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## **Efficiency and Equity in European Education and Training Systems**

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# Efficiency and Equity in European Education and Training Systems

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prepared by the  
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The aim of this analytical report is to provide an economic and social analysis of efficiency and equity in European education and training systems, based on a review of the relevant scientific literature. Section 1 gives a brief introduction on the contribution of economic and social sciences of education to the topic. Section 2 surveys the evidence on economic and social impact of education and training. Section 3 provides a detailed analysis of efficiency and equity aspects of education and training systems in Europe, focusing on complementarities and trade-offs between efficiency and equity over the life cycle.

## **1. Contribution of economic and social sciences of education**

### ***1.1 Economic and other social sciences of education***

In order to go beyond statistical description to an economic and social analysis of efficiency and equity in European education and training systems, a scientific approach is needed that tries to determine cause and consequence and give quantitative results on the importance of different relationships. The scientific analysis of education processes is the topic of several social sciences. Given that the topics of this study are efficiency and equity, it seems reasonable that the economics of education – as one discipline in the social sciences – should take a lead focus in this analysis. But obviously, the process of education encompasses many non-economic aspects, so that the analysis will draw on the expertise of other disciplines in the social sciences, such as pedagogy, sociology, psychology and political science, which can add valuable insights into specific aspects of the topic. An interdisciplinary perspective that draws on both economic and other social sciences seems best suited to address the multidisciplinary issues involved in the efficiency and equity of education and training systems.

Also, modern economics must not be understood as the mere analysis of economies and pecuniary quantities, but rather as the economic methodological approach to human behaviour, which is a general method of analysis of individual rational behaviour (e.g., Lazear 2000). In this sense, the economics of education provides a valuable means to understand the behaviour of the people involved in the education process.

Ultimately, the task of any scientific analysis of educational efficiency and equity is to try to detect causal relationships which apply to policy questions of interest. In this applied task, the questions are mostly empirical. Because in the real world, many causal interactions operate at the same time, any well-founded scientific analysis will have to take this multidimensionality into account by applying multivariate methods to the task at hand and by building proper research designs that allow for rigorous policy evaluations. Given the focus on European education and training systems, the following analyses will draw heavily on international comparisons between the different European systems, in order to learn from each other how efficient and equitable education and training systems should be designed.

### ***1.2 Human and social capital theories***

A key concept in the economics of education is the notion of human capital. The main idea of the theory of human capital is that each person's education is an investment in her human capital which allows her to contribute to her society in a productive way. As any investment, the investment in human capital requires initial costs, in terms of direct spending and the opportunity costs of students' time, which are taken on in the hope that the investment will create future benefits in terms of higher productivity, higher wages, lower risk of unemployment, and so on. As will be discussed in Section 2, such benefits will take the form

of both monetary and non-monetary impacts, and they will accrue to both individuals and the society at large. In addition to human capital theories, which have been developed mostly in the 1960s and 1970s with crucial contributions by Theodore W. Schultz (e.g., 1961), Gary S. Becker (e.g., 1964) and Jacob Mincer (e.g., 1974) and which stress the central role of education as an investment in human capital, economists also emphasise the role of education as a signalling and screening device (cf. Brown and Sessions 2004).

In addition, education also plays a crucial role in theories of social capital. These theories stress the importance of mutual trust, cohesion, social norms, civic mindedness and other connections among individuals for the well-being of societies (cf. the seminal contributions by Pierre Bourdieu 1986, James S. Coleman 1988 and Robert D. Putnam 1993). While applied research in this direction is still in its infancy, it is regularly emphasised that education can act as a crucial means to form the traits of social capital that may help to increase the standard of societal well-being (cf. Temple 2001 and de la Fuente and Ciccone 2002 for overviews). Thus, recent evidence suggests that education exerts causal effects on such outcomes as crime and civic engagement, among others (cf. Section 2.3 below).

Together, theories of human and social capital stress the importance of education for the long-run economic and social well-being of individuals and societies. This makes an analysis of how education can be supplied in an efficient and equitable way a research topic of utmost economic and societal importance.

### ***1.3 Efficient and equitable education and training policies***

The goals of education policy are usually two-fold, encompassing both goals of efficient allocation and goals of equitable distribution. The extent to which each of these goals should be pursued is a matter of political choice and as such beyond scientific evaluation. What scientific analysis can deliver, though, is an evaluation of how either may or may not be achieved, and of the relationship between the two goals. Of course, goals of efficiency and equity are not restricted to education policy. However, a combined policy perspective that would also address other policies such as social policies, labour market policies and immigration policies and determine joined policy solutions lies beyond the scope of the current analysis, which explicitly focuses on education and training policies.

The concept of efficiency relates the outcome of a process to its input. A system is said to be efficient if a maximum output is obtained from given input, or if a given output is obtained with minimum input. Efficiency has thus to do with the ratio between output and input: How much do we get for what we put into the system? The analysis of efficiency thus deals with a comparison of costs and benefits.

The output may either be measured as a goal within the education and training system, such as achievement scores or completion rates, or as a goal outside the education and training system, such as employment probabilities or earnings returns on the labour market. There are two main aspects of an efficient resource use. First, efficiency is about allocating efficiently between different kinds of resources – e.g., between teachers and blackboards, or between more teachers per student and better-qualified teachers – that is, about choosing the most efficient input mix (allocative efficiency). Second, efficiency is also about using each resource efficiently, that is, making the best use of each given input (technical efficiency). The assessment of efficiency in education and training has both an external aspect, where investments in education are compared to alternative investments outside the education system, and an internal aspect, which refers to the internal functioning of the education and training system.

The concept of equity is more evasive than the concept of efficiency. This has largely to do with the general evasiveness of clear scientific definitions of issues of fairness and justice. It seems, though, that a rather broad consensus among social scientists has evolved around some variant of an equity concept that is close to the definition of equality of opportunity proposed by Roemer (1998; cf. Betts and Roemer 2006). The central idea of this concept is that inequality should be tolerated only if it is due to persons' differences in levels of effort, but not if it is due to circumstances which are beyond a person's control. Thus, perfect achievement of equity would demand that a student's educational performance does not depend on her race, gender or family background. At the same time, equity will be achieved even if there is inequality in educational outcomes that is due to the fact that different persons, e.g. of the same race, choose to put different levels of effort into their learning. In other words, a person's expected educational outcome should be a function only of her effort, but not of her circumstances. The equity objective can again be expressed in terms of an outcome within the education and training system, such as test scores, or in terms of an outside outcome such as labour-market outcomes. Also, the assessment of equity has again an external aspect, asking whether a specific equity goal can be reached better by investments in education or by alternative uses of the money, and an internal aspect, asking how a given set of resources in the education and training system can be used in the most equitable way.

The concept of equity understood in terms of equality of opportunity would call for an equal access to education and training programmes independent of students' circumstances, as well as for an equal treatment of all students independent of their circumstances. At the same time, this concept of equity would not necessarily call for a strict equality of educational outcomes in the sense of a perfect sameness or egalitarianism, because people are allowed to choose to differ according to their self-determined effort. This report focuses mainly on equity along the dimension of socio-economic background; needless to say, issues of equity along other dimensions such as race, culture or immigration also need to be better explored in the future.

It should be stressed that anybody interested in equity will also want to have the equity goal achieved in an efficient way – that is, at the lowest cost. If a certain extent of remediation of inequity would not be achieved at the lowest possible cost, this would be a waste of resources, and one could achieve an even higher extent of remediation if resources were used efficiently in a pursuit of the equity goal.

But beyond that, the relationship between goals of efficiency and equity in the education and training system may take different forms. In some cases, efficiency and equity goals may be independent from (orthogonal to) one another. In other cases, there may be trade-offs in the extent to which the two goals can be obtained. And in still other cases, there may be a complementarity (synergy) in the achievement of both efficiency and equity. Thus, certain policies may bring the education and training system closer to an efficient system, without having any impact on equity. Other policies may be highly equitable without having an impact on efficiency. Other policies may advance both efficiency and equity in a complementary way. And still other policies may show a trade-off by either advancing efficiency at the detriment of equity or by advancing equity at the detriment of efficiency.

It will be a key focus of this study to highlight the presence or absence of trade-offs and complementarities in the design and functioning of education and training systems. It will be seen that efficient policies need not be inequitable, and equitable policies need not be inefficient. Countries do not necessarily have to choose between efficiency and equity. There are ways to evade strong trade-offs between efficiency and equity, while current attempts to reach the one or the other sometimes turn out to be both inefficient and inequitable.

## **2. Economic and social impact of education and training**

Since the seminal contributions of Schultz, Becker and Mincer, the economics of education has gathered vast evidence on the contribution of education to the economic and social well-being of individuals and nations. Particularly in recent years, there has been a strong upsurge of interest in the economics of education, especially amongst applied economists. Both at the individual level and at the level of society, there is now ample research showing substantial positive effects of education not only in terms of monetary benefits but also in terms of non-monetary benefits. This section summarizes the main findings with respect to the effects of education and training both for the individual and for society as a whole. The literature is much broader on the effects of education than of training, both because it is difficult to disentangle the effects of the two and because training is not unambiguously defined, whereas one can easily distinguish years of schooling or highest educational degree obtained. Moreover, in the case of training, it is especially hard to identify true exogenous variation in participation, so that estimating the effects of training faces particularly strongly the difficulty of accounting for factors correlated with training that at the same time affect the outcomes of interest.

### ***2.1 Effects for the individual***

#### *a) Monetary (market) effects:*

At the individual level, the most obvious effects of education and training are those on wages and earnings. The substantial empirical evidence both with respect to the existence and to the size of the returns to education is overwhelming (cf. the surveys by Card 1999 and Harmon et al. 2003). Schooling raises the individual market productivity which is rewarded in the labour market in terms of higher earnings or wages. The positive association between education and individual earnings in the labour market is probably one of the most robust findings in all of empirical economics. For example, Harmon et al. (2001) find that on average across European countries, each additional year of education is associated with more than an eight percent increase in wages (cf. also de la Fuente 2003). Furthermore, a lot of recent research attention has focused on the extent to which these associations depict causal relationships, suggesting that the regression estimates seem to be close to the causal effect of education on earnings (cf. the discussions in Card 1999 and Harmon et al. 2003).

Micro data analyses also provide evidence that cognitive test scores have strong positive effects on individual labour-market performance (cf. Neal and Johnson 1996; OECD 2000; McIntosh and Vignoles 2001; Currie and Thomas 2001; and the references in the latter). These qualitative measures of education yield even higher earnings returns than measures of educational quantity (Boissiere et al. 1985; Bishop 1989, 1992), and earnings returns to educational quality seem to have been increasing over time (Murnane et al. 1995). Moreover, while returns to educational quantity decrease with the time that employers can observe individuals in the labour market, returns to cognitive achievement increase (Altonji and Pierret 2001). Even among school dropouts, i.e. students with the lowest educational attainment, there are substantial earnings returns to basic cognitive skills (Tyler et al. 2000).

The education of an employee not only affects her wages, but also her non-wage remuneration (Duncan 1976; Lucas 1977). Such non-wage labour market remuneration can take the form of improved working conditions or fringe benefits such as insurance provided by the employer, a company car and childcare, to name a few. Micro evidence suggests that more educated people are more successful in securing such benefits for themselves than are people with lower levels of education.

Highly educated people are also more likely to participate in the labour market and have better chances to be employed. In the European Union, the unemployment rate of persons with only primary education is almost twice as high as the employment rate of persons with upper secondary education (OECD 2005a). The risk of becoming unemployed is considerably lower for the highly educated. Similarly, higher scores on literacy tests are associated with substantially higher labour force participation and lower unemployment rates (OECD 2000; McIntosh and Vignoles 2001).

While the evidence on labour-market returns to training is more mixed than for education (cf. the review by Cohn and Addison 1998), there is also strong evidence for a positive association between training and individual earnings (see Chapter 4 of Bassanini et al. 2005 for a survey of evidence from Europe and North America). Across Europe, private returns to training seem to be especially high in those countries where training incidence is low (Bassanini et al. 2005). However, it has to be kept in mind that it is particularly hard to give a causal interpretation of these associations in the case of training, because the literature on training has not reached a point where possibly confounding effects of other factors can be properly kept apart from the effects of training. Some studies that try to go in this direction find much lower returns to training, often not statistically significantly different from zero (e.g., Leuven and Oosterbeek 2004).

In addition to affecting labour-market outcomes, education also affects decisions related to expenditure and savings. A person's rate of saving is significantly correlated to her individual level of education (e.g. Bernheim and Scholz 1993). There is also some evidence that higher schooling is associated with higher saving rates even after controlling for income (Solmon 1975). Moreover, the adoption of consumer education policies and the inclusion of financial topics in the curricula of high schools in a number of states in the United States were shown to have long-term behavioural effects. They significantly raised the rate at which individuals save and accumulate wealth once exposed students reached adulthood (Bernheim et al. 2001).

*b) Non-monetary (non-market) effects:*

Education affects the well-being of individuals not only via monetary effects. There is also considerable evidence of non-market benefits of education (cf. the surveys by Haveman and Wolfe 1984; Wolfe and Zuvekas 1995; Wolfe and Haveman 2000; McMahon 2004).

Both life-satisfaction and happiness are related to education. It can reasonably be argued that an atmosphere of trust contributes to life-satisfaction. There is evidence for the fact that the extent to which someone trusts in other people is related to her educational level (Putnam and Helliwell 1999). Data for Great Britain and the United States show that a person's well-being rises with her level of education. This effect is found to be independent of the level of income (Blanchflower and Oswald 2004). Similarly, job-satisfaction is found to be highest among the highly educated (Clark 1996). Receiving training from one's employer also enhances job satisfaction.

Empirical evidence on the effects of education on health is overwhelming (cf. the survey by Grossman 2000). Education is consistently shown to have considerable effects on the general health status of an individual. There are several channels through which education can be assumed to make an impact on health and life expectancy. First, schooling may affect the decision to work in hazardous employments. Moreover, there is evidence that education is associated with better health behaviour. Lifestyle, diet and exercise as well as smoking behaviour seem to be related to education (e.g., Kenkel 1991). Better health also translates into higher wages and earnings, but apart from this monetary aspect, it contributes to a person's general well-being in terms of reduced pain, lower expenditures on medical care and

less time spent to treat various illnesses. A person's life expectancy also increases with her education (Feldman et al. 1989).

The educational attainment of parents has strong effects on the well-being of their children. Education of the mother, for example, affects a child's weight at birth (Currie and Moretti 2003). Important pathways for this effect of mother's education on infant health are the use of prenatal care and smoking behaviour, among others. Similarly, the general status of health of children is positively influenced by the education of their parents (e.g., Lam and Duryea 1999). Strong effects of parents' education are also found on the level of education eventually attained and on the cognitive development of children (Currie and Moretti 2003). There is consistent evidence that for daughters, the probability of teenage motherhood and the probability of giving birth out of wedlock are decreasing with the educational level of their mothers (e.g., An et al. 1993; Lam and Duryea 1999). Moreover, there is some evidence that the attainment of the desired number of children and the efficiency of contraceptives is related to schooling (e.g., Lam and Duryea 1999).

Education seems to enable individuals to choose more efficiently in a variety of situations. Some studies have shown that there is a positive relationship between the efficiency of choices made by consumers and their level of education (cf. the studies cited in Wolfe and Haveman 2000). Moreover, studies of assortative mating suggest that marital choices improve with schooling (Becker et al. 1977). Divorce rates are higher among less educated individuals (Martin 2004; White and Rogers 2000), possibly related to reduced stability due to their earlier timing of marriages and birth of children.

## ***2.2 Monetary effects for the economy***

There are three mechanisms through which education can impact on economic growth. First, education increases the human capital inherent in the labour force, which increases labour productivity and thus transitional growth towards a higher equilibrium level of output (augmented neoclassical growth theories, cf. Mankiw et al. 1992). Second, education can increase the innovative power of an economy, and the new knowledge on new technologies, products and processes promotes growth (theories of endogenous growth, cf., e.g., Romer 1990). Third, education facilitates the diffusion and transmission of knowledge which is needed to understand and process new information and to successfully implement new technologies which also leads to economic growth (cf., e.g., Nelson and Phelps 1966).

Early analyses of the determinants of economic growth, which disregarded human capital, left researchers with a large unexplained residual. However, macroeconomic theories soon came to include human capital into their models. Empirically, the inclusion of human capital into growth accounting increased the extent to which researchers could explain economic growth. Most research focused on the effects of quantitative measures of education on economic growth, where the most elaborate recent evidence shows that a statistically significant relationship indeed exists (e.g., Barro 1991; Mankiw et al. 1992; Temple 1999, 2001; Krueger and Lindahl 2001; de la Fuente and Domenech 2006; Vandebussche et al. 2004; Aghion et al. 2005; Ciccone and Papaioannou 2005). While the evidence on the relative importance of the three mechanisms is mixed, studies often find that education is important both as an investment in human capital and in facilitating research and development and the diffusion of technologies.

For example, de la Fuente (2003) estimates that each additional year of average educational attainment raises macroeconomic productivity by a direct 6.2 percentage points in the average EU country and by a further 3.1 percentage points in the long run through its contribution to faster technological progress. In addition, there is now a large strand of literature revealing



that qualitative measures of education based on student achievement test scores are even stronger predictors of national growth (Hanushek and Kimko 2000; Barro 2001; Wößmann 2002, 2003a; Pritchett 2006; Ciccone and Papaioannou 2005). Obviously, the macroeconomic effects of human capital also depend on other complementary growth-enhancing policies and institutions, so that the effects may not be positive in countries where the institutional framework encourages rent-seeking activities rather than productive uses of acquired human capital (cf. Pritchett 2006).

Whenever individuals decide on the amount of education to acquire, they tend to take only their private benefits into account. Quite often, they do not even realise their own benefits accurately. It is possible that many individuals are not aware of many of the individual benefits listed above. However, education may inhibit externalities which have to be taken into account when calculating the economy-wide returns to education. These externalities are not incorporated in the private market returns to education, but are part of the social rates of return to education. It can be argued that a large part of the externalities operates through intervening variables and are long delayed (cf. McMahon 2004). A wide interpretation of the social effects of education takes a dynamic view by acknowledging feedback effects of education on economic growth through other variables. Some estimates put the externality component in the social return to education at up to 14 percent, although the estimated externalities shrink substantially or even disappear completely when a narrower interpretation is used by controlling for differences in technology (cf. Heckman and Klenow 1997; Topel 1999; Psacharopoulos and Patrinos 2004; McMahon 2004).

There exists a multiplicity of intermediating factors through which education can affect growth. Technological change has already been mentioned as one of them, but there are also less obvious factors like democratisation and political stability that appear to affect growth. By increasing income and giving rise to a larger middle class, education leads to an increasing demand for political participation, and promotes democratisation and political stability. Even though it is not clear whether democratisation contributes to economic growth, democratisation is consistently found to promote political stability which in turn contributes to economic growth (Barro and Sala-i-Martin 1995; McMahon 2002; Oliva and Rivera Batiz 2002). Thus, education not only directly influences economic growth. There is also an indirect effect of education on growth via democratisation and political stability.

Among the externalities from education are also the external effects of human capital employed in production on the productivity of other workers. This externality arises if less educated workers become more productive because they are working together with more educated workers. Social interactions among neighbouring workers create learning opportunities and lead to human-capital spillovers. Yet, the empirical evidence for the existence of spillovers from learning is ambiguous. Moretti (2004) and the studies cited therein find evidence in favour of spillovers, whereas Acemoglu and Angrist (2000) and Ciccone and Peri (2006) find no evidence for this kind of spillovers.

From a fiscal point of view, a large impact of education and training on the society consists in their effect on taxes. In the same way as education and training raise the earnings of an individual, they also tend to raise the taxes paid by this individual. These tax payments are part of the government's budget and ideally benefit the society at large.

Education seems to be associated with social cohesion and lower inequality. Beyond being a non-monetary benefit for society, there is also some reason to attribute a monetary benefit to lower inequality as well. Recent research indicates that most of the cross-country variation in earnings inequality can be assigned to cross-country variation in skill dispersion (Nickell 2004). Therefore, the distribution of educational attainment is of crucial importance in

explaining the dispersion of both earnings and poverty. This has an economic dimension apart from the social aspect, since less people in poverty reduces the necessary transfer payments to alleviate the burden of poverty within the population. More educated people are not only less likely to be eligible for welfare transfers. Several studies also provide evidence that people with more education are less likely to draw on these transfers even if they are eligible (An et al. 1993; Kiefer 1985).

### ***2.3 Non-monetary effects for society***

There is also increasing evidence of non-market external returns to education (cf. the surveys by Haveman and Wolfe 1984; Wolfe and Zuvekas 1995; Wolfe and Haveman 2000; McMahon 2004).

Perhaps the most important fields of society that are influenced by education are the process of democratisation, the development of civic institutions and human rights, and political stability. The theories describing the mechanisms of these processes draw from political science. Education and higher per capita income play an important role in the democratisation process since they give rise to a growing demand for political participation. While authoritarian dictatorial regimes profit from an illiterate and poor population, the development of civic institutions, rule of law and the role of opposition require a literate population. Investment in secondary education has been found to be one of the determinants of democratisation in cross-country data (cf. McMahon 2004).

One channel through which education affects democratisation is through civic participation, civic knowledge and attitudes. Education leads to an increased demand for civic participation within the population. Empirical evidence suggests that educational attainment has large effects on both voter participation and support of free speech. Moreover, it increases the frequency of newspaper readership and thereby the quality of civic knowledge (Dee 2004). Additional evidence from the United Kingdom and the United States reveals that more educated citizens follow public affairs and politics more closely and have more information on candidates and campaigns (Milligan et al. 2004). Human rights have also been found to increase significantly with democratisation (cf. McMahon 2002, 2004).

Empirical evidence from cross-country data reveals that higher secondary enrolment rates are significantly related to lower homicide rates and property crime (cf. McMahon 2002, 2004). Microeconomic analysis also shows that the probability of committing crime is significantly reduced by schooling (Lochner and Moretti 2004). Effects of education are found to be particularly large on murder, assault and vehicle theft. Both an indirect and a direct effect of education on crime can be supposed. First, education leads to less urban poverty and inequality and therefore to less crime. Second, schooling induces individuals to commit less crime. It increases the return to work and the opportunity costs of criminal activities. In the case of incarceration due to criminal behaviour the individual has to bear opportunity costs in terms of foregone earnings. These costs are higher the more educated this person is. Moreover, education might affect preferences like patience and risk aversion and therefore reduce criminal activity.

Additionally, education also seems to promote social cohesion. Descriptive evidence suggests that schooling is positively associated with reduced alienation and social inequalities (cf. McMahon 2004). In cross-country data, extending access to secondary education to a higher percentage of the population especially in poor rural areas significantly reduces rural poverty. Absolute poverty is reduced by increasing economic growth and secondary education (cf. McMahon 2002, 2004). Education also has the potential of reducing inequality in the income distribution. But whether it reduces inequality depends crucially on the distribution of

educational resources within the population. Inequality in schooling has been found to be significantly related to the percentage of people at the end of the income distribution (Psacharopoulos 1977; Ehrlich 1975).

Social cohesion is also promoted by an increasing awareness of the responsibility that every single person has for the society. More educated people contribute more volunteer time and more financial resources to community service and charity. A US study found that even within income levels, the share of people reporting to volunteer both time and money was considerably larger among people with some post-secondary education compared to people with lower education (NCES 1995).

Both own education and the average education level within the population have been found to be positively associated with respondents' reported measure of social trust. More educated people seem to trust more in others, and people trust each other more in regions with higher average education (Putnam and Helliwell 1999).

Better public health is another social externality of education. It is often argued that education and health are the two most important sources of human capital and that they complement each other. Education is not only connected to own health and the health of ones' children. It also reduces the spread of contagious diseases within the whole population (e.g., Grossman 2006).

The effects of education on the environment are almost entirely indirect and operate through the reduction of poverty and population growth rates. Reduced poverty and population growth rates are associated with less water pollution (cf. McMahon 2002, 2004). Similarly, education has an indirect effect on air pollution through its effects on population growth, democratisation and economic growth (cf. McMahon 2004). In countries with high population growth rates and high poverty rates, forests are cleared for agriculture, heating and cooking but also for the export of timber. In cross-country data, higher population growth is significantly associated with the increase in deforestation. Investments in education seem to reduce the rate with which forests are destroyed by generating slower population growth (cf. McMahon 2004).

In sum, there appears to be ample evidence in support of the existence of non-market effects of education for both individuals and the society. Still, it should be borne in mind that some of the underlying evidence may be biased because of omitted variables and problems of simultaneity, so that the extent to which correlations mean causation is not validated beyond doubt.

### **3. Efficiency and equity aspects of education and training systems**

Relative to the well-established evidence on the economic and social impact of education and training presented in the preceding section, many parts of the literature on efficiency and equity in education and training are not as well-developed. Ultimately, profound country-specific empirical assessments would be required to evaluate the specific efficiency and equity consequences of different policies. Still, a unifying perspective and many specific features are evolving into a broad consensus which allows for several Europe-wide assessments rooted deeply in the current theoretical and empirical knowledge in the field. At the same time, it should be borne in mind that there are still some uncertainties surrounding some parts of the literature, which will be mentioned where necessary.

The analysis proceeds in two main parts, broadly following what might be termed external and internal assessments of efficiency and equity. In the external assessment (Section 3.1), investments in education and training at different levels over the life cycle are compared to

each other and to alternative uses of invested resources outside the education and training system – both in the pursuit of efficiency (getting the highest returns on these resources) and equity (helping the disadvantaged). The question addressed is: Where should policy spend its money – in education or in other investments, and if in education, at which stage of people’s life cycle?

The internal assessments (Sections 3.2-3.6) deal with the topic of using given input within each part of the education and training system in the most efficient and equitable way. These sections discuss specific policies that may change the extent to which the goals of efficiency and equity are achieved at each level of education. The question addressed in this later part is: How can policy get the most out of a Euro that is spent at a specific level of education, in terms of efficiency and/or equity?

### ***3.1 The life cycle of education: Efficiency and equity***

Building on the traditional theory of human capital (cf. Section 1.2 above), James J. Heckman and co-authors have developed a unifying perspective over recent years that allows to assess education and training policies over the life cycle of a person (cf., among others, Heckman 2000; Carneiro and Heckman 2003; Cunha et al. 2006). Their economic model of the technology of skill formation makes it possible to interpret the evidence on life cycle education and training in a combined framework.

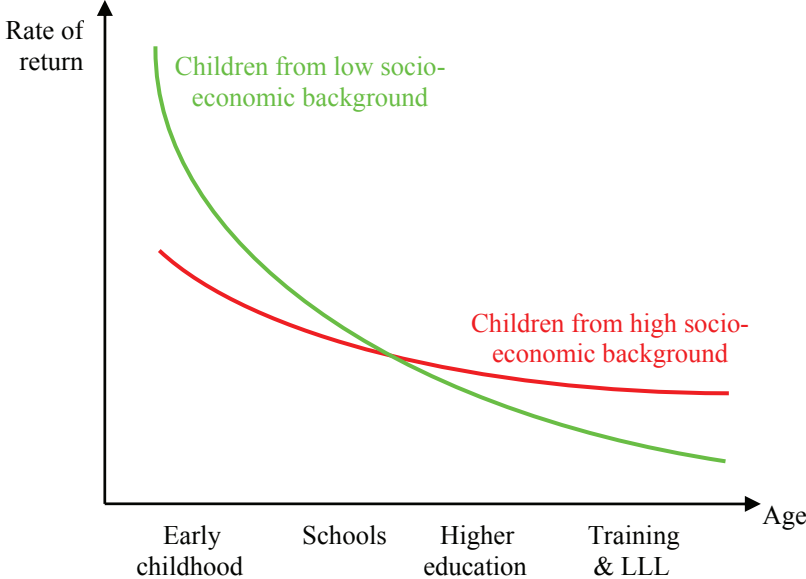
The key insight of their perspective is that the formation of skills is a life cycle process that exhibits both recursive productivity and complementarity. Recursive productivity means that the education learned at one stage is an input into the learning process of the next stage. Complementarity means that the productivity with which investments at one stage of education are transformed into valuable skills is positively affected by the level of skills that a person has already obtained in the previous stages. Together, these features of recursive productivity and complementarity generate a skill multiplier whereby an investment in education at one stage raises not only directly the skills attained at that stage, but also indirectly the productivity with which educational investments at the next stage will be transformed into even further skills. These multiplier effects explain why education is a dynamic synergistic process in which early learning begets later learning.

In their vast overviews of the empirical literature, mostly from the United States, Heckman and co-authors show that education is indeed a life cycle process that exhibits such dynamic synergies. They also stress that there are multiple important skills, both cognitive and non-cognitive, and that for some of these skills (most notably on the cognitive side), there are sensitive or even critical periods in a person’s life cycle where investments are particularly effective or even crucial. All this means that there are high returns to early investments, and that inadequate early investments are difficult and costly to remedy later on.

This result has profound consequences for the assessment of efficiency and equity of different policies that aim at fostering human capital. It creates a life cycle of human capital policies, where measures at early stages are particularly crucial and deficiencies that may have developed are hardly amenable at late stages. In early childhood, returns to educational investments are highest because of their effects on facilitating later learning. In addition, returns to early interventions are particularly high for children from disadvantaged backgrounds who do not receive at home the foundation of skills necessary to prosper at later stages of education. This is so because such interventions do not only build skills, but also lay the foundation that makes later learning more productive due to the complementarities in learning over the life cycle.

By contrast, in late adolescence and adulthood, returns to educational interventions are relatively low, because they do no longer create substantive synergies since even later learning is limited (and since people are beyond sensitive or critical periods to acquire certain skills). Additional reasons for the lower returns at later stages of the life cycle include that older people have a shorter time horizon during which to reap the beneficial effects of education. Skills acquired by training and adult learning activities may also lend themselves less easily to certification. What is more, the returns to investments at a late stage in the educational life cycle are particularly low for people who are lacking in terms of prior skills, because this lack makes their technology of forming additional skills a particularly unproductive one. This does not mean that there would be no capacity of learning during adulthood, but only that curative efforts at this late stage are particularly costly.

**Figure 1: Returns to a Euro spent at different levels of education**



Source: Authors’ depiction in adaptation of Cunha et al. (2006).

Figure 1 depicts this basic pattern of the life cycle of policies in education and training in terms of efficiency and equity graphically. The figure adapts a plot from Cunha et al. (2006) so that it depicts equity aspects in addition to efficiency aspects (see Cunha et al. 2006 for a closer discussion of the literature, model and assumptions underlying the basic version of this graph). When setting investments to be equal across the life cycle, the rate of return to a Euro invested in human capital declines with the age of a person of any background. Given the distribution of current spending across educational levels in Europe (cf. OECD 2005a) and given the evidence on the effectiveness of education policies at different levels presented below, the basic pattern of declining returns will also hold at current spending patterns (although it could obviously change with considerably modified policies). Furthermore, the two graphs depict that in the lack of public intervention, rates of return decline more rapidly for children from low than from high socio-economic background. At young ages, they tend to be higher for children from disadvantaged families, but at older ages, they tend to be higher for children from well-off families. Thus, given the obvious difference of private educational spending across socio-economic backgrounds, the pattern of declining returns will hold even stronger for public spending than for total spending. It appears that the basic pattern of declining returns and differences by socio-economic background holds for private and social returns to education alike (although some evidence gathered in Psacharopoulos and Patrinos

2004 suggests that the private return may be rather flat between secondary and tertiary education, while the social return shows the declining pattern). Both features may be even more pronounced for social returns than for private returns, given the evidence on externalities in terms of reduced crime and increased civic participation (cf. Section 2.3 above).

Of course, this pattern is a rough description of average effects. There is a lot of heterogeneity within each of the two groups, and some students from low socio-economic backgrounds will be doing particularly well in higher education. Also, the graphs depict a situation where no additional policy intervention happens at an early age. As already argued, early interventions could raise the returns of later investments also for children from low socio-economic background. Note also that the assessment stresses a relative evaluation over the life cycle. On average, there are probably positive returns to be had at later stages of the life cycle, as well – only that they are lower than the returns to be had at early stages. While most evidence seems to suggest that effects of early interventions can be very persistent through time, in particular for children from disadvantaged backgrounds (cf. Section 3.2 below), this is not to say that intervening in the early years alone will suffice to make the effects persist, as additional interventions at later ages might be needed to evade decay of effects. Finally, as will be discussed below, the depicted returns at the school level in particular are not necessarily to be understood in terms of spending more money within current institutional systems, but rather in terms of the returns that an improvement of the skills learned at school would bring. Because the costs of skill-enhancing institutional reforms in school systems can be very low, the rates of return for such policies, as depicted in the figure, can be relatively high (see Section 3.3 below for details).

As a consequence of the differing rates of return over the life cycle depicted in the figure, there is a trade-off between equity and efficiency for investments in late adolescent and adult years. The most efficient policy would be to invest in students who have already acquired a lot of skills because these give them higher learning productivity, while the most equitable policy would of course target investments at those students who have obtained the fewest skills up to then. While it may or may not be technically possible to remedy the lack of early investment, such a policy may often not be cost effective. In order to reach the equity goal of raising low-skilled adults to a certain income level it may be more efficient to give them a bond that earns an interest (based on investments in physical capital or in additional human capital of high-skilled persons) which would be higher than the return on an investment in their own education or training. Thus, in terms of an external assessment, there may be better alternative uses of invested resources outside the education and training system which would be more effective in raising the income of low-skilled adults. However, to the extent that the well-being of low-skilled adults is understood not only in terms of income but also in terms of social participation, the relative preference may shift more in favour of education and training policies (see Section 3.6 below for further discussion).

By contrast, there is no trade-off, but even a complementarity between equity and efficiency for investments in early childhood. The most efficient policy at an early stage is exactly the most equitable policy of investing in children who do not get taught necessary basic skills at home. Such investments yield particularly large returns because of their additional indirect effect of increasing the productivity of later skill acquisition of these children due to the dynamic complementarities in the technology of skill formation. It has to be stressed that this perspective requires a particularly long time horizon, which may run against the political self-interest of many policymakers, because the positive returns to early childhood investments may not be fully visible until 20 or 30 years later. But such a long-term perspective allows an assessment that shows the preferable investment strategies from a societal point of view.

While Heckman and co-authors build their view mainly on evidence from the United States, the available European evidence, which unfortunately is far less developed, suggests that the life cycle of human capital policies holds as much in Europe as in the United States. As will be discussed in detail in the next section, there is considerable European evidence that education and training policies that target low-skilled adults have often been ineffective, while the little European evidence that exists suggests that early investments have important long-lasting effects. Still, it should be borne in mind that our empirical knowledge on the relative effectiveness of interventions at different stages of the life cycle is limited in Europe, and less than perfect also in the United States (cf. Machin and Vignoles 2005).

In overall terms, the life cycle perspective on education and training policies suggests that the returns to public policies are highest at very early ages and diminish over the life cycle. This implies that an efficient policy would target its resources particularly at the very young. In addition, at early ages the highest returns are possible when targeting children from disadvantaged families, so that an efficient policy is at the same time equitable when enacted in early childhood. Only when public policies set in too late will the efficient allocation be inequitable.

This section determined the external efficiency and equity of policies in education and training over the life cycle. The following sections address the question of internal efficiency and equity of specific policies and instruments within the different levels of education and training.

### ***3.2 Early childhood education: Efficiency and equity***

#### *Efficiency:*

Evidence from the United States suggests that early childhood education can be highly efficient, especially when targeted at disadvantaged children (cf. the surveys in Barnett 1992, 1995; Currie 2001; Carneiro and Heckman 2003; Blau and Currie 2006; Cunha et al. 2006). In particular very intensive interventions such as the Perry Preschool Experiment, the Abecedarian Project and the Chicago Child-Parent Center Program, which have been scientifically evaluated using either an experimental setup or statistical matching techniques, show that participating children from disadvantaged backgrounds achieve superior educational outcomes in terms of test scores, grade retention and high school graduation, as well as reduced crime and delinquency. The studies that follow the participants into adult ages also show positive long-run effects on labour market outcomes, criminal and other behaviour. The benefits of these intervention programmes have been shown to exceed their costs by a multiple. Although the features that make a proper design for high-quality pre-school programmes are not well researched (cf. Currie 2001), a specific feature in terms of boosting outcomes seems to be the intensity of the programmes, such as setting in at very early ages, involving parents through home visits and generally intensive setups (cf. Cunha et al. 2006).

For European countries, there does not seem to be much comparable evidence in terms of the well-founded scientific research designs that try to establish causality in the US evaluations. For the Netherlands, Leuven et al. (2004) show that lowering the school starting age, which is already as low as four years, would increase later educational performance of disadvantaged students. Feinstein et al. (1999) find more mixed effects of pre-school attendance in the United Kingdom, which they ponder might hint at a relatively low quality of provision. Still, Feinstein (2003) shows that cognitive achievement in early childhood has a clear association with the educational qualifications of UK adults in their mid-20s, which indicates that there are substantial potential effects for early childhood interventions. In line with this, Goodman

and Sianesi (2005) find significant and long-lasting effects of early education on educational and labour-market outcomes in Britain. Kamerman et al. (2006) survey additional, particularly psychological studies from France, Sweden and the United Kingdom which suggest that participation in high-quality early childhood education and care programmes is positively associated with the cognitive, social and emotional development of children, their school readiness and school performance, with associations being especially strong for children from disadvantaged backgrounds.

In terms of international comparisons that contain many European countries, Fuchs and Wößmann (2004) show that kindergarten attendance and particularly reported pre-school reading performance are associated with higher reading performance at the end of primary school, even after controlling for a vast number of family-background and school effects. Schütz et al. (2005) find similar effects between the length of a country's pre-school education system and mathematics and science performance in middle school. The European and cross-country evidence should be taken cautiously, though, because it is based on relatively few studies and is mostly in terms of controlled descriptive associations without necessarily distilling causality.

On a less rigorous level, there is a strong feeling in many European countries that there is a lack of knowledge about the quality of early childhood education and care programmes, because they do not tend to be controlled or tested (for an example, see OECD 2004). Due to deficiencies in clarity and monitoring of goals and standards, the early childhood education systems tend to lack accountability. In some cases, such as Germany, there is also some worry about the low training level of staff and the weak link between pre-school and school system. The US evidence shows that the more intensive programmes show better results, suggesting that early childhood education is not just about day care. For Britain, Goodman and Sianesi (2005) similarly find that effects of education-based programmes are longer lasting than effects of attendance in nursery or playground programmes. In that sense, programmes such as the French *école maternelle*, which has a curriculum to teach children the basics of reading, writing and calculating, may be substantially more effective in fostering skills than programmes such as the German *Krippe* and *Kindergarten*, which function mainly as day care centres without strong educational mandate. Given the little and mixed evidence from Europe, it is not clear to which extent putting more money into current European early education systems without accounting for outcomes would indeed raise achievement and later labour-market outcomes.

#### *Equity:*

As indicated before, the US evidence shows that early intervention programmes targeted at children with disadvantaged backgrounds carry particularly large positive returns. Thus, policy measures to increase equality of educational opportunity through interventions in early childhood have the potential to yield very high returns. The positive effects of earlier education in the Dutch study were likewise restricted to the students from disadvantaged backgrounds (Leuven et al. 2004). In their cross-country research, Schütz et al. (2005) find that more extensive systems of pre-school education – in terms of both enrolment and duration – significantly increase equality of opportunity, as measured by a lower dependence of eighth-grade students' test scores on their family background. Thus, early childhood education programmes that are particularly targeted at disadvantaged children seem to have strong potential for raising equity.

A key issue here is whether effects from early interventions persist or decay through time. For the intensive US programmes that have been followed through adulthood, substantial long-lasting effects on economic and social outcomes have been shown in particular for children



from disadvantaged backgrounds. Among others, these long-run effects include impacts on school achievement, grade retention, employment, earnings, social adjustment, crime prevention, family relationships and health, and by now have been found to carry through to ages as high as forty (for details, cf. Barnett 1992, 1995; Garces and Currie 2002; Schweinhart et al. 2005; Cunha et al. 2006). While Magnuson et al. (2004) report that the positive cognitive effects of US pre-kindergarten programmes fade quickly on average, and that there are negative non-cognitive effects in terms of aggression and self-control, their results also show that there are more lasting cognitive gains for disadvantaged children and for those who get low instruction in early school years. Thus, even their more mixed results suggest that the effects of early interventions are long-lasting for the disadvantaged.

In the United Kingdom, Goodman and Sianesi (2005) find significant long-lasting effects of early childhood education on obtaining qualifications, employment and earnings at age 33. Analysing students' cognitive achievement during school life, Feinstein (2004) finds that differences in educational attainment along the socio-economic dimension – which carry through to adult economic outcomes – accumulate throughout school life. This suggests that to achieve equality of opportunity, the required early childhood investments may need to be supplemented by targeted investments for the disadvantaged throughout school. But UK evidence by Currie and Thomas (2001) suggests that the increase in differences in educational performance by socio-economic background during adolescence may be largely due to differences in school quality, so that a policy of equality of treatment at the school level may suffice once early interventions have laid an equal footing. Still, the evidence on the persistence of the effects of early interventions is limited, and if the positive effects of early interventions were to decay over the education life cycle, there would of course be more scope and need for interventions also at later ages.

#### *Complementarity or trade-off:*

Given that early childhood education programmes can be both efficient and equitable, there is obviously no efficiency-equity trade-off for early investment. Quite to the contrary, in particular when targeted at the disadvantaged, there is a strong complementarity between efficiency and equity in well-designed early childhood educational interventions, whose effects seem to be able to persist through adulthood.

### **3.3 Schools: Efficiency and equity**

Education policy at the school level can impact on efficiency and equity, but a key issue here is that one needs to be very careful about determining which policies are more effective in achieving these goals than others. This section discusses the evidence on the relative effectiveness of different policies to affect efficiency and equity at the school level.

#### *Efficiency:*

As seen in Section 2 above, the quantity and especially the quality of schooling carry substantial payoffs in terms of productivity and earnings in the labour market for the individual and society alike. Therefore, and given that most Member States achieve virtually universal enrolment in terms of the quantity of primary and (at least lower) secondary schooling, it is particularly any policy that increases the quality of schooling in terms of students' cognitive and non-cognitive skills that may bring considerable benefits with it.

However, research shows that there is no clear, systematic relationship between student achievement and the amount of resources spent on schools (see, e.g., Hanushek 2003 for an overview; Wößmann 2005a and the references therein for evidence from Europe; Wößmann

2003b for cross-country evidence; and Gundlach et al. 2001 for evidence from several European countries over time). In most European school systems, on average there seems to be virtually no effect of class size or per-pupil spending on the cognitive skills acquired by students. While results for teacher education and experience and for endowment with instructional material are more mixed, the evidence overall gives little hope that substantial gains in measured test scores would emanate if European countries increased their spending without changing the current institutional structures of their school systems.

In contrast, a lot of research has accumulated over recent years showing that the efficiency of the school system, in terms of cognitive skills per Euro spent (unfortunately, not much is known on efficiency in terms of non-cognitive skills), can be substantially increased by institutional reforms that focus the incentives of all actors in the system on increasing the performance of students. Given that most of these reforms are institutional changes that do not have major impacts on the spending level in the system, the gains in cognitive skills that they can elicit are pure efficiency gains.

One of the most promising institutional structures that could lead to substantial gains in many European education systems is a combination of accountability and school autonomy. International evidence suggests that institutional features that introduce accountability by externally testing and making public the quality of what students and schools deliver, e.g. in terms of external exit examinations, create the proper incentives to improve educational performance (cf. Bishop 1997, 2006; Bishop and Wößmann 2004; Betts 1998; Jürges et al. 2005; Wößmann 2002, 2003b, 2005b). Similar to the positive effects of external exit examinations, Figlio and Lucas (2004) report US evidence on positive effects of grading standards on student achievement. Another means to increase accountability are explicit school-focused accountability systems, which have been shown to increase students' learning achievement in the United States (Hanushek and Raymond 2004; Jacob 2005).

At the same time, it should be borne in mind that designing proper accountability systems that hold actors accountable for only those outcomes for which they are really responsible is not an easy task. External exit examinations can introduce incentives for students if they produce signals of accomplishment that have real consequences for students. Bishop (2006) suggests that a well-designed system of external exit examinations should be curriculum-based, define achievement relative to an external standard, measure the full range and signal multiple levels of achievement, and cover the vast majority of students. By contrast, accountability systems that aim to create proper incentives for schools require a value-added approach which tests the learning gains (rather than levels) of each individual student (cf. Kane and Staiger 2002; Ladd and Walsh 2002). School-focused accountability systems can also lead to strategic responses on part of teachers and schools, for example by increasing placements of low-performing students in special-education programs which are outside the accountability system or by preemptively retaining students (Jacob 2005). High-stakes testing may even introduce incentives for outright teacher cheating (Jacob and Levitt 2003). Thus, in implementing accountability systems, it is crucial to provide means that keep strategic responses and fraud to a minimum.

As another institutional feature that can increase the quality and effectiveness of European educational systems, school autonomy in personnel and process decisions can be beneficial for student learning, at least in systems where external exit exams introduce accountability. In several decision-making areas such as teacher salaries, course contents and school budgets, the cross-country evidence based on different international student achievement tests suggests that local decision-making without external exams is detrimental for student performance. But the effect turns around to be positive where external exams exist (cf. Wößmann 2005b). Thus, decentralisation works – if combined with the accountability introduced by external exams.

In effect, external exams and local decision-making complement each other in increasing the efficiency of education systems. By introducing accountability, external exams mitigate the negative effects of decentralisation due to opportunistic behaviour, ensuring a positive net effect of decentralisation due to superior local knowledge. The frequently urged decentralisation of school systems can enhance performance only if external exams provide the right incentives for local decision-makers to act in a manner which promotes better performance. Therefore, an efficient education policy would combine external exams with school autonomy. That is, it would specify standards and monitor their attainment, but simultaneously leave it up to the schools how these standards should be reached.

An institutional set-up that combines accountability with parental choice are systems which give students in schools that repeatedly do badly on the accountability test a voucher to attend private schools. In Florida, the threat of becoming subject to private-school choice if failing on the test has been found to increase school performance particularly for disadvantaged students (West and Peterson 2006).

More generally, policies that introduce competition, choice and market forces into the school system have been shown to have strong potential to shift school systems to a higher level of efficiency (for some background, cf. Hanushek et al. 1994; Shleifer 1998; Nechyba 2000; and Hoxby 2003a). Sandström and Bergström (2005) provide evidence on significant positive effects of competition from privately operated schools on the performance of public schools in Sweden (cf. Björklund et al. 2004 for similar results). Bradley and Taylor (2004) and Levačić (2004) find similar positive effects of school competition on the performance of English schools, and the former show that these efficiency gains are achieved without significant increases in polarization. Filer and Münich (2003) show that the introduction of a voucher-type system in the Czech Republic led to the creation of private schools in areas where public schools are doing badly and that the public schools facing private competition improved their performance in obtaining university admission for their graduates.

In a cross-country analysis, Wößmann (2003b, 2005c) shows that countries with a larger share of privately operated schools perform better on international achievement tests, after controlling for a host of other influences. At the same time, across countries, larger shares of public funding (as opposed to operation) are associated with better student outcomes. Since public funding may increase the set of choices for poor families, the positive effect of public funding may be another aspect of the skill-enhancing capacity of school choice and competition. While the extent to which this descriptive evidence depicts causal relationships remains to be seen, the international evidence is still suggestive in the sense that school systems based on public-private partnerships where the state finances schools but contracts their operation out to the private sector seem to be the most effective school systems.

Similar evidence of positive effects of school choice on student performance has been found in the United States. The evidence provided by Neal (1997, 2002) suggests that the choice of private Catholic schools leads to higher performance of US inner-city students. Hoxby (2003b) summarizes ample evidence from recent policy experiments in the United States indicating that school choice and school competition improve the performance not only of these schools, but also of the public schools that face their competition. Peterson et al. (2003) provide evidence from several randomized field trials in the United States showing that school vouchers substantially increased the academic performance of African Americans who were enabled to attend a private school. However, there are also sceptics who argue that efficiency gains from a widespread voucher system might be small (Ladd 2002). Within the traditional public system, increased competition among US public schools has been shown to improve student performance, as well (Hoxby 2000). Charter schools, publicly financed and

overseen schools that have substantial independence, constitute a new form of competition within the US public school system and have been shown to improve student performance in some states but not in others (cf. Hanushek et al. 2005 and the references therein).

Another policy with the potential to increase efficiency in the school system are financial incentives for teachers (cf. Lazear 2003a). Atkinson et al. (2004) find that the introduction of performance-related pay had a substantial positive impact on student achievement in England (see also their survey of other studies, the more rigorous of which also tend to find a positive relationship between financial teacher incentives and student outcomes). Similarly, Lavy (2002, 2004) has shown that monetary incentives for teachers based on their students' performance improved efficiency immensely in Israeli schools, with financial incentives for individual teachers being more efficient than teacher group incentives. The improvements in student performance due to performance-related pay for teachers appear to derive from changes in teaching methods, after-school teaching and increased responsiveness to students' needs.

Teacher incentives are particularly crucial because arguably, apart from the students themselves, teachers constitute the most important "input" in the education process. Teachers have been shown to differ severely in the amounts of knowledge that they convey to the same students (cf. Rivkin et al. 2005). The problem in terms of political utilisation is that teacher quality thus measured is hardly related to measurable features of teachers such as their level of education or experience. Thus, while improving teacher quality would beyond doubt increase the efficiency of schooling, there is currently little knowledge on how to best advance teacher quality. However, one component of teacher quality that is conducive to student outcomes seems to be teachers' academic proficiency (Eide et al. 2004). Eide et al. (2004) argue that the disconnection between the structure of teacher compensation and the individual teacher's performance is at the heart of the problem of the increasing difficulty of hiring and retaining high-skilled teachers. In line with this argument, Hoxby and Leigh (2004) show that pay compression due to unionization can explain a major part of the decline in teacher aptitude in the United States. Hoxby (2002) shows that different forms of school choice induce schools to hire higher-quality teachers. While many attempts at introducing performance-related reward programmes have been unsuccessful due to poor design and implementation, for example due to a lack of clarity in goals and reliability of criteria, well designed and implemented schemes that recognize and reward teacher performance stand a good chance of improving student outcomes (cf. OECD 2005b for a review).

On a more descriptive basis, OECD (2005b) provides a good review of international experiences on attracting, developing and retaining effective teachers. Important lessons include an emphasis of teacher quality over teacher quantity, a flexible and ongoing scheme of teacher education and development aligned with school needs, and school autonomy in teacher personnel management. To improve teacher quality, it is suggested to pay attention to the selection criteria for teacher education and employment, ongoing teacher evaluation throughout their career, and recognition and reward for effective teaching.

Taken together, policies that set the right incentives for students, teachers, schools, administrators and parents can contribute substantially towards increasing the efficiency of resource use in schooling. Institutional reforms that may enhance efficiency in school systems include external exit exam systems and other accountability systems, school autonomy in personnel and process decisions, competition and choice, and performance-related rewards.

### *Equity:*

The degree of equality of educational opportunities that is reached by school systems varies considerably across countries. While in some countries, students' educational performance is strongly predetermined by their family background, this is much less the case in other countries (cf. Schütz et al. 2005).

However, similar to the goal of efficiency, it seems hard to achieve more equity by just increasing educational spending on students from disadvantaged backgrounds. There is very little evidence suggesting that spending targeted at disadvantaged students is any more effective than spending on average. Thus, Leuven and Oosterbeek (2006) report quasi-experimental evidence from the Netherlands showing that for a broad range of interventions targeted at disadvantaged groups, such as class-size reductions, extra resources for personnel and extra resources for computers, substantial positive effects can be ruled out. Similarly, it has proven hard to find a significant effect of the policy of education priority zones in France, which channel additional resources to disadvantaged schools (Bénabou et al. 2004). Also, much US evidence suggests that the extent to which a refocusing of additional material resources towards the disadvantaged can alter the distribution of educational outcomes is very limited at best (cf. Betts and Roemer 2006; Hanushek 2006), although there are studies that find that class-size reductions are more effective for disadvantaged students (cf. Krueger 1999).

One policy with substantial impact on the equality of opportunity achieved in a school system is the timing of the tracking of students into different kinds of schools based on their ability. It seems that early tracking, e.g. at age ten to twelve, as is common in several European school systems, is particularly harmful for children from families with low socio-economic status and therefore hinders reaching equality of educational opportunity (for evidence, see Hanushek and Wößmann 2006; Schütz et al. 2005; Ammermüller 2005; Bauer and Riphahn 2006; Dustmann 2004). Therefore, postponing tracking to a later stage in the educational process can act as a policy to increase equality of opportunity at the school level.

A second policy that seems to affect equity at the level of compulsory schooling is the size of the pre-school education system in a country (cf. Section 3.2 above). Thus, an extensive system of early education in terms of both duration and universal enrolment can be viewed as another policy to increase equality of educational opportunity at the school level (cf. Schütz et al. 2005). In a similar vein, Leuven and Oosterbeek (2006) find for the Netherlands that lowering the compulsory school attendance age is the only intervention analyzed which produces significant positive effects for disadvantaged students. While equalizing effects might also be expected from whole-day schooling, the cross-country pattern does not show clear evidence for equalizing effects (Schütz et al. 2005).

Some of the above-mentioned institutional reforms that can boost efficiency may also be used to increase equity. For example, simulation studies by Nechyba (2000) show that a voucher system which gives choice to poor families can actually serve equity goals, e.g. by integrating neighbourhoods. This is even more so when the vouchers are designed to explicitly target disadvantaged families. In particular, because existing systems already have a lot of segregation, introducing choice can decrease the segregation due to mobility. Likewise, in the Florida setup which combines accountability with choice, it was especially the disadvantaged students whose educational performance gained from the threat of becoming subject to private-school choice if schools failed on an accountability test (West and Peterson 2006). Charter schools also tend to disproportionately serve disadvantaged students whose regular schools were performing badly (cf. Hoxby 2003b). Hanushek et al. (2005) show that parents seem to be capable of choosing in a well-informed way in the sense that they tend to exit

charter schools of low quality, although this tendency is weaker for students from poor families. To promote equity, financial incentives for teachers can also be targeted at at-risk students to particularly boost their performance (Lavy 2002, 2004).

Improving the quality of the teaching force of disadvantaged students could certainly advance the cause of equity. Ensuring that all students have access to high quality teaching, with capable people wanting to teach also in disadvantaged schools and with a high quality of their teaching, will help in raising the equity of schooling (cf. OECD 2005b). But the problem is again that current knowledge on practical means on how to achieve this is limited. Training teachers to identify learning problems early on might help, although empirical evidence on this is missing. A fundamental problem for equity in this area is the endogeneity of the distribution of teachers, in that better teachers may tend to choose to teach in relatively well-off schools, so that schools in problematic neighbourhoods have problems in attracting high-quality teachers (cf. Bonesrønning et al. 2005).

#### *Complementarity or trade-off:*

The current knowledge on the effects of schools and school policies is mostly limited to effects on cognitive skills, while there is not much research on non-cognitive and longer-term outcomes. Clearly, more research needs to be done here, particularly in Europe. But at the current level of knowledge, it seems fair to conclude that there appears to be no strong evidence for a substantive trade-off between efficiency and equity at the school level. Across countries, performance levels and the distribution of outcomes are largely unrelated (Schütz et al. 2005). With respect to specific policies acting at the school level, it often seems that policies that increase efficiency are neutral with respect to equity, while equity-conducive policies do not strongly affect efficiency. For example, Bradley and Taylor (2004) find that competition has positive effects on efficiency in UK secondary education, without significant polarization. Likewise, early tracking of students into different-ability schools has been found to increase inequality, while there is hardly any evidence that it would improve efficiency, at least in terms of basic cognitive skills (Hanushek and Wößmann 2006). If anything, there might even be a slight complementarity for this policy, in that later tracking reduces inequality and seems to have a slight positive impact on efficiency.

More generally, there is also some evidence for complementarities of certain policies in raising both efficiency and equity, most notably for policies that increase early education and well-designed forms of choice and accountability. In terms of the pre-school education system, it was already discussed that extensive intervention programmes in early childhood can be both equitable and efficient. Similarly, Schütz et al. (2005) find that an extensive system of early-childhood education can improve equity in the school system, and at least the length of the pre-school education cycle is also positively associated with average school performance across countries.

As discussed above, Wößmann (2005c) provides evidence for a strong complementarity between efficiency and equity policies in the sense that public funding of schools combines very well with private operation of schools. In fact, public funding even seems to improve efficiency, presumably because it allows additional choice and thus competition for families who could otherwise not choose because they are credit constrained. If public money is allowed to go to privately operated schools, this is the most efficiency-conducive combination. Thus, even in terms of mere efficiency, education systems where the state does the funding and the private sector runs the schools seem to outperform all other kinds of system. At the same time, Schütz et al. (2005) find that public funding improves equity, as does private operation. That is, a combination of private operation with public funding may be conducive to both efficiency and equity.

Similarly, while many people fear that voucher-based choice systems in education might reduce equity at the expense of efficiency, the simulations by Nechyba (2000) suggest that it is actually more likely that voucher systems would also improve equity, particularly with a well-targeted voucher design. West and Peterson (2006) find that choice threats embedded within accountability systems in Florida not only boosted average performance, but in particular favoured disadvantaged students. Similar equity-enhancing effects have been found for voucher and charter school programs (Hoxby 2003b). On the other hand, Burgess et al. (2006) find a positive association between the size of the choice set of nearby schools and post-residential stratification of students across schools in England, although the effect of school choice on initial residential choices is not clear. Björklund et al. (2004) also suggest that there are signs that competition from privately operated schools increased segregation and dispersion of student performance in Sweden, although they also show that the association between family background and student performance did not change. In general, issues of implementation seem crucial when competition is introduced in schooling, and without proper safeguards, critics fear that competition may induce cream skimming, increase segregation and lead to adverse effects on disadvantaged students (e.g., Ladd 2002). A proper design of an equitable voucher system and of limits to cream skimming by schools is thus a crucial task to ensure equitable outcomes. Issues of design and implementation of school choice to improve both efficiency and equity contain measures such as the flow of information to parents and regulatory and financial frameworks and incentives, which can be devised to encourage socio-economic integration (cf. Betts and Loveless 2005).

In terms of accountability systems, Wößmann (2005b) finds that central exams are strongly positively related to higher average levels of performance, while at the same time there is some evidence that they can reduce the disadvantage of coming from an immigrant background. There is also some tentative evidence that central exams may be able to increase equity along the parental-education dimension, although evidence here is much more mixed and may be better interpreted as central exams being rather neutral with respect to equity.

All in all, equity-enhancing structures often also seem to serve to improve educational efficiency and vice versa, showing few signs of an equity-efficiency trade-off in the structure of school systems. Even more, efficiency-conducive policies can be targeted at disadvantaged students in order to boost equity goals, as has been shown, for example, in the case of targeted teacher incentives (Lavy 2002, 2004). Ultimately, if schools challenge all students to their highest potential, an efficient school system can also be equitable at the same time (cf. Arrow et al. 2000; Peterson and Wößmann 2006).

### ***3.4 Initial vocational education and training: Efficiency and equity***

In several European countries, vocational education plays an important role at the end of or directly after the compulsory schooling cycle (issues of continuous training later in life will be discussed in Section 3.6 below). The main feature of vocational education programmes is that rather than aiming at the provision of general skills that can be used in a variety of different activities, they provide an education that prepares for specific tasks. Such programmes may be either solely school-based, or – more often – they may combine vocational schooling with work experience on the job, as in apprenticeship contracts. In the latter case, vocational programmes differ from programmes of general education in that the educational decisions are not only made by students and their families, but also by firms.

The debate on vocational versus academic qualifications and their payoffs is more heated in some European countries than others. But despite its prevalence in many European countries, there is a general lack of hard empirical evidence on which to base a sound analysis of

efficiency and equity issues in initial vocational education and training (cf. Leney et al. 2004). Consequently, the scientific assessment is forced to remain very limited. Furthermore, the extent, design and pattern of operation of initial vocational education and training are very different across Member States (cf. Lynch 1994) and even across sectors within Member States (e.g., Franz and Soskice 1995), so that Europe-wide assessments are particularly hard to arrive at for this type of education.

#### *Efficiency:*

The economic returns to vocational education on the labour market are scientifically particularly hard to identify because lower-ability students tend to sort themselves into these types of education. While descriptive comparisons tend to find that returns to vocational education may be lower than returns to general education (Psacharopoulos 1994), and while the size of the returns may differ considerably across European countries, it seems that vocational education does carry reasonable earnings returns in countries with well-developed systems of vocational education (cf. Lauer and Steiner 2000 for an example; cf. also Bishop 1994). Countries with well-established apprenticeship systems also tend to show lower shares of students without any post-compulsory education and lower youth unemployment (cf. Ryan 1998). On the other hand, they also appear to show large unemployment among older people who previously went through the apprenticeship system, suggesting that there is an increased obsolescence of specific skills due to rapid technical change.

In general, well-developed apprenticeship systems that combine specific education in vocational schools with on-the-job training in firms tend to receive positive assessments from economists (e.g., Steedman 1993; Acemoglu 2001; Clark and Fahr 2002). It is argued that the combination of vocational education with job experience facilitates the transition from schooling to work (cf. Ryan 2001 for a review) and motivates students to perform well and firms to provide decent training. For example, Bonnal et al. (2002) show that apprenticeship schemes that combine vocational education with within-firm training are better suited to facilitate the school-to-work transition in France than pure vocational schools. But apprenticeship contracts and their success in Europe differ substantially. It seems that the design of adequate schemes is important to foster satisfactory skill formation. Among others, a sufficient duration of the apprenticeship schemes may be vital (cf. Euwals and Winkelmann 2004 for evidence of positive labour-market outcomes of longer apprenticeship duration in Germany), as might be proper certification and quality monitoring by the state (cf. Acemoglu and Pischke 1999). It has also been argued that a high level of competition among firms offering apprenticeships and among students is important to assure success (Heckman 2000). But in general, the empirical knowledge on what determines a successful system of vocational education is very limited.

For example, Germany – a country with one of the most developed apprenticeship systems – has witnessed an increasing gap between the declining demand for apprentices by firms and the supply of students wishing to enter the apprenticeship system. This lack of apprenticeship training positions could point at inefficiencies, in the sense that training apprentices is too costly for the firms. Swiss evidence shows that firms' probability to train apprentices is strongly affected by the ratio between costs and benefits of training to them, in particular in terms of whether there are benefits of work to be performed productively by apprentices (Muehleman et al. 2005; Wolter et al. 2006). However, the German gap need not be a sign of general inefficiencies, but may rather be a sign of an improper sharing of costs between apprentices, firms and the state. Because of a shift of time from productive workplace activities to education, disproportionately large increases in apprentice earnings and a shift in teaching towards more general rather than firm-specific skills (Wößmann 2004), the financial



burden may have to shift away from firms towards apprentices in order for the gap to be closed.

In a somewhat less developed system of initial vocational education and training, the United Kingdom has faced the problem of a proliferation of vocational qualifications that weakened the signal of what students who go through a vocational programme learn (cf. Machin and Vignoles 2005). As a consequence, employers are unaware of the skills provided and thus unwilling to reward vocational credentials.

In general, these experiences suggest that it is important for an efficient system of initial vocational education and training to provide qualifications well-tailored to market needs, both in terms of content and in terms of signalling these contents. Provision by the private sector combined with certification by the public sector may be one means of achieving these goals.

#### *Equity:*

For students who do not reach the standards of academic skills necessary to succeed in general higher education courses, acquiring the more practical skills of initial vocational education and training programmes may be a viable road towards skill improvements, especially when the education is combined with training on the job. In France, the particularly disadvantaged students who tend to opt for apprenticeships gain from these apprenticeships in being more likely to find a job than students who obtained a merely school-based vocational education (Bonnal et al. 2002). On a descriptive level, there is an unconditional negative association between the share of students in vocational education and the proportion of early school leavers across European countries (Leney et al. 2004), suggesting that vocational programmes may help to reduce the incidence of school dropouts and thus target the most disadvantaged students.

On the other hand, the technological changes over recent decades have reduced the demand for relatively low-skilled workers (cf. Machin 2004), which may partly also hit vocational qualifications. It is a common experience over recent years that young adults who have left school with low grades have increasing difficulties in finding positions in vocational training. German evidence shows that lower-educated school leavers are selected into apprenticeships with less favourable employment prospects, and over time, they also find it increasingly difficult to transfer successfully from apprenticeship to work (Büchel 2002). This underlines the life cycle perspective taken above which stresses the importance of a high-quality education up to the school level.

Furthermore, the long-run payoffs to the relatively specific skills obtained in vocational education programmes may have declined due to more rapid obsolescence of specific skills caused by increasingly rapid technological change. Krueger and Kumar (2004) present a model calibration suggesting that the European focus on specialized, vocational education might have been successful during the 1960s/70s. But they show that the difference in education policy to the more concept-based, general education of the United States may be able to explain much of the lag in European growth when new technologies emerged more rapidly during the subsequent information age. Thus, the necessity of tailoring for market needs in order for vocational programmes to be effective is hard to achieve, because market needs in some areas are changing fast and often differ spatially. In particular, narrow vocational education run the problem of mismatching with market needs, a problem amplified by low skill multipliers of vocational skills. Because of the impossibility of planning vocational education given rapid technological advances, it may be more effective to enhance the level of general competence of students from low socio-economic background, and brief

stages of vocational specialization can take place throughout the labour-market career of the individual (cf. Psacharopoulos 1991).

*Complementarity or trade-off:*

Given the extremely tentative character of the assessments of efficiency and equity issues in initial vocational education and training, it seems hard to come to a conclusion about the possible complementarities or trade-offs between efficiency and equity at this stage of the education system. The only conclusion that seems reasonable to make is that any initiative that manages to increase the efficiency of vocational education programmes in all likelihood would also help the cause of overall equity in the system, because in relative terms it is the students from lower socio-economic backgrounds who enter the vocational system in larger shares. But without clearer evidence on the internal and external efficiency and equity of initial vocational education and training, any assessment will have to remain far from satisfactory.

### ***3.5 Higher education: Efficiency and equity***

In contrast to the vocational qualifications discussed in the previous section, higher education obtained at colleges, polytechnics and universities tends to impart more academic qualifications. While the empirical evidence on issues of efficiency and equity in European higher education is meagre at best, there is a substantial literature advancing theoretical arguments, often based on practical observations, in particular related to the financing side of higher education (see the reviews by Barr 2004 and Greenaway and Haynes 2004).

*Efficiency:*

Higher education is generally associated with high returns on the labour market in terms of earnings and employability (cf. Section 2.1), suggesting that obtaining a higher education degree can be a highly efficient investment. Over the last two decades of the twentieth century, there has been a strong shift in demand towards high-skilled workers in the majority of industrialized countries (cf. the surveys in Machin 2004 and chapter 10 of Cahuc and Zylberberg 2004). Mostly driven by technological changes that are biased in favour of high-skilled tasks, employers seem to be increasingly demanding workers with graduate qualifications, which has increased their relative labour-market prospects in terms of employability and earnings. In countries close to the technological frontier, returns to higher education may even be the highest ones (cf. Vandenbussche et al. 2004).

The amount of private spending on higher education might be inefficiently low if a lot of families were truly credit constrained in the traditional sense, that is, their children would not enter higher education because their families do not have the financial means to pay for it at the time of decision-making. However, ample evidence from the United States suggests that true credit constraints are not a binding issue in the admission to higher education in the vast majority of cases (cf. Carneiro and Heckman 2003; Cunha et al. 2006). Rather, the fact that students from disadvantaged family backgrounds have a much lower probability of entering university seems to be caused by a lack of early educational investments which deprive these students of the basic prerequisites to advance to university. If this is true in the United States, where colleges and universities charge substantial private fees, then it seems that it is even more relevant in Europe, where higher education is mostly publicly funded. For example, a major determinant of degree performance in UK universities is students' performance on A-level scores at the school level (Smith and Naylor 2001), and academic preparedness is the major determinant of dropout of medical students in UK universities (Arulampalam 2004b).

Thus, financial interventions at the late stage of higher education are unlikely to facilitate efficient investments – the intervention should have happened much earlier in the educational life cycle (see Section 3.1 above).

In terms of technical efficiency, in many Member States there is a growing feeling that current systems of higher education are not organized in an efficient way. While empirical evidence on this is hard to come by, many commentators, such as the German Council of Economic Experts, allege that current systems of higher education, which are traditionally run under state control and employee management in many Member States, exhibit a high degree of inefficiency. Psacharopoulos (2005) provides descriptive evidence supportive of this view, and Lowry (2004) presents US evidence showing that public universities faced with little competition and universities that rely heavily on government subsidies perform worse in terms of graduation rates in undergraduate education. As a consequence, commentators suggest that efficiency in European higher education could be raised by introducing competition, which would provide market discipline to the behaviour of providers. In Germany, for example, the Council of Economic Experts proposed market-based reforms that would organize higher education in a competitive framework, allow colleges and universities freedom from bureaucratic interventions, and give the actors incentives for superior performance and quality, among others through performance-related pay (Sachverständigenrat 1998, pp. 247-256). Rather than keeping the management of higher education institutions in the sole responsibility of the state, it seems that European systems of higher education could gain a lot in terms of efficiency by some measures of privatization (cf. Psacharopoulos 2005).

As part of market-based reforms, collecting tuition fees from students could increase the incentives for students to study more efficiently. If the beneficiaries of higher education had to make a greater private contribution to the costs, this could not only raise the efficiency of the use of their own time, but it could also create incentives for providers of higher education to use their resources more efficiently. In a European perspective, the internal market for higher education with mobility of students across Member States can help to enact functioning competition in higher education where the markets in many Member States are too small to enable workable competition. At the same time, the mobility of students calls for some form of coordination of the policies of Member States to ensure a proper matching of costs to beneficiaries.

#### *Equity:*

The shift in relative demand towards highly educated and skilled labour over the past decades, which seems to be mostly driven by skill-biased technological change, had major effects on the education structure of employment and educational wage differentials on the labour market (cf. Machin 2004; Cahuc and Zylberberg 2004, chapter 10). Largely unrelated to the education policies pursued, this shift has entailed an increase in overall inequality which manifested itself mainly in a strong increase in wage inequality in the United Kingdom (as well as the United States) and in a strong increase in relative unemployment of the low-skilled in Member States in Continental Europe. This suggests that inequalities in access to higher education translate into inequalities in economic outcomes in an ever stronger way.

In most current systems of higher education in Europe, equality of access is not achieved. In terms of financing, all tax-paying households contribute to the public financing of higher education in the standard tax-financed systems of European higher education. But in terms of access, in contrast to the compulsory levels of education, there is self-selection at the stage of higher education programmes in that children of academics are much more likely to go to university. As a consequence, unless there is very strong tax progression, tax funding may be viewed as unequal in that part of the funding may come from groups with little opportunities

to access higher education (cf. Barr 2004; Psacharopoulos 2005). As argued above, the main reason for inequality in access is probably not that children from disadvantaged backgrounds cannot afford to go, but rather that they do not have the prerequisite educational qualifications. To alleviate this inequality in access, policy has to intervene much earlier. Otherwise, any policy that aims to increase participation in higher education could easily result in higher participation combined with increased inequity because it will be students from well-off families who increase participation, as has happened in the United Kingdom in the 1980s/90s (cf. Machin 2006). US evidence, while suggesting that financial aid schemes can have a significant effect on college attendance (although the effect on college completion is less clear), is also mixed on whether the effect of financial aid is larger or smaller for students from disadvantaged backgrounds (cf. Kane 1994; Dynarski 2003; and the review in Dynarski 2002).

Introducing tuition fees in the current setting without proper care for equity goals would probably aggravate the problem of unequal access to higher education – at least when equity is viewed in terms of the students' family background. Therefore, it seems critical from an equity perspective to provide proper financial means to able students from poor family backgrounds. An obvious solution is to defer the tuition fees by combining them with a system of income-contingent loans, which allow credit-constrained students to cover the fees. Income-contingent loans are loans that enable students to finance university education and that have to be paid only if and when the students have left university and earn an income above a specified threshold. For a proper functioning, such loans should be made available to all students and should cover cost of living in addition to tuition fees.

The fees could be selective rather than across the board. Students from low socio-economic backgrounds could receive targeted grants and scholarships, whereas students from well-off families would pay the full social cost of their study (cf., e.g., Acemoglu 2001 for a brief survey of possible equity-enhancing effects of means-tested subsidies to higher education). Subsidizing higher education conditional on parental income can be a useful component in an efficient design of overall redistribution policy (Dur et al. 2004). Because the substantial uncertainty of investments in higher education could discourage particularly disadvantaged students, the state could carry most of this uncertainty through the income contingency of the loans. In equity terms, the income contingency creates a built-in insurance against inability to repay the loan. Again, issues of implementation will determine the administrative costs of the system. From an international perspective, contracts should be set up to ensure repayment also if a student later emigrates (see Barr 2004 and Greenaway and Haynes 2004 for further details of how to design a system of fees with income-contingent loans).

Income-contingent loans can even be equity-enhancing when a different perception of equity is used: equity not in terms of family background, but in terms of students' own lifetime well-being. This seems to be a particularly relevant perspective for higher education. As discussed above, there are substantial private returns from obtaining a degree in higher education, so that by the very attendance of higher education these students will be the economically better-off in the future. Therefore, it seems only right from an equity perspective that they should also make contributions to the cost of their higher education, at least at a time when their earnings are indeed high once they have entered the labour market.

#### *Complementarity or trade-off:*

In this perspective, both efficiency and equity considerations support a system of higher education where beneficiaries contribute tuition fees which they finance through income-contingent loans (cf. Greenaway and Haynes 2003). Furthermore, fee and loan policies could be targeted specifically at students from poor family backgrounds to alleviate further equity

concerns. By contrast, the state-run and state-financed way in which European higher education systems are currently set up makes them both inefficient and inequitable (cf. Psacharopoulos 2005). Thus, a policy of tuition fees coupled with income-contingent loans could create some complementarity between efficiency and equity in higher education. Similarly, if credit constraints were the main cause for unequal access, equitable policies which subsidize costs for students from low-income families would also be efficient, because they would enable high-ability students with high returns to obtain a higher education degree.

Still, in reality the main reason for unequal access to higher education lies mainly in a lack of prerequisites due to deficiencies at earlier stages of the education life cycle. In this case, there is indeed a trade-off between efficiency and equity in higher education, since it would be efficient to focus resources on those who are already advantaged. As has been seen in the past, policies that aim to increase participation in higher education in an effort to enhance equity can therefore end up raising inequity, because it is students from relatively well-off families who will disproportionately take up the new slots (cf. Machin 2006).

### ***3.6 Continuing training and adult learning: Efficiency and equity***

While the previously discussed education programmes mostly take place before students enter the labour market, this section discusses investments in continuing training and adult learning that take place concurrent with or after some labour-market experience. Similar to the work-related programmes of initial vocational education and training discussed in Section 3.4, continuous training tends to provide specific skills, and it is decided upon not only by the person to be educated, but also by the employer.

As in the case of higher education, the basis for addressing issues of efficiency and equity of education in adulthood, in terms of continuing training and adult learning, is relatively thin. On the one hand, policy recommendations based on theory are ambiguous and depend crucially on the specific setting (cf. the recent survey by Leuven 2005). On the other hand, particularly in Europe, statistical data on training costs are rare, and information on training benefits in terms of productivity is limited (Bassanini et al. 2005), restraining a profound empirical analysis. But still, in particular in light of recent cross-European evidence on workplace training by Bassanini et al. (2005), some basic patterns and general results emerge.

#### *Efficiency:*

In terms of efficiency, a fundamental difference emerges between employer-provided workplace training and publicly provided training programmes, mostly for the unemployed. Workplace training provided by firms seems to be associated with substantial earnings returns, although distilling causality is particularly hard in this case (cf. Section 2.1 above, and chapter 4 of Bassanini et al. 2005 for a survey and own evidence). From a theoretical point, it is not clear whether the current institutional setup of European labour markets sets efficient incentives for investments in training. In competitive labour markets, firms have incentives to invest efficiently in firm-specific skills, while employees have incentives to invest efficiently in general skills (Becker 1964). In imperfect labour markets, by contrast, firms can also have incentives to sponsor general training, but underinvestment may still arise (cf. Acemoglu and Pischke 1999). Firms can also have incentives to finance the acquisition of general skills if different firms use the different general skills in different combinations and attach different weights to each of them (Lazear 2003b). Empirically, Bassanini et al. (2005) point out that there is no clear-cut evidence for an under-provision of workplace training, so that the currently achieved level may not be too far from the socially efficient one in most European countries.

However, there is a clear pattern emerging that training by private firms goes mostly to the higher educated. Similar to previous research from the United States, Arulampalam et al. (2004a) and Bassanini et al. (2005) find that also in Europe, training increases with education and skill-intensity of occupations, as would be expected from the skill multiplier effects discussed in Section 3.1. This suggests that the rates of return to training seem to be highest for people who already have high education – either because the benefits are higher or because the costs are lower – so that an efficient allocation of investment in training would go to those who are already high-skilled. By contrast, rates of return to training investments might be particularly low for the disadvantaged. Oosterbeek (1998) presents Dutch evidence suggesting that this pattern reflects indeed differing net benefits for workers of different education levels, rather than firms favouring different workers differently.

A role for the state in furthering the efficiency of training systems might lie in improving information about training opportunities, setting appropriate legal frameworks and ensuring portability of skills (Bassanini et al. 2005). State regulation could also help by monitoring the quality of training programmes and certifying skills, which could facilitate contracting between firms and employees at the individual level. However, in theory such measures can also be counter-productive, and detailed empirical evidence on the efficiency effects of state regulation of training programmes is still missing (cf. Acemoglu and Pischke 1999).

In contrast to employer-provided workplace training, the track record of the efficiency of public sector training programmes, usually devised as part of active labour market policies, is far bleaker (cf. Heckman et al. 1999 for a general survey of US evidence and Heckman 2000 for a survey of failed training programmes in the United States). Evaluation studies of public training programmes in European countries, including France, Germany, Ireland, Norway, Poland, the Slovak Republic, Sweden and the United Kingdom, tend to report very low or even negative returns, in the sense that the costs of the programmes are significantly higher than the benefits in terms of increased earnings or employment probabilities (cf., e.g., the surveys by Martin and Grubb 2001 and Kluge and Schmidt 2002). Often, it is hard to identify any significant positive effect of public training programmes on earnings and employability (cf. Fitzenberger and Prey 2000 and Lechner 2000 for examples from East Germany). There are even cases where significant negative effects of public sector sponsored training on earnings and employability of participants have been found, at least in the short run, although more recent evidence suggests that effects in the longer run may be not as bleak, albeit probably far from being cost effective (cf. Lechner et al. 2004 and the references therein for evidence from West Germany).

Thus, training schemes devised by the state seem to be mostly ineffective and remote from cost effectiveness. Still, effects can vary substantially between different groups. Broadly speaking, public sector training programmes have been found to be more effective for adult women than for adult men and youth (cf. Heckman 2000; Kluge and Schmidt 2002). But quite generally, evidence from the United Kingdom suggests that adult learning has very little directly measurable labour-market effects (cf. Machin and Vignoles 2005), although there may be some effects for the most disadvantaged (Jenkins et al. 2002).

Together, the discussed evidence suggests that programmes of continuing training and adult learning should be related to and thus produced on the job. Therefore, encouraging the private sector, which is better aware of market demands, to produce additional training seems better policy than direct public production of training (cf. Heckman 2000; Kluge and Schmidt 2002).

### *Equity:*

In terms of equity, publicly provided training programmes often target the unemployed, which would seem highly welcome from an equity perspective. However, the evidence just discussed that these programmes are not effective in most cases suggests that they in effect do not strongly advance the cause of equity. Among targeted public sector training programmes, US evidence suggests that results for programmes aimed at displaced workers are often discouraging (cf. Heckman 2000). But there is some European evidence suggesting that programmes targeted at the disadvantaged can help to improve their labour-market outcomes (cf. Kluve and Schmidt 2002).

The fact that firm-provided workplace training tends to be confined to the high-skilled suggests that this kind of training tends to hinder rather than advance equity causes. In terms of equality of opportunity, public interventions might be justified if circumstances out of the reach of individuals, such as their family background, prevent them from obtaining additional training. While in the United States, the provision of company training is negatively associated with family background once education and ability are controlled for (cf. Carneiro and Heckman 2003), Bassanini et al. (2005) find that training outcomes in Europe are significantly affected by parental background even after controlling for education, in particular in Southern European Member States. Given data restrictions, the extent to which this result is robust, and the extent to which public policies might be able to affect it, remains an open question. Because equality of opportunity is not necessarily a goal of private firms, Bassanini et al. (2005) stress that public training policies that try to address equity issues should be targeted at individuals rather than firms.

There are two features that move this relatively negative assessment of training programmes from an equity point of view towards a more positive assessment. First, the perspective taken in this document, recommending that skill deficiencies of the disadvantaged should be remedied as early as possible, is very long-run. In particular, this perspective misses those who currently have already left the phase of compulsory education with a low level of skills. Especially when taking the view that equity is not just about money transfers but also about social inclusion, which may mean that working carries intrinsic individual dignity that should be valued as a means against a culture of dependence, the relative preference for targeted training policies over other equity policies increases. In many cases, it may still be more cost effective to subsidize jobs rather than to spend the money on investments in adult learning. But in this perspective, it is particularly noteworthy that among the different active labour market policies, training programmes seem to be more effective than subsidy-type programmes (Kluve and Schmidt 2002). Thus, policies that encourage training may in many instances still be the best available option to increase the fates of currently low-qualified adults, helping them find work and earn income. In terms of implementation, for such policies to be successful it seems important that they aim at encouraging the private sector to provide training, while the government can help through certification and quality monitoring, rather than at direct training provision by the public sector (cf. Acemoglu 2001; Heckman 2000).

Second, when combining the life cycle perspective with the fact that family background is a crucial input into early learning and child development, adult learning activities aimed at young parents may carry the additional benefit of improving the early educational environments for children from otherwise disadvantaged backgrounds. Educational involvement of low-educated parents during adulthood can reap the intergenerational gains of improved early learning of their children, with all its subsequent dynamic effects (cf. Section 3.1 above), by improving the educational background of families. Unfortunately, empirical knowledge about the extent to which such educational interventions at the parental level, like

the national plan targeted at illiterate parents in Italy in the 1970s, can be effective in an intertemporal sense is largely missing.

*Complementarity or trade-off:*

Despite these countervailing features, the basic facts remain that returns to training seem highest for the well-educated and that public training schemes aimed at low-skilled workers have proven to be quite ineffective. Therefore, in general there seems to be a trade-off between efficiency and equity at this late stage of the life cycle of education. At the level of continuing training and adult learning, it seems that returns are highest for those who have already obtained high degrees of education. By contrast, policies that try to target programmes of continuing training and adult learning at disadvantaged people run into the problem that the returns to these late investments may be particularly low among the disadvantaged, so that alternative redistributive policies may be more efficient (cf., e.g., Bassanini et al. 2005). Therefore, it seems crucial that policies targeted at equity set in much earlier, trying to improve the access to high-quality early childhood and school education for students from disadvantaged families.

#### **4. Conclusion**

Ideally, a sound assessment of investment priorities at the margin would have to be established on the basis of country-specific empirical assessments. Lacking encompassing assessments for most Member States, it is still possible based on the available empirical evidence to arrive at a broad pattern of priorities for educational investments as depicted in Figure 1. The overall assessment of efficiency and equity in European education and training systems suggests that there seem to be strong complementarities between efficiency and equality of opportunity in policies that act at early stages of the education process. However, these seem to turn into trade-offs between efficiency and equity at late stages of the education life cycle. Thus, the earlier equity- and efficiency-enhancing policies set in, the better. If Member States focus their public investments early on, improving the fates of disadvantaged students in early childhood and at the school level, then they do not necessarily have to choose between efficiency and equity. Only if they wait until students reach the age to enter higher education or even continuing training and adult learning, their attempts to foster equity sometimes end up being both inefficient and unfair.

Within the different stages of the education and training system, the evidence suggests that the technical efficiency in educating both the disadvantaged and the student population at large can best be promoted by leaving behind a simple input orientation in favour of an output orientation. Such an output orientation can be achieved through institutional reforms that focus incentives on the performance of students. By setting clear standards and monitoring their achievement, while at the same time using the forces of choice and competition to find the best ways of how to achieve the output goals, public policies can best ensure that every person gets decent education and training.

Of course, as this paper has discussed in detail, the specific implementation of such policy features will be different for each stage of the education cycle. At the stage of early childhood education, an implementation aimed at educational intensity and accountability seems advisable. In schools, combining accountability with autonomy and competition with public funding, as well as setting performance-related rewards for teachers and de-tracking schools, seem well-suited to advance efficiency and equity, especially when designed to target disadvantaged students. Private competition coupled with tuition fees and income-contingent loans designed also to help the most disadvantaged are recommendable features in higher



education, while competitive private provision on the job oriented towards market needs, combined with public certification and quality monitoring, seem key in vocational education, training and adult learning. In each case, policymakers have to take caution in designing and implementing such output-oriented reforms in ways that induce proper and fair incentives for all agents. By doing so, public policies can establish education and training systems that can get very far in being both efficient and equitable at the same time. Given the importance of education and training for the long-run economic and social well-being of individuals and societies alike, such policies could also go a long way towards reaching goals of future economic and social prosperity in Europe.

However, an important caveat is in order about these overall assessments of education and training policies in Europe. Currently, far too little is known on the specifics of equity and efficiency of different European programmes because of severe lacks of appropriate data and rigorous empirical evaluation studies. This is particularly true for the details on how to best advance learning in early childhood and how early advancements are sustained through the life cycle, but also more generally at other stages of education and training. The particularly positive assessment of early interventions may be based on too little and specific empirical evidence which may not translate into very general findings in the end. Analyses that confront the benefits of specific interventions with their costs are mostly missing in Europe.

To be able to implement better-informed policies to foster equity and efficiency in education and training, Member States will have to design policy interventions in ways that are amenable to rigorous empirical evaluation, collect the necessary data on inputs and outcomes and implement independent evaluation studies that create knowledge on what works and what does not. Such country-specific empirical assessments will be able to provide particularly useful and robust findings if evaluators are involved in designing the policy *ex ante*, in order to set up a convincing evaluation design. There could also be scope for ensuring that country-specific assessments are done in as standardised a way as possible to facilitate learning across European systems, in particular when European institutions set up Europe-wide research projects on international comparisons. Such an improved management of policy innovations would enable a process of continuous learning and adaptation in European education and training that could ultimately contribute much more to the causes of equity and efficiency than many policy interventions have done in the past.

## References

- Acemoglu, Daron (2001). Human Capital Policies and the Distribution of Income: A Framework for Analysis and Literature Review. New Zealand Treasury Working Papers 01/03. Wellington: The Treasury.
- Acemoglu, Daron, Joshua Angrist (2000). How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws. In: Ben S. Bernanke, Kenneth Rogoff (eds.), *NBER Macroeconomics Annual 2000*. Cambridge, MA: MIT Press.
- Acemoglu, Daron, Jörn-Steffen Pischke (1999). Beyond Becker: Training in Imperfect Labour Markets. *Economic Journal* 109 (453): F112-F142.
- Aghion, Philippe, Leah Boustan, Caroline Hoxby, Jerome Vandenbussche (2005). Exploiting States' Mistakes to Identify the Causal Impact of Higher Education on Growth. Harvard University, mimeo.
- Altonji, Joseph G., Charles R. Pierret (2001). Employer Learning and Statistical Discrimination. *Quarterly Journal of Economics* 116 (1): 313-350.
- Ammermüller, Andreas (2005). Educational Opportunities and the Role of Institutions. ZEW Discussion Paper 05-44. Mannheim: Centre for European Economic Research.
- An, Chong Bum, Robert H. Haveman, Barbara L. Wolfe (1993). Teen Out-of-Wedlock Births and Welfare Receipt: The Role of Childhood Events and Economic Circumstances. *Review of Economics and Statistics* 75 (2): 195-208.
- Arrow, Kenneth, Samuel Bowles, Steven Durlauf, eds. (2000). *Meritocracy and Economic Inequality*. Princeton, NJ: Princeton University Press.
- Arulampalam, Wiji, Mark L. Bryan, Alison L. Booth (2004a). Training in Europe. *Journal of the European Economic Association* 2 (2-3): 346-360.
- Arulampalam, Wiji, Robin A. Naylor, Jeremy P. Smith (2004b). A Hazard Model of the Probability of Medical School Drop-out in the UK. *Journal of the Royal Statistical Society Series A* 167 (1): 157-178.
- Atkinson, Adele, Simon Burgess, Bronwyn Croxson, Paul Gregg, Carol Propper, Helen Slater, Deborah Wilson (2004). Evaluating the Impact of Performance-related Pay for Teachers in England. CMPO Working Paper 04/113. Bristol: Centre for Market and Public Organisation.
- Barnett, W. Steven (1992). Benefits of Compulsory Preschool Education. *Journal of Human Resources* 27 (2): 279-312.
- Barnett, W. Steven (1995). Long-Term Effects of Early Childhood Programs on Cognitive and School Outcomes. *The Future of Children* 5 (3): 25-50.
- Barr, Nicholas (2004). Higher Education Funding. *Oxford Review of Economic Policy* 20 (2): 264-283.
- Barro, Robert J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics* 106 (2): 407-443.
- Barro, Robert J. (2001). Human Capital and Growth. *American Economic Review* 91 (2): 12-17.
- Barro, Robert J., Xavier Sala-i-Martin (1995). *Economic Growth*. New York: McGraw-Hill.
- Bassanini, Andrea, Alison Booth, Giorgio Brunello, Maria De Paola, Edwin Leuven (2005). Workplace Training in Europe. IZA Discussion Paper 1640. Bonn: Institute for the Study of Labor.

- Bauer, Philipp, Regina T. Riphahn (2006). Timing of School Tracking as a Determinant of Intergenerational Transmission of Education. *Economics Letters*: forthcoming.
- Becker, Gary S. (1964/1993). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Third Edition. Chicago: University of Chicago Press.
- Becker, Gary S., Elizabeth M. Landes, Robert T. Michael (1977). An Economic Analysis of Marital Instability. *Journal of Political Economy* 85 (6): 1141-1188.
- Bénabou, Roland, Francis Kramarz, Corinne Prost (2004). Zones d'éducation prioritaire: quels moyens pour quels résultats? Une évaluation sur la période 1982-1992. *Économie et Statistique* (380): 3-29.
- Bernheim, B. Douglas, Daniel M. Garrett, Dean M. Maki (2001). Education and Saving: The Long-term Effects of High School Financial Curriculum Mandates. *Journal of Public Economics* 80 (3): 435-465.
- Bernheim, B. Douglas, John Karl Scholz (1993). Private Saving and Public Policy. In: James M. Poterba (ed.), *Tax Policy and the Economy 7*: 73-110. Cambridge, MA: MIT Press and National Bureau of Economic Research.
- Betts, Julian R. (1998). The Impact of Educational Standards on the Level and Distribution of Earnings. *American Economic Review* 88 (1): 266-275.
- Betts, Julian R., Tom Loveless, eds. (2005). *Getting Choice Right: Ensuring Equity and Efficiency in Education Policy*. Washington, D.C.: Brookings Institution Press.
- Betts, Julian R., John E. Roemer (2006). Equalizing Opportunity for Racial and Socioeconomic Groups in the United States Through Educational Finance Reform. Forthcoming in: Paul E. Peterson, Ludger Wößmann (eds.), *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press.
- Bishop, John H. (1989). Is the Test Score Decline Responsible for the Productivity Growth Decline? *American Economic Review* 79 (1): 178-197.
- Bishop, John H. (1992). The Impact of Academic Competencies on Wages, Unemployment, and Job Performance. *Carnegie-Rochester Conference Series on Public Policy* 37: 127-194.
- Bishop, John H. (1994). The Impact of Previous Training on Productivity and Wages. In: Lisa M. Lynch (ed.), *Training and the Private Sector: International Comparisons*: 161-199. NBER Comparative Labor Markets Series. Chicago: University of Chicago Press.
- Bishop, John H. (1997). The Effect of National Standards and Curriculum-Based Exams on Achievement. *American Economic Review* 87 (2): 260-264.
- Bishop, John H. (2006). Drinking from the Fountain of Knowledge: Student Incentive to Study and Learn. Forthcoming in: Eric A. Hanushek, Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland.
- Bishop, John H., Ludger Wößmann (2004). Institutional Effects in a Simple Model of Educational Production. *Education Economics* 12 (1): 17-38.
- Björklund, Anders, Per-Anders Edin, Peter Freriksson, Alan Krueger (2004). Education, Equality and Efficiency: An Analysis of Swedish School Reforms during the 1990s. IFAU Report 2004:1. Uppsala: Institute for Labour Market Policy Evaluation.
- Blanchflower, David, Andrew Oswald (2004). Wellbeing over Time in Britain and the USA. *Journal of Public Economics* 88 (7-8): 1359-1386.
- Blau, David, Janet Currie (2006). Preschool, Day Care, and Afternoon Care: Who's Minding the Kids? Forthcoming in: Eric A. Hanushek, Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland. (available as NBER Working Paper 10670, Cambridge, MA: National Bureau of Economic Research, 2004)

- Boissiere, M., J.B. Knight, R.H. Sabot (1985). Earnings, Schooling, Ability, and Cognitive Skills. *American Economic Review* 73 (5): 1016-1030.
- Bonesrønning, Hans, Torberg Falch, Bjarne Strøm (2005). Teacher Sorting, Teacher Quality, and Student Composition. *European Economic Review* 49 (2): 457-483.
- Bonnal, Liliane, Sylvie Mendes, Catherine Sofer (2002). School-to-Work Transition: Apprenticeship versus Vocational School in France. *International Journal of Manpower* 23 (5): 426-442.
- Bourdieu, Pierre (1986). The Forms of Capital. In: John G. Richardson (ed.), *Handbook of Theory and Research for the Sociology of Education*, p. 241-258. New York: Greenwood.
- Bradley, Steve, Jim Taylor (2004). The Economics of Secondary Schooling. In: Geraint Johnes, Jill Johnes (eds.), *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.
- Brown, Sarah, John G. Sessions (2004). Signalling and Screening. In: Geraint Johnes, Jill Johnes (eds.), *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.
- Büchel, Felix (2002). Successful Apprenticeship-to-Work Transitions: On the Long-term Change in Significance of the German School-leaving Certificate. *International Journal of Manpower* 23 (5): 394-410.
- Burgess, Simon, Brendon McConnell, Carol Propper, Deborah Wilson (2006). The Impact of School Choice on Sorting by Ability and Socio-economic Factors in English Secondary Education. Forthcoming in: Paul E. Peterson, Ludger Wößmann (eds.), *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press.
- Cahuc, Pierre, André Zylberberg (2004). *Labor Economics*. Cambridge, MA: MIT Press.
- Card, David (1999). The Causal Effect of Education on Earnings. In: Orley Ashenfelter, David Card (eds.), *Handbook of Labor Economics, Volume 3A*: 1801-1863. Amsterdam: North-Holland.
- Carneiro, Pedro, James J. Heckman (2003). Human Capital Policy. In: James J. Heckman, Alan B. Krueger, *Inequality in America: What Role for Human Capital Policies?*. Cambridge, MA: MIT Press. (also available as NBER Working Paper 9495, Cambridge, MA: National Bureau of Economic Research)
- Ciccone, Antonio, Elias Papaioannou (2005). Human Capital, the Structure of Production, and Growth. Universitat Pompeu Fabra, Barcelona, mimeo.
- Ciccone, Antonio, Giovanni Peri (2006). Identifying Human Capital Externalities: Theory with Applications. *Review of Economic Studies*: forthcoming.
- Clark, Andrew E. (1996). Job Satisfaction in Britain. *British Journal of Industrial Relations* 34 (2): 189-217.
- Clark, Damon, René Fahr (2002). The Promise of Workplace Training for Non-College Bound Youth: Theory and Evidence from German Apprenticeship. CEP Discussion Paper 528. London: Centre for Economic Performance, London School of Economics.
- Cohn, Elchanan, John T. Addison (1998). The Economic Returns to Lifelong Learning in OECD Countries. *Education Economics* 6 (3): 253-307.
- Coleman, James S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology* 94: S95-S120.
- Cunha, Flavio, James J. Heckman, Lance Lochner, Dimitriy V. Masterov (2006). Interpreting the Evidence on Life Cycle Skill Formation. Forthcoming in: Eric A. Hanushek, Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland. (available as

- NBER Working Paper 11331, Cambridge, MA: National Bureau of Economic Research, 2005)
- Currie, Janet (2001). Early Childhood Education Programs. *Journal of Economic Perspectives* 15 (2): 213-238.
- Currie, Janet, Enrico Moretti (2003). Mother's Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings. *Quarterly Journal of Economics* 118 (4): 1495-1532.
- Currie, Janet, Duncan Thomas (2001). Early Test Scores, School Quality and SES: Longrun Effects on Wage and Employment Outcomes. *Research in Labor Economics* 20: 103-132.
- de la Fuente, Angel (2003). Human Capital in a Global and Knowledge-Based Economy, Part II: Assessment at the EU Country Level. Report for the European Commission, Directorate-General for Employment and Social Affairs. Brussels.
- de la Fuente, Angel, Antonio Ciccone (2002). Human Capital and Growth in a Global and Knowledge-Based Economy. Report for the European Commission, Directorate-General for Employment and Social Affairs. Brussels.
- de la Fuente, Angel, Rafael Domenech (2006). Human Capital in Growth Regressions: How Much Difference Does Data Quality Make. *Journal of the European Economic Association*: forthcoming.
- Dee, Thomas S. (2004). Are There Civic Returns to Education? *Journal of Public Economics* 88 (9): 1697-1720.
- Duncan, Greg J. (1976). Earnings Functions and Nonpecuniary Benefits. *Journal of Human Resources* 11 (4): 462-483.
- Dur, Robert, Coen Teulings, Thijs van Rens (2004). Should Higher Education Subsidies Depend on Parental Income? *Oxford Review of Economic Policy* 20 (2): 284-297.
- Dustmann, Christian (2004). Parental Background, Secondary School Track Choice, and Wages. *Oxford Economic Papers* 56 (2): 209-230.
- Dynarski, Susan M. (2002). The Behavioral and Distributional Implications of Aid for College. *American Economic Review* 92 (2): 279-285.
- Dynarski, Susan M. (2003). Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion. *American Economic Review* 93 (1): 279-288.
- Ehrlich, Isaac (1975). On the Relation between Education and Crime. In: F. Thomas Juster (ed.), *Education, Income and Human Behavior*. New York: McGraw-Hill.
- Eide, Eric, Dan Goldhaber, Dominic Brewer (2004). The Teacher Labour Market and Teacher Quality. *Oxford Review of Economic Policy* 20 (2): 230-244.
- Euwals, Rob, Rainer Winkelmann (2004). Training Intensity and First Labor Market Outcomes of Apprenticeship Graduates. *International Journal of Manpower* 25 (5): 447-462.
- Feinstein, Leon (2003). Inequality in the Early Cognitive Development of British Children in the 1970 Cohort. *Economica* 70 (1): 73-97.
- Feinstein, Leon (2004). Mobility in Pupils' Cognitive Attainment During School Life. *Oxford Review of Economic Policy* 20 (2): 213-229.
- Feinstein, Leon, Donald Robertson, James Symons (1999). Pre-School Education and Attainment in the National Child Development Study and British Cohort Study. *Education Economics* 7 (3): 209-234.

- Feldman, Jacob, Diane Makuc, Joel Kleinman, Joan Cornoni-Huntley (1989). National Trends in Educational Differentials in Mortality. *American Journal of Epidemiology* 129 (5): 919-933.
- Figlio, David N., Maurice E. Lucas (2004). Do High Grading Standards Affect Student Performance? *Journal of Public Economics* 88 (9): 1815-1834.
- Filer, Randall K., Daniel Münich (2003). Responses of Private and Public Schools to Voucher Funding. Paper presented at the Annual Meeting of the American Economic Association in Washington, D.C.
- Fitzenberger, Bernd, Hedwig Prey (2000). Evaluating Public Sector Sponsored Training in East Germany. *Oxford Economic Papers* 52 (3): 497-520.
- Franz, Wolfgang, David Soskice (1995). The German Apprenticeship System. In: Friedrich Buttler, Wolfgang Franz, Ronald Schettkat, David Soskice (eds.), *Institutional Frameworks and Labor Market Performance: Comparative Views on the U.S. and German Economies*: 208-234. London: Routledge.
- Fuchs, Thomas, Ludger Wößmann (2004). Governance and Primary-School Performance: International Evidence. Ifo Institute for Economic Research at the University of Munich, mimeo.
- Garces, Eliana, Duncan Thomas, Janet Currie (2002). Longer-Term Effects of Head Start. *American Economic Review* 92 (4): 999-1012.
- Goodman, Alissa, Barbara Sianesi (2005). Early Education and Children's Outcomes: How Long Do the Impacts Last? *Fiscal Studies* 26 (4): 513-548.
- Greenaway, David, Michelle Haynes (2003). Funding Higher Education in the UK: The Role of Fees and Loans. *Economic Journal* 113 (485): F150-F166.
- Greenaway, David, Michelle Haynes (2004). Funding Higher Education. In: Geraint Johnes, Jill Johnes (eds.), *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.
- Grossmann, Michael (2000). The Human Capital Model. In: A.J. Culyer, J.P. Newhouse (eds.), *Handbook of Health Economics Volume 1A*: 347-408. Amsterdam: Elsevier.
- Grossman, Michael (2006). Education and Nonmarket Outcomes. Forthcoming in: Eric A. Hanushek, Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland. (available as NBER Working Paper 11582, Cambridge, MA: National Bureau of Economic Research, 2005)
- Gundlach, Erich, Ludger Wößmann, Jens Gmelin (2001). The Decline of Schooling Productivity in OECD Countries. *Economic Journal* 111 (471): C135-C147.
- Hanushek, Eric A. (2003). The Failure of Input-Based Schooling Policies. *Economic Journal* 113 (485): F64-F98.
- Hanushek, Eric A. (2006). Some U.S. Evidence on How the Distribution of Educational Outcomes Can Be Changed. Forthcoming in: Paul E. Peterson, Ludger Wößmann (eds.), *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press.
- Hanushek, Eric A., with co-authors (1994). *Making Schools Work: Improving Performance and Controlling Costs*. Washington, D.C.: Brookings Institution Press.
- Hanushek, Eric A., John F. Kain, Steven G. Rivkin, Gregory F. Branch (2005). Charter School Quality and Parental Decision Making with School Choice. NBER Working Paper 11252. Cambridge, MA: National Bureau of Economic Research.
- Hanushek, Eric A., Dennis D. Kimko (2000). Schooling, Labor-Force Quality, and the Growth of Nations. *American Economic Review* 90 (5): 1184-1208.

- Hanushek, Eric A., Margaret E. Raymond (2004). The Effect of School Accountability Systems on the Level and Distribution of Student Achievement. *Journal of the European Economic Association* 2 (2-3): 406-415.
- Hanushek, Eric A., Ludger Wößmann (2006). Does Early Tracking Affect Educational Inequality and Performance? Differences-in-Differences Evidence across Countries. *Economic Journal* 116 (510): C63-C76.
- Harmon, Colm, Hessel Oosterbeek, Ian Walker (2003). The Returns to Education: Microeconomics. *Journal of Economic Surveys* 17 (2): 115-155.
- Harmon, Colm, Ian Walker, Niels Westergaard-Nielsen, eds. (2001). *Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education*. Cheltenham: Edward Elgar.
- Haveman, Robert H., Barbara L. Wolfe (1984). Schooling and Economic Well-Being: The Role of Nonmarket Effects. *Journal of Human Resources* 19 (3): 377-407.
- Heckman, James J. (2000). Policies to Foster Human Capital. *Research in Economics* 54 (1): 3-56.
- Heckman, James J., Peter J. Klenow (1997). *Human Capital Policy*. University of Chicago, Mimeo.
- Heckman, James J., Robert LaLonde, Jeffrey A. Smith, (1999). The Economics and Econometrics of Active Labor Market Programs. In: Orley Ashenfelter, David Card (eds.), *Handbook of Labor Economics, Volume 3A*: 1865-2097. Amsterdam: North-Holland.
- Hoxby, Caroline M. (2000). Does Competition among Public Schools Benefit Students and Taxpayers? *American Economic Review* 90 (5): 1209-1238.
- Hoxby, Caroline M. (2002). Would School Choice Change the Teaching Profession? *Journal of Human Resources* 37 (4): 846-891.
- Hoxby, Caroline M., ed. (2003a). *The Economics of School Choice*. A National Bureau of Economic Research Conference Report. Chicago: University of Chicago Press.
- Hoxby, Caroline M. (2003b). School Choice and School Competition: Evidence from the United States. *Swedish Economic Policy Review* 10 (3): 9-65.
- Hoxby, Caroline M., Andrew Leigh (2004). Pulled Away or Pushed Out? Explaining the Decline of Teacher Aptitude in the United States. *American Economic Review* 94 (2): 236-240.
- Jacob, Brian A. (2005). Accountability, Incentives and Behavior: The Impact of High-stakes Testing in the Chicago Public Schools. *Journal of Public Economics* 89 (5-6): 761-796.
- Jacob, Brian A., Steven D. Levitt (2003). Rotten Apples: An Investigation of the Prevalence and Predictors of Teacher Cheating. *Quarterly Journal of Economics* 118 (3): 843-877.
- Jenkins, Andrew, Anna Vignoles, Alison Wolf, Fernando Galindo-Rueda (2002). The Determinants of Effects of Lifelong Learning. CEE Discussion Paper 19. London: Centre for the Economics of Education, London School of Economics.
- Jürges, Hendrik, Kerstin Schneider, Felix Büchel (2005). The Effect of Central Exit Examinations on Student Achievement: Quasi-Experimental Evidence from TIMSS Germany. *Journal of the European Economic Association* 3 (5): 1134-1155.
- Kamerman, Sheila B., Michelle Neuman, Jane Waldfogel, Jeanne Brooks-Gunn (2003). Social Policies, Family Types and Child Outcomes in Selected OECD Countries. OECD Social, Employment and Migration Working Paper 6. Paris: OECD.

- Kane, Thomas J. (1994). College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education. *Journal of Political Economy* 102 (5): 878-911.
- Kane, Thomas J., Douglas O. Staiger (2002). The Promise and Pitfalls of Using Imprecise School Accountability Measures. *Journal of Economic Perspectives* 16 (4): 91-114.
- Kenkel, Donald S. (1991). Health Behavior, Health Knowledge, and Schooling. *Journal of Political Economy* 99 (2): 287-305.
- Kiefer, Nicholas M. (1985). Evidence on the Role of Education in Labor Turnover. *Journal of Human Resources* 20 (3): 445-452.
- Kluve, Jochen, Christoph M. Schmidt (2002). Can Training and Employment Subsidies Combat European Unemployment? *Economic Policy* 17 (35): 410-448.
- Krueger, Alan B. (1999). Experimental Estimates of Education Production Functions. *Quarterly Journal of Economics* 114 (2): 497-532.
- Krueger, Alan B., Mikael Lindahl (2001). Education for Growth: Why and For Whom? *Journal of Economic Literature* 39 (4): 1101-1136.
- Krueger, Dirk, Krishna B. Kumar (2004). US-Europe Differences in Technology-Driven Growth: Quantifying the Role of Education. *Journal of Monetary Economics* 51 (1): 161-190.
- Ladd, Helen F. (2002). School Vouchers: A Critical View. *Journal of Economic Perspectives* 16 (4): 3-24.
- Ladd, Helen F., Randall P. Walsh (2002). Implementing Value-Added Measures of School Effectiveness: Getting the Incentives Right. *Economics of Education Review* 21 (1): 1-17.
- Lam, David, Suzanne Duryea (1999). Effects of Schooling on Fertility, Labour Supply, and Investments in Children, with Evidence from Brazil. *Journal of Human Resources* 34 (1): 160-192.
- Lauer, Charlotte, Viktor Steiner (2000). Returns to Education in West Germany: An Empirical Assessment. ZEW Discussion Paper 00-04. Mannheim: Centre for European Economic Research.
- Lavy, Victor (2002). Evaluating the Effect of Teachers' Group Performance Incentives on Pupil Achievement. *Journal of Political Economy* 110 (6): 1286-1317.
- Lavy, Victor (2004). Performance Pay and Teachers' Effort, Productivity and Grading Ethics. NBER Working Paper 10622. Cambridge, MA: National Bureau of Economic Research.
- Lazear, Edward P. (2000). Economic Imperialism. *Quarterly Journal of Economics* 115 (1): 99-146.
- Lazear, Edward P. (2003a). Teacher Incentives. *Swedish Economic Policy Review* 10 (3): 179-214.
- Lazear, Edward P. (2003b). Firm-Specific Human Capital: A Skill-Weights Approach. NBER Working Paper 9679. Cambridge, MA: National Bureau of Economic Research.
- Lechner, Michael (2000). An Evaluation of Public-Sector-Sponsored Continuous Vocational Training Programs in East Germany. *Journal of Human Resources* 35 (2): 347-375.
- Lechner, Michael, Ruth Miguel, Conny Wunsch (2004). Long-run Effects of Public Sector Sponsored Training in West Germany. IZA Discussion Paper 1443. Bonn: Institute for the Study of Labor.
- Leney, Tom, with Consortium Partners (2004). Achieving the Lisbon Goal: The Contribution of VET. Final Report to the European Commission. Brussels: European Commission.



- Leuven, Edwin (2005). The Economics of Private Sector Training: A Survey of the Literature. *Journal of Economic Surveys* 19 (1): 91-111.
- Leuven, Edwin, Hessel Oosterbeek (2004). Evaluating the Effect of Tax Deductions on Training. *Journal of Labor Economics* 22 (2): 461-488.
- Leuven, Edwin, Hessel Oosterbeek (2006). The Effectiveness of Human Capital Policies for Disadvantaged Groups in the Netherlands. Forthcoming in: Paul E. Peterson, Ludger Wößmann (eds.), *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press.
- Leuven, Edwin, Mikael Lindahl, Hessel Oosterbeek, Dinand Webbink (2004). New Evidence on the Effect of Time in School on Early Achievement. Scholar Working Paper 47/04. Amsterdam: Research Institute Scholar.
- Levačić, Rosalind (2004). Competition and the Performance of English Secondary Schools: Further Evidence. *Education Economics* 12 (2): 177-193.
- Lochner, Lance, Enrico Moretti (2004). The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports. *American Economic Review* 94 (1): 155-189.
- Lowry, Robert C. (2004). Markets, Governance, and University Priorities: Evidence on Undergraduate Education and Research. *Economics of Governance* 5 (1): 29-51.
- Lucas, Robert E.B. (1977). Hedonic Wage Equations and Psychic Wages in the Returns to Schooling. *American Economic Review* 67 (4): 549-558.
- Lynch, Lisa M. (1994). Introduction. In: Lisa M. Lynch (ed.), *Training and the Private Sector: International Comparisons*: 1-24. NBER Comparative Labor Markets Series. Chicago: University of Chicago Press.
- Machin, Stephen J. (2004). Skill-biased Technical Change and Educational Outcomes. In: Geraint Johnes, Jill Johnes (eds.), *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.
- Machin, Stephen J. (2006). Education Expansion and Intergenerational Mobility in Britain. Forthcoming in: Paul E. Peterson, Ludger Wößmann (eds.), *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press.
- Machin, Stephen J., Anna Vignoles, eds. (2005). *What's the Good of Education? The Economics of Education in the UK*. Princeton University Press.
- Magnuson, Katherine A., Christopher J. Ruhm, Jane Waldfogel (2004). Does Prekindergarten Improve School Preparation and Performance? NBER Working Paper 10452. Cambridge, MA: National Bureau of Economic Research.
- Mankiw, N. Gregory, David Romer, David N. Weil (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics* 107 (2): 408-437.
- Martin, John P., David Grubb (2001). What Works and For Whom: A Review of OECD Countries' Experience with Active Labour Market Policies. *Swedish Economic Policy Review* 8 (2): 9-56.
- Martin, Steven P. (2004). Growing Evidence for a "Divorce Divide"? Education and Marital Dissolution Rates in the U.S. Since the 1970s. Russell Sage Foundation Working Papers: Series on Social Dimensions of Inequality.
- McIntosh, Steven, Anna Vignoles (2001). Measuring and Assessing the Impact of Basic Skills on Labour Market Outcomes. *Oxford Economic Papers* 53 (3): 453-481.
- McMahon, Walter W. (2002). *Education and Development: Measuring the Social Benefits*. Oxford: Oxford University Press.

- McMahon, Walter W. (2004). The Social and External Benefit of Education. In: Geraint Johnes, Jill Johnes (eds.), *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.
- Milligan, Kevin, Enrico Moretti, Philip Oreopoulos (2004). Does Education Improve Citizenship? Evidence from the United States and the United Kingdom. *Journal of Public Economics* 88 (9): 1667-1695.
- Mincer, Jacob (1974). *Schooling, Experience, and Earnings*. New York: National Bureau of Economic Research.
- Moretti, Enrico (2004). Workers' Education, Spillovers, and Productivity: Evidence from Plant-Level Production Functions. *American Economic Review* 94 (3): 656-690.
- Muehlemann, Samuel, Juerg Schweri, Rainer Winkelmann, Stefan C. Wolter (2005). A Structural Model of Demand for Apprentices. CESifo Working Paper 1417. Munich: CESifo.
- Murnane, Richard J., John B. Willett, Frank Levy (1995). The Growing Importance of Cognitive Skills in Wage Determination. *Review of Economics and Statistics* 77 (2): 251-266.
- National Center for Education Statistics (NCES) (1995). *The Condition of Education 1995*. Washington, DC: U.S. Department of Education.
- Neal, Derek A. (1997). The Effects of Catholic Secondary Schooling on Secondary Achievement. *Journal of Labor Economics* 15 (1): 98-123.
- Neal, Derek A. (2002). How Vouchers Could Change the Market for Education. *Journal of Economic Perspectives* 26 (4): 25-44.
- Neal, Derek A., William R. Johnson (1996). The Role of Premarket Forces in Black-White Wage Differences. *Journal of Political Economy* 104 (5): 869-895.
- Nechyba, Thomas J. (2000). Mobility, Targeting, and Private-School Vouchers. *American Economic Review* 90 (1): 130-146.
- Nelson, Richard R., Edmund S. Phelps (1966). Investment in Humans, Technological Diffusion, and Economic Growth. *American Economic Review* 56 (2): 69-75.
- Nickell, Stephen (2004). Poverty and Worklessness in Britain. *Economic Journal* 114 (494): C1-C25.
- Oliva, Maria-Angels, Luis A. Rivera Batiz (2002). Political Institutions, Capital Flows, and Developing Country Growth: An Empirical Investigation. *Review of Development Economics* 6 (2): 248-262.
- Oosterbeek, Hessel (1998). Unravelling Supply and Demand Factors in Work-Related Training. *Oxford Economic Papers* 50 (2): 266-283.
- Organisation for Economic Co-operation and Development (OECD) (2000). *Literacy in the Information Age: Final Report of the International Adult Literacy Survey*. Paris: OECD.
- Organisation for Economic Co-operation and Development (OECD) (2004). *Early Childhood Education and Care Policy in the Federal Republic of Germany*. Paris: OECD.
- Organisation for Economic Co-Operation and Development (OECD) (2005a). *Education at a Glance: OECD Indicators 2005*. Paris: OECD.
- Organisation for Economic Co-Operation and Development (OECD) (2005b). *Teachers Matter: Attracting, Developing and Retaining Effective Teachers*. Paris: OECD.
- Peterson, Paul E., William G. Howell, Patrick J. Wolf, David E. Campbell (2003). School Vouchers: Results from Randomized Experiments. In: Caroline M. Hoxby (ed.), *The Economics of School Choice*: 107-144. Chicago: University of Chicago Press.

- Peterson, Paul E., Ludger Wößmann, eds. (2006). *Schools and the Equal Opportunity Problem*. Cambridge, MA: MIT Press (forthcoming).
- Pritchett, Lant (2006). Does Learning to Add up Add up? The Returns to Schooling in Aggregate Data. Forthcoming in: Eric A. Hanushek and Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland.
- Psacharopoulos, George (1977). Unequal Access to Education and Income Distribution. *De Economist* 125 (3): 383-392.
- Psacharopoulos, George (1991). Vocational Education Theory, Voced 101: Including Hints for 'Vocational Planners'. *International Journal of Educational Development* 11 (3): 193-199.
- Psacharopoulos, George (1994). Returns to Investment in Education: A Global Update. *World Development* 22 (9): 1325-1343.
- Psacharopoulos, George (2005). Why Some University Systems Are Collapsing: Realities from Europe. Paper presented at the conference 'The Future of the University', Vienna.
- Psacharopoulos, George, Harry A. Patrinos (2004). Returns to Investment in Education: A Further Update. *Education Economics* 12 (2): 111-134.
- Putnam, Robert D. (1993). The Prosperous Community: Social Capital and Public Life. *The American Prospect* 4 (13): 35-42.
- Putnam, Robert D., John F. Helliwell (1999). Education and Social Capital. NBER Working Paper 7121. Cambridge, MA: National Bureau of Economic Research.
- Rivkin, Steven G., Eric A. Hanushek, John F. Kain (2005). Teachers, Schools, and Academic Achievement. *Econometrica* 73 (2): 417-458.
- Romer, Paul M. (1990). Endogenous Technological Change. *Journal of Political Economy* 98 (5): S71-S102.
- Roemer, John E. (1998). *Equality of Opportunity*. Cambridge, MA: Harvard University Press.
- Ryan, Paul (1998). Is Apprenticeship Better? A Review of the Economic Evidence. *Journal of Vocational Education and Training* 50 (2): 289-325.
- Ryan, Paul (2001). The School-to-Work Transition: A Cross-National Perspective. *Journal of Economic Literature* 39 (1): 34-92.
- Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (1998). *Vor weitreichenden Entscheidungen - Jahresgutachten 1998/99*. (German Council of Economic Experts, Annual Report 1998/99). Metzler-Poeschel, Stuttgart.
- Sandström, F. Mikael, Fredrik Bergström (2005). School Vouchers in Practice: Competition Will Not Hurt You. *Journal of Public Economics* 89 (2-3): 351-380.
- Schultz, Theodore W. (1961). Investment in Human Capital. *American Economic Review* 51 (1): 1-17.
- Schütz, Gabriela, Heinrich W. Ursprung, Ludger Wößmann (2005). Education Policy and Equality of Opportunity. CESifo Working Paper 1518. Munich: CESifo.
- Schweinhart, Lawrence J., J. Montie, Z. Xiang, W.S. Barnett, C.R. Belfield, M. Nores (2005). *Lifetime Effects: The High/Scope Perry Preschool Study Through age 40*. Monographs of the High/Scope Educational Research Foundation, 14. Ypsilanti, MI: High/Scope Press.
- Shleifer, Andrei (1998). State versus Private Ownership. *Journal of Economic Perspectives* 12 (4): 133-150.
- Smith, Jeremy, Robin Naylor (2001). Determinants of Degree Performance in UK Universities: A Statistical Analysis of the 1993 Student Cohort. *Oxford Bulletin of Economics and Statistics* 63 (1): 29-60.

- Solmon, Lewis C. (1975). The Relation between Schooling and Savings Behavior: An Example of the Indirect Effects of Education. In: F. Thomas Juster (ed.), *Education, Income and Human Behavior*. New York: McGraw-Hill.
- Steedman, Hilary (1993). The Economics of Youth Training in Germany. *Economic Journal* 103 (420): 1279-1291.
- Temple, Jonathan R.W. (1999). The New Growth Evidence. *Journal of Economic Literature* 37 (1): 112-156.
- Temple, Jon (2001). Growth Effects of Education and Social Capital in the OECD Countries. *OECD Economic Studies* 33 (2): 57-101.
- Topel, Robert (1999). Labor Markets and Economic Growth. In: Orley Ashenfelter, David Card (eds.), *Handbook of Labor Economics, Volume 3C*: 2942-2984. Amsterdam: North-Holland.
- Tyler, John H., Richard J. Murnane, John B. Willett (2000). Do the Cognitive Skills of School Dropouts Matter in the Labor Market? *Journal of Human Resources* 35 (4): 748-754.
- Vandenbussche, Jérôme, Philippe Aghion, Costas Meghir (2004). Growth, Distance to Frontier and Composition of Human Capital. Harvard University, mimeo.
- West, Martin R., Paul E. Peterson (2006). The Efficacy of Choice Threats within School Accountability Systems: Results from Legislatively-Induced Experiments. *Economic Journal* 116 (510): C46-C62.
- White, Lynn K., Stephanie J. Rogers (2000). Economic Circumstances and Family Outcomes: A Review of the 1990s. *Journal of Marriage and the Family* 62 (4): 1035-1051.
- Wolfe, Barbara, Robert Haveman (2000). Accounting for the Social and Non-market Benefits of Education. Mimeo, OECD Workshop. Paris: OECD.
- Wolfe, Barbara, Samuel Zuvekas (1995). Nonmarket Outcomes of Schooling. Institute for Research on Poverty Discussion Paper 1065-95.
- Wolter, Stefan C., Samuel Mühlemann, Jürg Schweri (2006). Why Some Firms Train Apprentices and Many Others Not. *German Economic Review*: forthcoming.
- Wößmann, Ludger (2002). *Schooling and the Quality of Human Capital*. Berlin: Springer.
- Wößmann, Ludger (2003a). Specifying Human Capital. *Journal of Economic Surveys* 17 (3): 239-270.
- Wößmann, Ludger (2003b). Schooling Resources, Educational Institutions and Student Performance: The International Evidence. *Oxford Bulletin of Economics and Statistics* 65 (2): 117-170.
- Wößmann, Ludger (2004). Entwicklung betrieblicher Kosten und Nutzen der Berufsausbildung: Einige Anmerkungen zu den Ursachen des Ausbildungsplatzmangels. *Ifo Schnelldienst* 57 (6): 21-24.
- Wößmann, Ludger (2005a). Educational Production in Europe. *Economic Policy* 20 (43): 445-504.
- Wößmann, Ludger (2005b). The Effect Heterogeneity of Central Exams: Evidence from TIMSS, TIMSS-Repeat and PISA. *Education Economics* 13 (2): 143-169.
- Wößmann, Ludger (2005c). Public-Private Partnerships in Schooling: Cross-Country Evidence on their Effectiveness in Providing Cognitive Skills. Program on Education Policy and Governance, Research Paper PEPG 05-09. Cambridge, MA: Harvard University.

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