

Efficiency and equity of European education and training policies

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Abstract This paper reviews empirical evidence, especially from Europe, on how education and training policies can be designed to advance both efficiency and equity. Returns to educational investments tend to decrease over the life cycle. Moreover, they are the highest for disadvantaged children at early stages and for the well-off at late stages of the life cycle. This creates complementarities between efficiency and equity at early stages and trade-offs at late stages. The paper discusses specific policies for efficiency and equity at each educational stage, ranging from early childhood education and schools over vocational and higher education to training and lifelong learning. The available evidence suggests that both efficiency and equity can be enhanced by output-oriented reforms properly designed to each stage, where the state generally sets a regulatory framework that ensures accountability and funding, and uses the forces of choice and competition to deliver best results. Designed this way, education and training systems can advance efficiency and equity at the same time.

Keywords Education · Training · Europe · Efficiency · Equity · Life cycle · Trade-off

JEL Classification I28 · H52 · D6 · J24

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1 Introduction

Any society aims for economic prosperity coupled with equality of opportunity. Thus, it is not a surprise that European Union heads of state could agree on the so-called “Lisbon strategy” with its goal to become “the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.” At the same time, it has been realized that education and training systems that create efficient and equitable outcomes are key for economic prosperity and social cohesion. This has been stressed by leading European economic advisors (e.g., Sapir et al. 2003; Calmfors et al. 2006), and the European Union puts education and training at center stage in its agenda for jobs and growth (e.g., European Commission 2006). For example, the European Council (2006, p. 6) concludes that “education and training are critical factors to develop the EU’s long-term potential for competitiveness as well as for social cohesion.” But how can an efficient and equitable education and training system be achieved in practice? This paper reviews the empirical evidence from Europe and elsewhere for conclusions on how education and training policies can be designed to advance both efficiency and equity.

The strong upsurge of applied research in the economics of education over the past decade has produced ample evidence that the monetary and nonmonetary prosperity of individuals and nations indeed hinges on education and training. Education produces substantial returns to the individual in terms of earnings (cf. the surveys by Card 1999 and Harmon et al. 2003) and employability (e.g., OECD 2005a), significant effects on economic growth (e.g., de la Fuente and Doménech 2006; Hanushek and Wößmann 2007) and noteworthy nonmonetary benefits for the individual and for society as a whole, among others in terms of superior health, civic participation, and reduced crime (cf. Milligan et al. 2004; Lochner and Moretti 2004; and the survey by Grossman 2006). Given the effects of education on individual well-being, the distribution of education is also crucial for societal inequality (cf. Nickell 2004).

So, efficient education and training systems can create economic growth, and equitable systems can create social cohesion. For some European politicians, education and training are, therefore, high on the policy agenda because they can boost efficiency, for others because they can boost equity. But what is the relationship between efficiency and equity? Many governments tend to think that there is a trade-off that forces them to choose between efficiency and equity in their prioritizing. But achieving more equity in the design of education systems may help to evade the need for intense redistributive policies at later ages, which are often viewed as obstacles to the creation of growth and jobs in Europe.

In reality, the relationship between efficiency and equity in education and training systems may take different forms. In some cases, efficiency and equity may be independent from one another. In other cases, there may be trade-offs in the extent to which the two goals can be achieved. And in still other cases, there may be complementarities in the achievement of the two goals. Thus, certain policies may bring education and training systems closer to efficiency without having any impact on equity. Other policies may be highly equitable without affecting efficiency. Other

policies may advance both efficiency and equity in a complementary way. And still other policies may show a trade-off by advancing either efficiency at the detriment of equity or equity at the detriment of efficiency.

It will be a key focus of this paper to highlight the presence or absence of trade-offs and complementarities in the design and functioning of education and training systems. The reviewed evidence shows 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 trade-offs between them, whereas current attempts to reach one or the other sometimes turn out to be both inefficient and inequitable.

While a universally accepted definition of equity is elusive, it seems that most people could agree to some variant close to the concept of equality of opportunity proposed by Roemer (1998; cf. Betts and Roemer 2007), which is adopted in this paper. The central idea of this concept is that inequality should be tolerated only if it is due to differences in effort, but not if it is due to circumstances which are beyond a person's control. Thus, equity would demand that a person's expected educational outcome should be a function only of her effort, but not of her circumstances, such as race, gender, or family background. The concept of efficiency is much more straightforward, representing a situation where a maximum aggregate outcome of the educational production process is obtained with given input or a given aggregate outcome with minimum input. Under this concept, an efficient situation is one which would be preferred by any individual who is ignorant of her position in society (and which would allow for an optimal outcome for each individual under costless redistribution). In the calculus of applied welfare economics, equity and efficiency goals can be combined by maximizing welfare functions; in practice, such a combination is faced with insurmountable aggregation problems, so that the relative achievement of the two goals remains a value judgment which this paper takes as being beyond scientific analysis in general.

Relative to the well established and extensive literature on the economic and social impacts of education and training, 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, the available literature has produced evidence consistent enough to warrant a general unifying perspective and many specific features for a Europe-wide assessment. At the same time, it should be borne in mind that uncertainties remain for some parts of the assessment, which will be mentioned where necessary.

The analysis proceeds in two main parts. Section 2 presents a unifying framework in which investments in education and training at different stages over the life cycle are compared to each other—both in the pursuit of efficiency (getting the highest returns on invested resources) and equity (helping the disadvantaged). The section asks at which stage of people's life cycle education and training policy should spend its money.

Section 3 goes into the details of how to design each stage of the education and training system so that the input given at each stage is used in the most efficient and equitable way. The subsections discuss specific policies that may change the

extent to which efficiency and equity are achieved at each educational stage. The section addresses the question how policy can get the most out of a Euro spent at a specific stage in terms of efficiency and equity. Section 4 closes with some concluding remarks.

2 A unifying framework: efficiency and equity over the life cycle

Building on the traditional theory of human capital (cf., e.g., Becker 1964/1993), James Heckman and coauthors 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 enables an interpretation of the evidence on life cycle education and training in a combined framework.

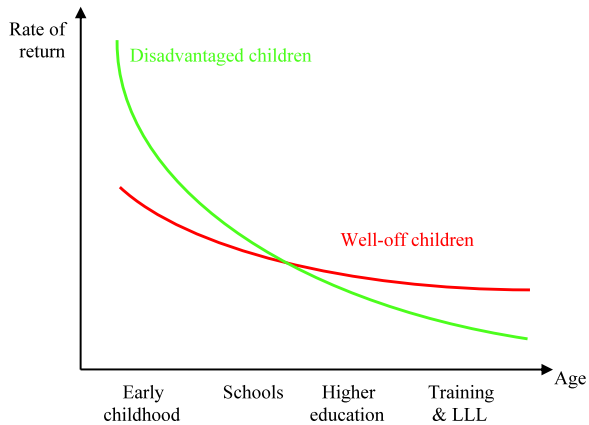
2.1 Dynamic synergies in skill formation and the life cycle of human capital policies

The key insight of Heckman's 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, the features of recursive productivity and complementarity generate a skill multiplier whereby an investment in education at one stage does not only raise the skills attained at that stage directly, but also the productivity with which educational investments at the next stage will be transformed into even further skills. This multiplier effect makes education 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 coauthors 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 noncognitive, 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 in which 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 efficiency and equity of different policies which aim at fostering human capital. It creates a life cycle of human capital policies, where measures at early stages are particularly crucial and deficiencies are hardly amenable at late stages. Returns to educational investments are highest in early childhood because of their effects on facilitating later learning. In addition, returns to early interventions are particularly high for children from disadvantaged backgrounds whose homes do not provide them with the foundation of skills necessary to prosper at later educational stages. Such interventions do not only build skills, but also lay

Fig. 1 Stylized returns to a Euro spent at different stages of education and training. Source: Author's depiction in extension of Cunha et al. (2006)



the foundation that makes later learning more productive due to the complementarity 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 benefits of education. Skills acquired by training and lifelong learning activities may also lend themselves less easily to certification. What is more, returns to investments at a late stage in the 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 is no capacity of learning during adulthood, but it does mean that curative efforts at this late stage are particularly costly.

The stylized graphs of Fig. 1 depict this basic pattern of the life cycle of education and training policies in terms of efficiency and equity. The figure extends a graph by 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 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 stages in Europe (cf. OECD 2005a) and given the evidence on the effectiveness of education policies at different stages 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 disadvantaged children than for children who are well off in terms of their acquired educational background. At young ages, returns tend to be higher for children from disadvantaged backgrounds, but at older ages, they tend to be higher for children who have already received a decent education up to that stage. Because the return to education at one stage in the life cycle depends on the education obtained at earlier stages, children from a low socioeconomic background

can in principle change to the track of well-off children if they are well educated in early childhood. Given the obvious difference of private educational spending across socioeconomic backgrounds, the pattern of declining returns will hold even stronger for public spending than for total spending. The basic pattern of declining returns and differences by socioeconomic background appears to hold for private and social returns to education alike (although some evidence in Psacharopoulos and Patrinos 2004 suggests that the private return may be rather flat between secondary and tertiary education, while the social return does decline). Both features may be even more pronounced for social returns than for private returns because of externalities of reduced crime and increased civic participation (e.g., Lochner and Moretti 2004; Milligan et al. 2004).

This pattern is obviously a rough depiction of average effects. There is substantial heterogeneity within the two groups, and some disadvantaged students will do particularly well in higher education. Note also that the assessment stresses a relative evaluation over the life cycle. As depicted in the figure, there are probably positive average returns at later stages of the life cycle, as well—only that they are lower than the returns at early stages.

While most evidence suggests that effects of early interventions can be very persistent through time, in particular for children from disadvantaged backgrounds (cf. Sect. 3.1), 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 may be needed to evade decay of effects. Depreciation of human capital will be particularly relevant in a world of rapid technological change and requires additional investments later in the life cycle. Finally, as will be discussed below, the depicted returns at the school level in particular do not necessarily refer to spending more money within current institutional systems, but rather to the returns to improvements in the skills learned at school. Because the costs of skill-enhancing institutional reforms in school systems can be very low, their rates of return can be very high (cf. Sect. 3.2 for details).

2.2 Complementarities and trade-offs between efficiency and equity

As a consequence of the differing rates of return over the life cycle, 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 target investments at those students who have obtained the lowest skills up to then. While it may or may not be technically possible to remedy the lack of early investment, such a policy often is not cost effective. In order to reach the equity goal of raising low-skilled adults to income levels that are independent of circumstances beyond their control, it may be more efficient, for example, to provide them with a bond that earns an interest (based on investments in physical capital or in additional human capital of high-skilled persons) that would be higher than the return on an investment in their own education or training. There may thus 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 wellbeing 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 favor of education and training policies (see Sect. 3.5 for further discussion).

By contrast, investments in early childhood reveal no trade-off, but even complementarity between efficiency and equity. 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 high returns because of their additional indirect effect of increasing the productivity of later skill acquisition due to the dynamic complementarities in the technology of skill formation. It should be noted 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 reveals the preferable investment strategies from a societal point of view.

While Heckman and coauthors 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 below, 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).

3 Policies for efficiency and equity at each educational stage

The previous section discussed the efficiency and equity of education policies across the stages of the life cycle. This section addresses the question of internal efficiency and equity of specific policies and instruments within each stage of education and training.

3.1 Early childhood education

Efficiency: Evidence from the United States suggests that early childhood education can be highly efficient, especially when targeted at disadvantaged children (cf. the surveys by Barnett 1992; 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, evaluated scientifically using an experimental setup or statistical matching techniques, reveal 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. As an example of an intensive intervention, the Perry Preschool Program included not only daily classroom sessions, but also weekly home visits by the teacher to involve the parents, low child-teacher ratios below 6 and certification of all teachers. Studies

that follow participants into adulthood reveal positive long-run effects on labor market outcomes, criminal, and other behavior. The benefits of these interventions have been found to exceed their costs by a multiple (cf. Belfield et al. 2006). Although the features that make a proper design for high-quality preschool programs are not well researched (cf. Currie 2001), the intensity of the program, such as setting in at very early ages and involving parents through home visits, appear important for boosting outcomes (cf. Cunha et al. 2006).

For European countries, there is not much comparable evidence with well-founded scientific research designs for establishing causality as in the US evaluations. Unfortunately, the relevance of some of the US experience for the European context may be limited, because some interventions were targeted at high-risk areas with crime rates hardly observable in most of Europe. 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 preschool 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 labor-market outcomes in Britain. Kamerman et al. (2003) 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 with many European countries, Fuchs and Wößmann (2004) show that kindergarten attendance and particularly preschool reading performance are associated with higher performance at the end of primary school, even after controlling for a vast number of family-background and school effects. Schütz et al. (2008) find similar effects between the length of a country's preschool education system and cognitive 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 knowledge on the quality of early childhood programs is lacking because of a lack of control and testing (e.g., OECD 2004). Because goals and standards are not clearly stated and monitored, 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 preschool and school system. The US evidence shows that the more intensive programs 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 programs are longer lasting than effects of attendance in nursery or playground programs. In that sense, programs 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 centers 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 labor-market outcomes.

Equity: The US evidence reveals that early interventions 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 are likewise restricted to students from disadvantaged backgrounds (Leuven et al. 2004). In their cross-country research, Schütz et al. (2008) find that more extensive systems of preschool education—in terms of both enrollment and duration—significantly increase equality of opportunity, as measured by a lower dependence of eighth-grade students' test scores on their family background. Early childhood education programs targeted at disadvantaged children thus have strong potential for raising equity.

A key issue is whether effects of early interventions persist or decay through time. For the intensive US programs 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; Garces et al. 2002; Schweinhart et al. 2005; Cunha et al. 2006; Belfield et al. 2006). While Magnuson et al. (2007) report that the positive cognitive effects of US prekindergarten programs fade quickly on average, and that there are negative noncognitive 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. Analyzing students' cognitive achievement during school life, Feinstein (2004) finds that differences in educational attainment along the socioeconomic 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 socioeconomic 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 programs 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.

3.2 Schools

Policies at the school level can impact on efficiency and equity, but some policies are more effective in achieving the 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: Ample evidence shows that the quantity and especially the quality of schooling, in terms of student performance on cognitive achievement tests, carry substantial payoffs of productivity and earnings in the labor market for the individual and society alike (cf. Hanushek and Wößmann 2007 for an extensive survey). Moreover, while returns to educational quantity decrease with the time that employers can observe individuals in the labor market, returns to cognitive achievement increase (Altonji and Pierret 2001). Therefore, and given that most European countries achieve virtually universal enrollment 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 noncognitive 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 accumulating evidence from Europe; Wößmann 2003 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 noncognitive 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; Jürges et al. 2005; Wößmann 2002, 2003, 2005b). 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 exams 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 quality and effectiveness, 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 autonomous decision-making of schools without external exams is detrimental for student performance. But the effect turns around to be positive where external exams exist (cf. Wößmann 2005b).

In effect, external exams and school-based decision-making complement each other in increasing the efficiency of education systems. By introducing accountability, external exams mitigate the negative effects of decentralization due to opportunistic behavior, ensuring a positive net effect of decentralization due to superior local knowledge. The frequently urged decentralization 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 provide students in schools that repeatedly do badly on the accountability test with a voucher to attend private schools. In Florida, the threat of becoming sub-

ject 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; Nechyba 2000; Hoxby 2003a). Sandström and Bergström (2005) and Björklund et al. (2004) provide evidence on significant positive effects of competition from privately operated schools on the performance of public schools in Sweden. 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 Munich (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 cross-country analyses, Wößmann (2003, 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 exists for the United States. The evidence provided by Neal (1997) 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. 2007 and the references therein).

Another policy with the potential to increase efficiency in the school system is 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 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 utilization 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 increase the efficiency of schooling, there is currently little knowledge on how to best achieve it. Eide et al. (2004) suggest that teachers' academic proficiency is one component of teacher quality that is conducive to student outcomes. They argue that the disconnection between the structure of teacher compensation and teacher's performance is at the heart of the problem 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) finds that different forms of school choice induce schools to hire higher-quality teachers. While many attempts at introducing performance-related reward programs 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 toward 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 to which students' school performance is predetermined by their family background varies considerably across countries (cf. Schütz et al. 2008). 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 dis-

advantaged students is any more effective than spending on average. Thus, Leuven and Oosterbeek (2007) 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 toward the disadvantaged can alter the distribution of educational outcomes is very limited at best (cf. Betts and Roemer 2007; Hanushek 2007), 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 equity is the tracking of students into different kinds of schools. Early tracking, e.g., at ages 10 to 12, as is common in several European school systems, has been found to be particularly harmful for children from families with low socioeconomic status and, therefore, hinders reaching equality of educational opportunity (cf. Hanushek and Wößmann 2006; Schütz et al. 2008; Ammermüller 2005; Bauer and Riphahn 2006). 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 found to affect equity at the level of compulsory schooling is the size of the preschool education system in a country (cf. Sect. 3.1 above). In a similar vein, Leuven and Oosterbeek (2007) 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 produce clear evidence (Schütz et al. 2008).

Some of the above-mentioned institutional reforms that can boost efficiency may also be used to increase equity. Simulation studies by Nechyba (2000) show that a voucher system that gives choice to poor families can serve equity goals, e.g., by integrating neighborhoods, especially when designed to target disadvantaged families. Because existing systems are already very segregated, introducing choice can decrease the segregation due to mobility. In the Florida setup that combines accountability with choice, the disadvantaged students gained, in particular, from the threat of becoming subject to private-school choice if schools failed on an accountability test (West and Peterson 2006). Charter schools also disproportionately serve disadvantaged students whose regular schools were performing badly (cf. Hoxby 2003b). Hanushek et al. (2007) show that parents are capable of choosing in a well-informed way, exiting 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 choose to teach in relatively well-off schools, so that schools in problematic neighborhoods find it difficult to attract 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 noncognitive 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 is 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. 2008). Specific policies that increase efficiency are often neutral 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 (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 evidence for complementarities of certain policies in raising both efficiency and equity, most notably for policies of early education and well-designed forms of choice and accountability (see above). Wößmann (2005c) provides evidence that public funding of schools combined with private operation improves efficiency, presumably because it allows additional choice and thus competition for families who could otherwise not choose because they are credit constrained. At the same time, Schütz et al. (2008) find that public funding improves equity, as does private operation. Combining private operation with public funding may thus 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, favored disadvantaged students. Similar equity-enhancing effects have been found for voucher and charter school programs (Hoxby 2003b). On the other hand, Burgess et al. (2007) 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 socioeconomic 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.

All in all, equity-enhancing structures often also 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 to boost equity goals, for example, by 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. Wößmann and Peterson 2007).

3.3 Vocational education

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 Sect. 3.5). The main feature of vocational education programs 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 programs 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 programs differ from programs 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 vocational education (cf. Leney et al. 2004). Consequently, the scientific assessment is forced to remain very limited. Furthermore, the extent, design, and pattern of operation of vocational education are very different across European countries (cf. Lynch 1994) and even across sectors within countries (e.g., Franz and Soskice 1995), so that Europe-wide assessments are particularly hard to arrive at for this type of education.

Efficiency: The return to vocational education on the labor market is particularly hard to identify because lower-ability students tend to sort themselves into this type 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). 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 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 German evidence), 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 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 (Muehlemann et al. 2007; 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 toward more general rather than firm-specific skills (Wößmann 2004), the financial burden may have to shift away from firms toward apprentices in order for the gap to be closed.

In a less developed vocational system, the United Kingdom has faced the problem of a proliferation of vocational qualifications that weakened the signal of what students who attend a vocational program 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 vocational education system to provide qualifications well tailored to market needs, both in terms of content and in terms of signaling these contents. Provision by the private sector combined with certification by the public sector may be one means for 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 vocational education programs may be a viable road toward skill improvements, especially when 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 programs may help to reduce the incidence of school dropouts and thus target the most disadvantaged students.

On the other hand, technological changes over recent decades have reduced the demand for lower-skilled workers (cf. Machin 2004), which may partly also hit vocational qualifications. In recent years, 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 favorable 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 programs 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. Tailoring vocational programs for market needs is thus 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 a low socio-economic background, and brief stages of vocational specialization can take place throughout the labor-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 vocational education, 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 programs in all likelihood would also help the cause

of overall equity in the system, because in relative terms it is the students from lower socioeconomic backgrounds who enter the vocational system in larger shares. But without clearer evidence on the internal and external efficiency and equity of vocational education, any assessment will have to remain far from satisfactory.

3.4 Higher education

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 higher earnings and better employability on the labor market (cf., e.g., Card 1999; Harmon et al. 2003; OECD 2005a), so 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 toward high-skilled workers in the majority of industrialized countries (cf. the surveys in Machin 2004 and Chap. 10 of Cahuc and Zylberberg 2004). Mostly driven by technological changes that are biased in favor of high-skilled tasks, employers seem to be increasingly demanding workers with graduate qualifications, which have increased their relative labor-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. Vandebussche et al. 2006).

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 et al. 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 Sect. 2.1 above).

In many European countries, there is a growing feeling that current systems of higher education are not organized in a technically 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 European countries, 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 behavior of providers. In Germany, the Council of Economic Experts proposed market-based reforms that 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 to use the resources more efficiently. The internal market for higher education with mobility of students across the European Union can help to enact functioning competition in higher education where the markets in many European countries are too small to enable workable competition. At the same time, as long as not all countries have tuition fees that cover the full cost of study, the mobility of students calls for some form of coordination of the policies of the member states of the European Union to ensure a proper matching of costs to beneficiaries.

Equity: The shift in relative demand toward highly educated and skilled labor over the past decades, mostly driven by skill-biased technological change, had major effects on the education structure of employment and educational wage differentials on the labor market (cf. Machin 2004; Cahuc and Zylberberg 2004, Chap. 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 continental European countries. 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 into higher education with children of academics being much more likely to go to university. As a consequence, unless there is very strong tax progression, tax funding may be viewed as unequal because part of the funding may come from groups with little opportunity 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 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 2007). 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 2002, 2003).

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 socioeconomic 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 means-tested subsidies). 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. The contingency threshold has to be set to minimize incentives for students to go into lower-income occupations. From an international perspective, contracts should be set up to ensure repayment if students later emigrate (cf. Barr 2004 and Greenaway and Haynes 2004 for details on fees with income-contingent loans).

Income-contingent loans can even be equity-enhancing when perceiving equity not in terms of family background, but of students' own lifetime well being. This perspective seems to be a particularly relevant in higher education. As discussed above, there are substantial private returns to higher education, so that by its very attendance 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 labor market.

Complementarity or trade-off: Both efficiency and equity considerations thus support a system of higher education where beneficiaries contribute tuition fees financed through income-contingent loans (cf. Greenaway and Haynes 2003). Furthermore, fee and loan policies could be targeted at students from poor backgrounds to alleviate

further equity concerns. By contrast, the current state-run and state-financed set-up of European higher education systems 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 2007).

3.5 Training and lifelong learning

While the previously discussed education programs mostly take place before students enter the labor market, this section discusses investments in training and lifelong learning that take place concurrent with or after some labor-market experience. Similar to the work-related programs of vocational education discussed in Sect. 3.3, continuous training tends to provide specific skills, and the person to be educated decides on it jointly with the employer. The basis for addressing issues of efficiency and equity of education in adulthood is relatively thin. Policy recommendations based on theory are ambiguous and depend crucially on the specific setting (cf. the survey by Leuven 2005). Statistical data on training costs are rare, and information on training benefits on 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 programs, 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. Chap. 4 of Bassanini et al. 2005). From a theoretical point, it is not clear whether the current institutional setup of European labor markets sets efficient incentives for investments in training. In competitive labor markets, firms have incentives to invest efficiently in firm-specific skills, while employees have incentives to invest efficiently in general skills (Becker 1964/1993). In imperfect labor 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 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 US evidence, Arulampalam et al. (2004a) and Bassanini et al. (2005) find that training increases with education and skill-intensity of occupations also in Europe, as would be expected from skill multiplier effects (cf. Sect. 2.1). Returns to training are thus highest for people who already have high education—either because benefits are higher or because costs are lower—so that an efficient allocation of investment in training would go to those who are already high-skilled. By contrast, returns 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 favoring 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 programs 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 programs 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 programs, usually devised as part of active labor market policies, is far bleaker (cf. Heckman et al. 1999 for general US evidence and Heckman 2000 for US failed training programs). Evaluation studies of public training programs 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 programs 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 programs 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 lifelong learning has very little directly measurable labor-market effects (cf. Machin and Vignoles 2005), although there may be some effects for the most disadvantaged (Jenkins et al. 2002).

Together, the evidence suggests that programs of training and lifelong 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: Publicly provided training programs often target the unemployed, which would seem conducive to equity. However, the evidence just discussed that these programs are not effective in most cases suggests that they in effect do not strongly advance the cause of equity. Among targeted public sector training programs, US evidence suggests that results for programs aimed at displaced workers are often discouraging (cf. Heckman 2000). But there is some European evidence suggesting that programs targeted at the disadvantaged can help to improve their labor-market outcomes (cf. Kluge 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 countries. 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 make this relatively negative equity assessment of training programs slightly more positive. First, remedying skill deficiencies of the disadvantaged as early as possible is a very long-run strategy which 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 lifelong learning. But still, among different active labor market policies, training programs seem to be more effective than subsidy-type programs (Kluge and Schmidt 2002). Policies that encourage training may thus often be the best available option to increase the fates of currently low-qualified adults, helping them to find work and earn income. For a successful implementation of such policies, it seems important that they aim at encouraging the private sector to provide training, while the government can help through skill 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, lifelong learn-

ing 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. Sect. 2.1 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 public training schemes aimed at low-skilled workers have proven quite ineffective. Therefore, in general, there seems to be a trade-off between efficiency and equity at this late stage of the education life cycle. Policies that try to target programs of adult training and lifelong learning at disadvantaged people face the problem that returns to these late investments may be particularly low among the disadvantaged (cf., e.g., Bassanini et al. 2005). Policies targeted at equity must 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 European countries, it is still possible based on the available empirical evidence to arrive at a broad pattern of priorities for educational investments as depicted in Fig. 1. The overall assessment of efficiency and equity in European education and training systems suggests that there are strong complementarities between efficiency and equality of opportunity in policies that act at early stages of the education process. However, these 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 European countries focus public investments early on, improving the fates of disadvantaged students in early childhood and in school, 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 adult training, 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 is best promoted by leaving behind a simple input orientation in favor of an output orientation. This can be achieved by institutional reforms that focus incentives on student performance. 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 to achieve the output goals, public policies can best ensure that every person gets decent education and training.

Of course, the specific implementation of such policy features will be different for each stage of the education cycle. In early childhood education, an implementation aimed at educational intensity and accountability seems advisable, while transition issues of wider access such as the difficulty of finding and training the relevant personnel have to be recognized. In schools, combining accountability with autonomy and competition with public funding, as well as setting performance-related rewards for teachers and detracking 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. Competitive private provision on the job oriented towards market needs, combined with public certification and quality monitoring, seem key in vocational education, training, and lifelong 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 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 toward 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 programs because of a severe lack 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 monetary costs are often missing in Europe.

Increased Europe-wide mobility of parents and students may help to increase Tiebout competition as a process to detect best policies in Europe. In addition, to be able to implement better-informed policies to foster equity and efficiency in education and training, European countries 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 standardized 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.

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