SK	7.1	8.3	5.8	10.7	91.3	24.9	4.6	37.1
FI	8.7	17.4	9.9	24.6	84.6	5.7	24.6	62.7
SE	8.6	13.9	9.7	17.9	86.3	13.3	35.8	41.9
UK	16.7	19.5	13.2	25.5	76.4	15.2	21.3	75.2

Notes: [1] LU, NL 2003; [2] LU 2000, DK 2001, BE, EE, ES, CY, IT, MT, FI, UK 2002; [3] LU 2000, IT, FI 2002. Target 1: Early school leavers; Target 2: MST graduates per 1000 of the corresponding population aged 20-29; Target 3: Youth education attainment level – total ; Target 4: Reading proficiency of 15-year-olds ; Target 5: Lifelong learning ; Target 6: Graduates (ISCED 5-6) of all ages per 1000 of the population aged 25-34

Source: Eurostat

As we have already noted, policy measures moving a country closer to achieving the Lisbon targets may already be in place in some Member States. Therefore, when estimating the additional investment required for each of the targets one should take into account the future enrolment and educational achievement projections under current spending plans. We asked Member States to provide their projections of education enrolment and attainment to

2010 based on current spending plans and for different levels of education. The projections have been incorporated into the model.

The variables and parameters used in the computations of the internal rates of returns are described for each of the targets in the different subsections below. In general, our costs estimates for USE, TE, MST, LLL and Literacy, distinguish between public (government) and private (household) expenditures.[57] We have assumed that firms do not contribute directly to education funding except in the cases of training.

In addition to the direct financial costs, one needs to account also for the foregone earnings of the additional students in education (i.e. the opportunity costs of being in education). For USE and TE we have assumed that the foregone earnings correspond to the earnings of the workers with one lower level of education. For example, in the case of the additional students in TE the foregone earnings correspond to the earnings of workers having completed USE only. In contrast, for programmes aimed at improving literacy rates the opportunity costs are zero, as the programme is targeted at students who are still in school and are below the minimum legal working age.

For each age cohort, we also calculate the benefits from achieving the education levels specified in the different targets. From a private point of view, such benefits include individuals' increase in net earnings and a higher probability of being employed. From a social point of view, the benefit comes from an increase in per capita GDP and a higher proportion of employed people in the economy. To calculate the increases in wages and per capita GDP we use the Mincerian rates of return that have been reported in de la Fuente (2003).[58]

An important assumption that is made in our computations is that the life-cycle earnings profile across cohorts remains stable over time. Although this is a reasonable assumption for more developed economies there could be significant changes in the distribution of earning across cohorts in countries undergoing fast economic development such as, for example, the New Member States.[59] However, since the magnitude and direction of the changes in earning profiles is uncertain, we have not been able to incorporate them in the model.

Target 1: Reduce the numbers of early school leavers

The policy intervention for this target involves investing in USE education of early school leavers. Although this will not immediately improve Target 1

[57] We assume that all costs increase annually by 1% in real terms.

[58] In projecting future wages and GDP we have assumed that wages increase annually 1% in real terms and GDP increases annually by 2% in real terms.

[59] We thank Daniel Münich for bringing this to our attention.

(which is defined for the population aged 18-24), the number of people with additional education will increase gradually and, after some years, a reduction in the number of early school leavers will be observed in the 18-24 age cohort.

Our calculations are based on the following data and assumptions.

The length of USE and the last year of compulsory education are shown in columns (1) and (2) of Table A.2, for the different Member States. The number of additional years of schooling required for early school leavers to achieve USE education has been computed as the difference between the typical USE graduation age and age at which compulsory education ends. This is shown in column (3) of Table A.2.[60]

For example, in the United Kingdom education is compulsory until the age of 16, and USE runs from 14 to 17 (i.e., a duration of 4 years). Therefore, reducing the number of early school leavers involves educating early school leavers at the age of 16 to achieve 2 additional years of education. Moreover, our policy option is also directed at early school leavers one year older than the age at which compulsory education ends. In the United Kingdom, this would imply educating also early school leavers at the age of 17.[61]

Finally, we also account for the fact that some people will drop out from education before completing the additional years of USE. Our estimates of USE success rates (i.e., probability of a new entrant successfully completing the entire course of education) have been estimated from OECD (2004)[62] data using the same method as de la Fuente and Jimeno (2004).[63] Survival rates (the probability of successfully completing one year of education) for USE are shown in column (4) of Table A.2. For countries where such data were not available, we have used an imputed value constructed by taking the median value of the corresponding data from a similar group of countries.[64] Imputed values are shown in italics in Table A.2.

[60] We note that, in Hungary, until recently, compulsory schooling extended to the end of the academic year in which students turned 16 years old. However, as a result of a recent change for students who began their studies on September 1st, 1998 or thereafter, compulsory schooling will last until the end of the school year in which they turn 18 years old. Therefore, we expect that by 2010 the number of early school leavers will have fallen sharply as all youngsters between 18 and 24 years (aside from those who have failed and dropped out of the system) will be either in education or will have achieved USE.

[61] Because data on early school leavers are only available for the 18-24 cohort, we have assumed that the percentage of early school leavers for younger cohorts (i.e. 16 and 17) is the same as the 18-24 cohort.

[62] Education at a Glance, Tables C1.3 and A2.1.

[63] Having overall course survival rates for USE (OECD) theoretical course durations, we calculate the yearly survival rate as exp{(ln x)/d}, where x = overall survival rate, and d = course length.

[64] Countries have been grouped on the basis of broadly similar per capita GDP. See Annex 4 for a detailed description of the country groups.

Table A.2: USE education characteristics

Member State	Typical age range* (1)	Last year of compulsory education (2)	Additional years required to achieve USE (3)	USE yearly survival rate** (4)
BE	14-17	15	3	0.92
CZ	15-18	15	4	0.95
DK	16-18	16	3	1.00
DE	16-18	16	3	0.99
EE	16-18	16	3	*0.95*
EL	14-17	15	3	0.97
ES	16-17	16	2	0.89
FR	15-17	16	2	0.95
IE	15-17	16	2	0.93
IT	14-18	15	4	0.98
CY	15-17	15	3	*0.89*
LV	15-18	15	4	*0.95*
LT	16-17	16	2	*0.95*
LU	15-18	15	4	0.93
HU**	14-17	18	0	0.95
MT	16-17	16	2	*0.89*
NL	15-17	16	2	0.97
AT	14-17	15	3	0.90
PL	16-18	16	3	1.00
PT	15-17	15	3	0.85
SI	15-18	15	4	*0.89*
SK	15-18	16	3	0.89
FI	16-18	16	3	0.96
SE	16-18	16	3	0.93
UK	14-17	16	2	0.91

Note: * at start of academic year. ** 2002 data. *** As a result of a recent change in Hungary, students will remain in education until the end of the school year in which they turn 18 (see footnote 60). Imputed values for missing data are shown in italics.
Source: Eurydice, OECD.

Estimates of the direct financial costs of USE are based on data on private and government expenditure on secondary education taken from the OECD's *Education at a Glance*. The OECD figures provide average (total and private) cost per student and are used in our model as an approximation of the

marginal costs caused by the new enrolments required to achieve Target 1.[65] A detailed description of the data is presented in Annex 3.

A limitation of our cost estimates is that average education costs can differ noticeable from marginal costs.[66] If the number of additional students to be educated is sufficiently small, marginal costs could be very low, as a slightly higher number of students could be educated with almost the same resources (in terms of teachers and equipment). On the other hand, if the number of additional students to undertake the additional USE years of schooling is high, it could require new teachers, new buildings or even education restructuring, resulting in very high marginal costs. Moreover, the additional students may have some characteristics which are less favourable and more resources could be needed to educate them.

As we could not obtain accurate quantitative estimates of the marginal costs of education, we use the average cost estimates and test the sensitivity of this assumption by undertaking a sensitivity analysis, showing the impact in the results of changes in the costs under different assumptions.

The foregone earnings of USE are the opportunity costs while in education. We have assumed that the opportunity costs of studying in USE are equal to the earnings of the workers without USE in the same age cohort (a description of earnings estimates for different cohorts and levels of education is provided in Annex 4).

An important input in the computation of the internal rates of return is the estimate of the benefits from achieving additional years of education. Our estimates of private and social returns from additional USE are based on the one-year Mincerian returns estimated by de la Fuente (2003).[67] The one-year (private and social) estimates are corrected to account for the additional years of schooling required to complete USE in each country.[68] The Mincerian private and social returns for one year of education and for the additional USE years are shown in columns (1) to (4) of Table A.3. The additional years required to complete USE is shown in the last column of Table A.3.

No estimates of Mincerian returns are available for New Member States. For each of these countries, we have imputed a value using the median value of the Mincerian returns of a group of countries with similar characteristics.[69]

[65] One difference between our estimates and the estimates presented in other studies (such as de la Fuente, 2003) is that our costs include data on associated costs of education (but not directly paid to educational institutions). Hence, we include the costs of books and the costs of living due to being far from the parental home. We also distinguish between private and public expenditure at source (meaning all subsidies given to households are included under public expenditure).

[66] We thank Daniel Münich for this point.

[67] See Annex 2 for details.

[68] Mincerian return for the USE level of education is computed as $(1+x)^d - 1$, where x = Mincerian return to one additional year of education, and d = education length (in years).

[69] Countries have been grouped on the basis of broadly similar per capita GDP. See Annex 4 for a detailed

As a result, we used the Mincerian returns of Greece for all New Member States. We use the median to avoid any outliers unduly influencing our results. Imputed values are shown in Table A.3 in italics.

It is also worth noting that youngsters dropping out from education may be less able students. Therefore, their returns after completion of USE could be lower than the average return of those who have finished school. By using the Mincerian returns we are implicitly assuming that such students returning to USE will perform as well as an average USE student. To show how the results are conditioned on these assumptions, we undertake some sensitivity analysis around these assumptions.

Finally, it is worth noticing that the benefits from additional education follow from higher earnings, and also from a higher probability of being employed. Some authors (de la Fuente, 2003) have warned against attributing the whole difference between the employment rates of the various education levels to education only. Because probably other factors are at play, only a fraction of this difference can be attributed to education. Following de la Fuente (2003) for private returns we count as a benefit only 2/3 of the total change in employment probability. We have used the same assumption for the social returns.

description of the country groups.

Table A.3: Private and social Mincerian returns (one-year and USE)

Member State	Mincerian private returns		Mincerian social returns		Additional USE years
	One-year (1)	To additional USE education (2)	One-year (3)	To additional USE education (4)	(5)
BE	0.07	0.23	0.06	0.18	3
CZ	*0.08*	*0.37*	*0.07*	*0.33*	4
DK	0.06	0.18	0.05	0.16	3
DE	0.09	0.29	0.05	0.14	3
EE	*0.08*	*0.27*	*0.07*	*0.24*	3
EL	0.08	0.27	0.07	0.24	3
ES	0.08	0.17	0.08	0.17	2
FR	0.08	0.16	0.06	0.12	2
IE	0.11	0.23	0.06	0.13	2
IT	0.08	0.36	0.07	0.33	4
CY	*0.08*	*0.27*	*0.08*	*0.27*	3
LV	*0.08*	*0.37*	*0.07*	*0.33*	4
LT	*0.08*	*0.17*	*0.07*	*0.15*	2
LU	..	..	..	..	4
HU	*0.08*	*0.00*	*0.07*	*0.00*	0
MT	*0.08*	*0.17*	*0.08*	*0.17*	2
AT	0.09	0.28	0.05	0.16	3
NL	0.07	0.14	0.05	0.11	2
PL	*0.08*	*0.27*	*0.07*	*0.24*	3
PT	0.10	0.32	0.09	0.30	3
SI	*0.08*	*0.37*	*0.08*	*0.37*	4
SK	*0.08*	*0.27*	*0.07*	*0.24*	3
FI	0.09	0.28	0.05	0.17	3
SE	0.04	0.12	0.06	0.18	3
UK	0.10	0.22	0.06	0.11	2

Note : Imputed values for missing data are shown in italics.
Source: de la Fuente and Jimeno (2004), LE calculations.

Target 2: Increase in graduates in mathematics, science and technology, while reducing gender imbalance

The policy option for this target assumes an increase in the overall number of MST students. We assume that the increase in new entrant in MST studies is gradual and that it will take a few years until the number of current additional students reaches its steady state level. Implementation of this

target means that the number of MST graduates needs to increase 43,000 by 2010 (however, for each country only a share of this increase is required).

The benchmark for this target is specified in absolute terms. This means that if a country has reached the benchmark but its student population declines in the future it will be necessary to increase steadily the proportion of students going into MST studies to be able to maintain the number of graduates constant.

MST financial cost data are not available for each of the Member States. However, due to the high costs of laboratories, the costs of a MST education are usually higher than the average TE education. MST cost estimates are based on the average cost of TE, adjusted to reflect the higher cost of MST courses. Data on the costs of education for different types of courses in England show that the costs of MST courses are 11% higher than the overall TE average costs.[70] We make the assumption that this percentage difference in costs is the same across all Member States, and adjust TE financial costs data of all Member States accordingly.

Earnings of MST graduates are usually different from the earnings of the average worker with TE. We estimate the impact of MST education on earnings as a mark-up of TE earnings. The ratio of MST earnings to average TE earnings is used to mark up private benefits in the computation of private returns.[71] To construct the social mark-up we have modified the private mark-up using the observed relationship between private and social one-year Mincerian returns.

A limitation of this approach is that we identify occupations that are most closely associated with the skills possessed by MST graduates, but it is not possible to get an exact match. The closest data available are on "professional" occupations, to which occupations alone MST graduates are not limited. Moreover, professional earnings include fields of occupation not associated with MST (e.g., lawyers, performing arts, behavioural sciences). However, data at a more detailed breakdown are not publicly available.

Our estimates of mark-ups are shown in Table A.4. It is interesting to see that in some countries MST graduates do not earn more than the overall average of TE graduates and sometimes less. Moreover, since MST education is in general more costly than the average TE, the rates of returns in these countries will probably result in negative returns. This is already a

[70] England data from HEFCE on overall costs of courses. Subjects considered to be MST comprise: Science, Mathematics, Computing, Engineering, Manufacturing and Construction.

[71] Average individual earnings by occupation and in the economy overall have been obtained from Eurostat (Structure of Earnings Survey 2002). We have used the average earnings of professionals (ISCO group 2) as an estimation of MST earnings. This included the following fields of occupation: physical, mathematical and engineering science professionals; life science and health professionals; teaching professionals; business, legal, information and social science professionals; writers and creative or performing artists; religious professionals; and public service administrative professionals. We should note that Eurostat informed us on 8th June 2005 that the whole SES2002 dataset were under revision. For our model we used data extracted on 5th May 2005.

noteworthy finding that, in some countries, further investments in MST education will not necessarily yield positive returns, especially when compared with the returns of other types of TE studies.

However, we would expect that as economies grow, MST earnings may increase in these countries due to a higher demand for MST skills. Moreover, MST graduates can move to other countries in search for better-paid jobs. Italy shows a high mark up. This is due to large differences in earnings of MST and non-MST graduates in the original data.

Table A.4: Mark-up of MST earnings relative to average TE earnings (2002).

Member State	MST private mark-up	MST social mark-up
BE	11.1%	8.9%
CZ	-18.2%	-16.5%
DK	10.6%	9.3%
DE	-1.2%	-0.6%
EE	10.3%	9.3%
EL	13.5%	12.2%
ES	13.5%	13.6%
FR	20.9%	15.1%
IE	7.2%	4.1%
IT	104.4%	96.5%
CY	17.2%	17.2%
LV	-7.4%	-6.6%
LT	-4.5%	-4.1%
LU	..	..
HU	-18.6%	-16.8%
MT	13.5%	13.6%
AT	7.8%	4.7%
NL	-1.7%	-1.4%
PL	-11.8%	-10.6%
PT	13.5%	12.7%
SI	2.0%	2.0%
SK	-13.7%	-12.4%
FI	17.0%	10.5%
SE	1.9%	2.7%
UK	5.2%	2.8%

Source: Structure of Earnings Survey, 2002 and LE calculations.

Target 3: Increase population with at least upper secondary education

The proposed policy measure is the same as for achieving Target 1. Namely, it requires an increase in the number of students enrolled in USE who otherwise would have been early school leavers. We make the same assumptions as for Target 1 (see Table A.2 and Table A.3).

Target 4: Low-achieving in reading

Our policy option for this target assumes that reading literacy rates can be improved with a reading recovery programme at the age of 10.

Our calculations are based on the following data and assumptions.

As a result of the programme, pupils with low reading skills will improve their reading and achieve a level similar to the average class performance. Moreover, for successful pupils, the effects of the programme will last until the age of 15 and, as a result, their reading literacy proficiency in the reading tests will be above "level 1".

There have been two PISA surveys: in 2000 and 2003. We assume that results from the 2003 survey are valid representative values of the situation in 2004.[72]

Per pupil costs of a Reading Recovery programme have been estimated by Assad and Condon (1996) for programmes in the United States.[73] The costs for the different Member States have been imputed by using the US per pupil costs adjusted for differences in US and Member States' data on teachers' salaries. The costs have also been adjusted for inflation. It is important to note that the opportunity costs for this target are zero, as at the age of 10, students are still in school and are below the minimum legal working age.

There exist no studies that estimate the private and social impact of reducing the number of low-achieving 15 year olds in reading literacy.[74] Our approach for this target is the following. The benefits to students of improving their literacy skills are indirect and accrue from the fact that those pupils who are in such a programme will be as successful as the mainstream students in

[72] There are some noticeable differences in the UK data for 2000 and 2003: the percentage of pupils with reading literacy below level 1 was 12.8 and 15.2 in 2000 and 2003 respectively (2003 data is available online at http://www.pisa.oecd.org/dataoecd/16/50/34016945.xls [sheet B2.4]). Some commentators have questioned the validity of the 2003 UK figure due to problems with the selection of the sample (for example, EC, 2005). As agreed with DG-EAC, we use the 2003 figure, although we note that the UK figure must be treated with caution.

[73] See Annex 1 for details.

[74] Nevertheless, some studies have analysed the effects on growth of human capital using the countries' school tests *aggregate* as indicators of human capital. For example, Coulombe et al. (2004) use aggregate literacy results for individuals aged 17 to 25, and Hanushek and Kimko (2000) use the countries' aggregate for mathematics and science tests. On the other hand, Dearden, McIntosh, Myck and Vignoles (2000) report that individuals with Level 1 literacy skills have higher earnings than individuals below that level in the United Kingdom.

completing USE. Such a student is assumed to be successful at each of the stages with a certain probability. The probability of being successful at the Reading Recovery programme has been estimated at 75% (Sensenbaugh, 1996, Pollock, 1994): this is the successful rate in accelerating students to the level of their peers. After catching up with their peers, we assume that the individual will be able to continue his education, with the same success/drop-out rates as the average student. The probability of dropping out from education is the same as the one used in assessing the achievement of Target 1.[75]

The benefits from improving literacy rates are computed for both private and social benefits. From a social point of view, the costs of both the reading programme and those related to progressing further in USE will be included. From the private point of view, only the costs of progressing in USE are included, as the reading programmes are provided for free by the government.

Target 5: Participation in lifelong learning

Our proposed policy option for this target is to increase the number of individuals between 25 and 65 that undertake extra lifelong learning.

Our calculations are based on the following data and assumptions.

The increase in the total number of learners is shared equally among the different cohorts in the age range 25-65.

Training costs per participant include the direct costs of training, the labour cost of the worker undergoing training (opportunity cost) and the net contribution to collective funds organised for the purpose of training. The data come from Eurostat's Continuing Vocational Training Survey in 1999 (CVTS2). We have adjusted for inflation using the HICP for each Member State to reflect 2005 costs.

We have not been able to compute the benefits of training, as there are no estimates of Mincerian returns available in the literature for lifelong learning. Hence, we report only the required enrolments and their related costs.

Target 6: Increase graduates in tertiary education

The proposed policy measure requires an increase in the intake of tertiary education of students in the cohorts in year one and two following their graduation from USE.

The achievement of this target needs to account for the number of additional years required to complete TE, which differs across Member States. We use

[75] Because Hungary's compulsory education is until the age of 18, we cannot say that pupils will be more likely to finish USE as a result of improving their literacy skills. We believe that the benefits of having less illiterates could yield high benefits in Hungary. However, the approach for this target does not allow computing a quantitative estimates for this country.

theoretical course durations from de la Fuente and Jimeno (2004) for the EU15 Member States, and information from Eurydice to estimate typical course durations for New Member States. Our estimates for the typical ages for being enrolled in TE are shown in column (1) of Table A.5. The number of additional years required to graduate from TE are shown in column (2) of Table A.5.

Finally, we also need to account for people dropping out from education. Our estimates of education success rates are based on the same approach as the one of de la Fuente and Jimeno (2004). It uses data from the OECD (2004) and our estimates of typical course durations (see footnote 63). The yearly survival rates for TE are shown in column (3) of Table A.5. For countries where data were not available, we have used an imputed value constructed by taking the median value of this variable in a similar group of countries.[76] Imputed values are shown in italics.

[76] Countries have been grouped into groups of similar characteristics using per capita GDP. See Annex 4 for a list of countries' groups.

Table A.5: TE educations characteristics

Member State	Typical age range (1)	Years required to achieve TE (2)	Yearly Survival Rate (3)
BE	18-21	4	0.88
CZ	19-22	4	0.89
DK	19-22	4	0.91
DE	19-22	4	0.92
EE	19-22	4	***0.95***
EL	18-21	4	***0.89***
ES	18-22	5	0.95
FR	18-21	4	0.88
IE	18-21	4	0.96
IT	19-23	5	0.84
CY	18-21	4	***0.89***
LV	19-22	4	***0.95***
LT	18-22	5	***0.95***
LU	19-23	5	..
HU	18-22	5	0.95
MT	18-21	4	***0.89***
AT	18-21	4	0.88
NL	18-22	5	0.93
PL	19-23	5	0.96
PT	18-21	4	0.84
SI	19-22	4	***0.89***
SK	19-22	4	***0.95***
FI	19-23	5	0.94
SE	19-22	4	0.83
UK	18-21	4	0.95

Note: Imputed values for missing data are shown in italics.
Source: Eurydice

Estimates of the direct private and total costs of TE are based on data on private and government expenditure on secondary education taken from OECD's Education at a Glance. A detailed description of the data is presented in Annex 2.

The foregone earnings during TE are the opportunity costs of being in education. We have assumed that the TE opportunity costs are equal to the earnings of workers with USE in the same age cohort (a description of earnings estimates for different cohorts and levels of education is in Annex 4).

An important input into the computation of the internal rates of return is the benefit from having achieved TE. Our estimates of private and social returns for TE are based on the one-year Mincerian returns estimated by de la Fuente (2003).[77] The one-year (private and social) estimates are corrected to account for different lengths of TE education across Member States, using the same formula as in footnote 68. The private and social Mincerian returns for one year of education and for TE are shown in columns (1) to (4) of Table A.6. The number of years needed to complete TE are shown in the last column of Table A.6.

No estimates of Mincerian returns are available for New Member States. For each of these countries, we have imputed a value using the median value of the Mincerian returns of a group of countries with similar characteristics.[78] As a result, we used the Mincerian returns of Greece for all New Member States. We use the median to avoid any outliers unduly influencing our results. Imputed values are shown in italics.

The benefits from TE education include higher earnings, and also a higher probability of being employed. As for USE, we count only 2/3 of the total change in the employment probability between the two levels of education (TE and USE) as a private benefit from achieving TE. We use the same assumption in the estimation of social returns.

[77] See Annex 2 for details.

[78] Countries have been grouped into groups of similar characteristics using per capita GDP. See Annex 4 for a list of countries' groups.

Table A.6: Private and social Mincerian returns (one-year and TE)

Member State	Mincerian private returns		Mincerian social returns		TE (years)
	One-year (1)	TE (2)	One-year (3)	TE (4)	(5)
BE	0.07	0.32	0.06	0.25	4
CZ	*0.08*	*0.37*	*0.07*	*0.33*	4
DK	0.06	0.25	0.05	0.22	4
DE	0.09	0.40	0.05	0.19	4
EE	*0.08*	*0.37*	*0.07*	*0.33*	4
EL	0.08	0.37	0.07	0.33	4
ES	0.08	0.49	0.08	0.49	5
FR	0.08	0.35	0.06	0.24	4
IE	0.11	0.51	0.06	0.27	4
IT	0.08	0.46	0.07	0.42	5
CY	*0.08*	*0.37*	*0.08*	*0.37*	4
LV	*0.08*	*0.37*	*0.07*	*0.33*	4
LT	*0.08*	*0.48*	*0.07*	*0.43*	5
LU	..	..	..	..	5
HU	*0.08*	*0.48*	*0.07*	*0.43*	5
MT	*0.08*	0.37	*0.08*	0.37	4
NL	0.07	0.38	0.05	0.30	5
AT	0.09	0.39	0.05	0.22	4
PL	*0.08*	*0.48*	*0.07*	*0.43*	5
PT	0.10	0.45	0.09	0.42	4
SI	*0.08*	*0.37*	*0.08*	*0.37*	4
SK	*0.08*	*0.37*	*0.07*	*0.33*	4
FI	0.09	0.52	0.05	0.30	5
SE	0.04	0.17	0.06	0.24	4
UK	0.10	0.48	0.06	0.24	4

Note: Imputed values for missing data are shown in italics.
Source: de la Fuente (2003) and LE calculations.

Annex 3 Costs and benefits

Costs of USE and TE

The publication OECD Education at a Glance 2004 contains tables that detail the total expenditures on LSE, USE and TE by source of income.[79] Our measure of public and private expenditure has been defined as follows:

- Private expenditures include private direct expenditures for education (fees, books, etc) net of subsidies received from the public sector, and include various other costs associated with education (e.g., lodging[80], transport, etc).

- Public expenditures include public transfers to educational institutions and subsidies to the private sector for expenditure relating to education.

From the OECD tables, we have calculated the private spending per student for the various education streams (LSE, USE and TE). The social spending has been computed by adding the private and public costs. The costs are shown in Table A.7.

[79] The distinction between public and private expenditure is not always clear-cut in the OECD data, as some of the private expenditures on education are subsidised by public money. Our approach has been to record all subsidies as public expenditures. For example, in the instances where governments subsidise households for the payment of fees to universities, we classify the subsidy as public sector spending, although the payment is made by a private individual.

[80] As noted, costs of housing should only include the additional cost that students pay for being in education. OECD data do not provide separate figures for housing. Hence, costs estimates that include costs of housing could be biased upwards. However, because in many instances university education involves a move to a different city (and paying for housing that otherwise could have been free if the individual had remained at his parent's home) we believe that the magnitude of the bias should be small.

Table A.7: Costs of USE and TE. Expenditure per student (€), 2001.

Eurostat Code	USE			TE		
	Private	Public	Total	Private	Public	Total
BE	574	6839	7413	1981	7250	9231
CZ	244	1505	1748	427	1795	2222
DK	1431	10732	12163	8771	20296	29067
DE	2183	7724	9907	1679	7035	8714
EE	*162*	*1284*	1446	*502*	*1846*	2347
EL	228	2431	2660	198	2678	2876
ES	876	5102	5977	1656	3524	5180
FR	687	7799	8486	1560	5826	7386
IE	417	5206	5623	3663	7364	11027
IT	231	6625	6856	3711	4416	8127
CY	*387*	*3879*	4266	*783*	*2971*	3754
LV	*162*	*1284*	1446	*502*	*1846*	2347
LT	*162*	*1284*	1446	*502*	*1846*	2347
LU	33	10279	10312	..	..	..
HU	192	1344	1536	924	2419	3343
MT	*387*	*3879*	4266	*783*	*2971*	3754
NL	493	5625	6118	2921	7804	10725
AT	632	8112	8744	861	8339	9200
PL	**124**	1338	1461	**310**	1496	1806
PT	56	4105	4161	494	2711	3205
SI	*387*	*3879*	4266	*783*	*2971*	3754
SK	88	951	1039	346	1672	2018
FI	716	6040	6756	4274	9061	13335
SE	785	7540	8325	7578	11992	19571
UK	968	5270	6238	5369	5496	10865

Note: Expenditure by original source (€), 2001. *Italic text*: values for Cyprus, Malta and Slovenia imputed as average of values for Greece, Spain and Portugal. Values for Estonia, Latvia and Lithuania imputed as average of values for Czech Republic, Hungary, Poland and Slovakia. **Bold text**: private expenditure for Poland imputed using the relationship between private and public expenditure in Slovakia.
Source: OECD Education at a Glance 2004.

Costs of Reading Recovery programmes

Per pupil costs of a Reading Recovery programme have been estimated using Assad and Condon (1996) estimates for the United States.

In Assad and Condon (1996) the Reading Recovery per pupil costs includes the cost of teacher training and a teacher's salary for a teacher, who would remain an assumed 5 years in the position. The cost of teacher training is calculated as an initial training fee of $7,000 and $300 per year of continuing training over the 4 remaining years. The teacher's salary is calculated as 50% of the maximum teacher salary, since Reading Recovery teachers serve usually in half-time positions. This gives a salary of $17,256. The per pupil costs is then computed by dividing the total teacher costs by the number of children served by each teacher and year (8 on average). This results in a per pupil cost of $2,362.

Since teaching costs differ across countries, we use salary data to adjust the estimated per pupil costs for the Member States. We use the ratio of the salary of a teacher in that country relative to that of a teacher in the United States to make the adjustment. The costs have also been adjusted for inflation to reflect 2004 costs. We should note that the opportunity costs for this target are zero, as at the age of 10 the students are still in school and are below the minimum legal working age.

Costs of LLL

The Continuing Vocational Training Survey 1999 (CVTS2) from Eurostat provides data on the costs of training per participant. The costs include the direct costs of training; the foregone labour cost of the participant while at training; and net contributions to collective funds set up for the purpose of vocational training. Eurostat data are in 1999 PPS, so we converted them to euros, using data from the national accounts dataset, and the Harmonised Index of Consumer Prices (HICP) to adjust to 2004 prices.

Mincerian returns for USE and TE

For private benefits we have used Mincerian returns from different sources. A set of individual-level Mincerian returns to one year of schooling for the EU15 Member States has been estimated in de la Fuente (2003). The estimates are constructed using the results of microeconometric wage regressions reported in Harmon, Walker and Westergaard-Nielsen (2001).[81] The estimates from de la Fuente (2003) should be comparable across the EU15 Member States, except for the results for Belgium, where no Mincerian return has been estimated and the average of French and Dutch estimates is used.

The macroeconomic Mincerian returns to schooling measure the average increase in output per employed worker resulting from an additional year of schooling of the adult population. It is obtained by dividing the estimated

[81] These authors provide separate estimates of this coefficient for men and women in most EU countries using relatively homogeneous data for 1995 or a nearby year and a common econometric specification. In De la Fuente (2003) the estimates are averaged across sexes, and some corrections are introduced in cases in which the original estimates seemed to be based on data referring to net rather than gross wages.

elasticity of output with respect to the stock of human capital by average attainment in each country, using the results in de la Fuente and Doménech (2002).

Because no estimates of Mincerian returns are available for New Member States, we have imputed these returns as follows: for Cyprus, Malta and Slovenia, we used the median return of three other countries (Greece, Spain and Portugal). For the remaining New Member States, we assumed that the Greek return is the closest representative return.

Finally, the Mincerian returns to USE and TE were computed by taking into account the number of years students remain in each of these education streams in the different countries.

Annex 4 Computation of earnings data

Our measure of earnings is based on the Structure of Earnings Survey 2002 (SES 2002) from Eurostat. This survey provides two series of data on Gross Earnings: by age group[82] and by highest level of education attained.

To compute the gross earnings for different sub-groups (educational attainment and age groups) we have used the following procedure.

We first construct a ratio of average gross earnings of workers with a given level of educational attainment to the average gross earnings of workers with USE. This ratio can be expressed as $\varphi_i = w_i / w_{USE}$, with *i = LSE, USE, TE*.

Hence, for each education level *i* and age cohort *j*, the corresponding monetary earnings w_{ij} can be obtained by applying the relative index rate φ_i to the age cohort average USE wage (w_j^{USE}):

$$w_{ij} = \varphi_i w_j^{USE} \tag{2}$$

One difficulty with this calculation is that we need to estimate w_j^{USE}. We have proceeded as follows. The average earnings for each age cohort *j* can be written as: $\bar{y}_j = \sum_i \theta_{ij} w_{ij}$, where θ_{ji} is the share of people employed in age cohort *j* with education level *i* (i.e. θ_{ji} is the cohort-education level employment rate). Using (2) we can rearrange the parameters to express them in terms of φ_i:

$$\bar{y}_j = \sum_i \theta_{ij} w_j^{USE} \frac{w_{ij}}{w_j^{USE}} = w_j^{USE} \sum_i \theta_{ij} \varphi_i .$$

We can then calculate the average USE earnings as follows:

$$w_j^{USE} = \bar{y} / \sum_i \theta_{ji} \varphi_i .$$

These will be used to derive the gross earnings of people in the age cohort *j* with education level *i*, w_{ij}, as in (2).

It should be noted that under this procedure we are making an important assumption. Because φ_i is obtained for the economy as whole (and not by age group) we are in fact assuming that the relative income of an individual by level of educational attainment is constant over the different age groups. That is, the ratio of earnings of those with upper secondary education to those with tertiary education is constant over the different age groups.

[82] The age groups are 0-29, 30-39, 40-49, 50-59 and more than 60 years old.

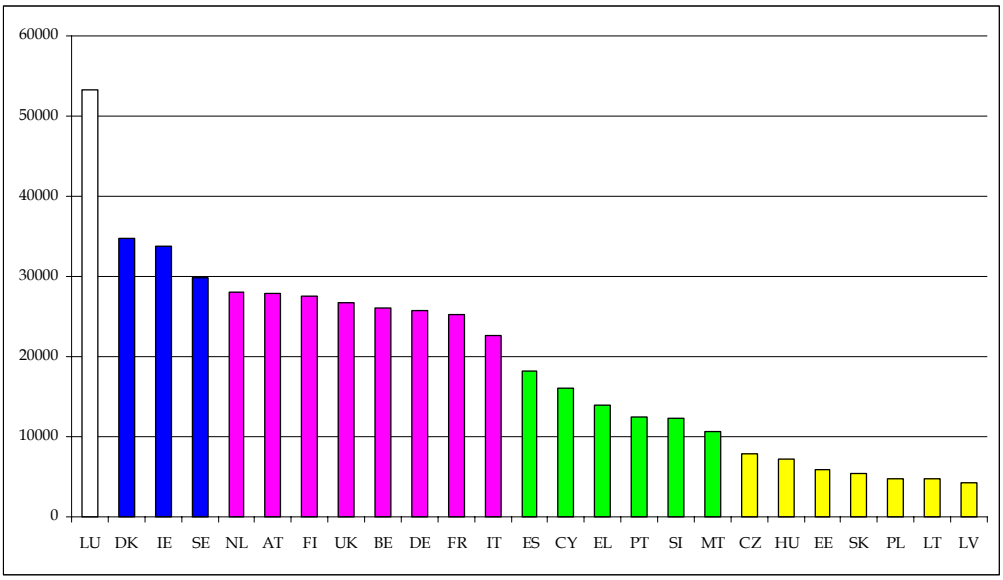
Finally, Net Earnings have been constructed by applying a tax rate to the Gross Earnings.[83] We have used the average tax rate applicable to the average production worker (APW) in 2004 (2003 in Estonia) to estimate Net Earnings.

[83] Eurostat provides data on the net income received for different levels of gross income, which are related to the average gross income of a production (manufacturing) worker.

Annex 5 Country groupings

Throughout the report, in cases where data were missing we have used imputed values. To do so, we have grouped the EU Member States by GDP per capita (see Figure A.1). To impute a missing data point for a specific country, we have used the median value of the corresponding data points from the group to which the country belongs. These country groups are shown in Table A.8.

Figure A.1: GDP per capita (€). 2003.



Source: Eurostat

Table A.8: Country groupings for imputation of missing data

Group 0	Group 1	Group 2	Group 3	Group 4
LU	DK, IE, SE	BE, DE, FR, IT, NL, AT, FI, UK	EL, ES, CY, MT, PT, SI	CZ, EE, LV, LT, HU, PL, SK

Source: LE calculations.