CPB Memorandum

CPB Netherlands Bureau for Economic Policy Analysis

Sector	:	Growth, structure and knowledge economics
Unit/Project	:	Micro-macro
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Number	:	122
Date	:	7 July 2005

Why should governments intervene in education, and how effective is education policy?

A review of the literature

Abstract

This paper reviews arguments for government interference in the education sector and discusses the effectiveness of commonly used policy instruments. There are both efficiency and equity reasons for government intervention. Particular attention is paid to education spillovers (an efficiency motive). The empirical literature shows that there is little reason to argue for additional policy efforts to correct for externalities. There is some promising evidence, however, for non-pecuniary spillovers in the form of crime reduction and health improvements. With regard to the effectiveness of policy instruments, the paper discusses studies with a (quasi-)experimental design so that the causal impact of the policy can be identified. Early childhood interventions appear to be more effective than interventions in later stages of the education cycle.

Korte samenvatting

Dit memorandum behandelt redenen voor overheidsinterventie in het onderwijs, en gaat nader in op de effectiviteit van de meest voorkomende beleidsinstrumenten. Er zijn zowel efficiëntieoverwegingen (marktfalen) als rechtvaardigheidsoverwegingen om in te grijpen in de onderwijsmarkt. Speciale aandacht wordt besteed aan externe effecten van onderwijs (een vorm van marktfalen). Uit de empirische literatuur volgt dat er weinig redenen zijn om aan te nemen dat extra overheidsinspanningen nodig zijn om te corrigeren voor externe effecten. Desalniettemin bestaat er veelbelovend bewijs voor niet-monetaire externaliteiten in de vorm van lagere criminaliteit en verbeteringen in de gezondheidssituatie. Met betrekking tot de effectiviteit van beleidsinstrumenten bespreken we studies met een (quasi-)experimentele opzet, zodat het causale effect van het beleidsinstrument kan worden bepaald. Voor- en vroegschoolse educatie blijken effectiever te zijn dan interventies in een later stadium van het onderwijs.

Contents

Executive summary 4

1 Introduction 7

2 Rationale for policy intervention in education 8

2.1 Introduction 8

2.2 Education spillovers 9

2.2.1 Private effects 10

2.2.2 Non-private effects 11

2.3 Equity motives 17

3 Effectiveness of education policy 21

3.1 Introduction 21

3.2 Outcomes of evaluation studies 21

3.3 A note of caution 27

4 Conclusion and suggestions for further research 28

References 30

Executive summary

This paper reviews arguments for government interference with education and discusses the effectiveness of commonly used instruments. Governments all over the world intervene substantially in education in terms of public support for education institutions and students and by means of extensive regulation of the schooling system. But are current levels of government interference justified, and if so, on which grounds? Spillovers from education (a source of market failure) and income-distributional (or equity) considerations are among the most often heard arguments. In this paper we review the empirical relevance of these two arguments.

Spillovers

Spillovers from education have been identified in the theoretical literature as an important source of market failures, which may drive a wedge between the social and private rate of return on education. The empirical literature, however, is ambiguous about the existence of these externalities at current levels of policy efforts. This does not implicate that education externalities are absent at all; current policy efforts may already have internalised the spillovers.

Education externalities may arise in various forms. The most widely studied refer to *externalities in production*. These occur when an individual's human capital - of which education is a major component - positively affects productivity and, hence, wages of *others*. Convincing evidence for this type of spillovers is lacking, though there are some indications that a worker's wage and productivity are positively affected by the local average education level (i.e. education spillovers at the city level).

Most promising evidence for the prevalence of spillovers from education concerns so-called *non-pecuniary* spillovers in the form of crime reduction and health improvements. These non-pecuniary external benefits of education are not incorporated in standard estimations of the social return to education, which typically measure effects on GDP and not on the wider concept of welfare. This would imply that conventional estimates represent an underestimation of the true social returns to education. However, the magnitude of this downward bias is unclear, as we are unaware of any attempts to incorporate these non-pecuniary spillovers in an econometric analysis of the social returns to education.

Equity considerations

Another argument that governments often use to legitimate interference with education is that education policy may help to reduce income inequality. The argument works as follows. Education policies, if they succeed in raising average educational attainment (or enrolment at higher levels of education), make low-skilled workers scarcer, lifting their wages. At the same time, supply of highly educated workers increases, which leads to a reduction in their wages. This reduction in the *skill premium* would imply a reduction of wage inequality.

There are several reasons to believe, however, that this equity argument does not hold in practice. One proposition is that a larger relative stock of skilled workers induces the development of new technologies that are more complementary to skilled workers. This means that stimulating skill formation with education policy does not only increase relative supply of skilled workers, but also relative demand. The hike in relative demand for skilled workers may be so strong that the skill premium eventually rises, such that income inequality increases rather than decreases.

How effective is education policy?

Not all government interventions in education are effective: there is always the possibility of government failure. This brings the question which types of interventions are effective, and at what stage of the education cycle governments should intervene. A particular intervention can be said to be effective if it leads to either higher educational attainment (i.e. educational quantity), or improvements in student performance (i.e. educational quality), or both.

Determining the effectiveness of a particular intervention is a difficult exercise because there is no counterfactual, that is, we do not know what would have happened in the absence of the intervention. The majority of evaluations of education policies cannot determine the true causal effects of an intervention. This is due to the absence of rigorous methodological evaluation designs, that is, designs with credible control groups. Experiments with education policies, in which some students or schools are randomly exposed to a particular intervention (the treatment group), and others not (the control group), provide policymakers with valuable insights into which interventions are effective and which not.

A review of the evaluation literature based on such controlled or natural experiments shows that both *timing* (when to intervene?) and *type* (how to intervene?) matter. The majority of interventions currently carried out appears to be directed towards raising the quality of education. Regarding timing, it appears that early childhood interventions are most effective, as they succeed in lifting both the quality and quantity of education. The evidence on interventions at the (post) compulsory level is mixed. Examples of promising interventions during compulsory schooling are additional instruction time and merit payments for teachers and schools. Among the interventions that do not appear to improve student performance are teacher testing, and introducing more computer facilities inside the classroom. Evidence is inconclusive for a lot of other types of interventions (e.g. policies for students at risk or class-size reductions), which can be attributed to differences in the setting, design, and management of programs.

These findings are mostly based on evaluations of interventions carried out abroad. However, effects found in one program need not occur when exactly the same program is implemented in another country, due to differences in schooling systems or student demographics. Therefore, identifying effective interventions requires carrying out more experiments domestically. Moreover, experiments can also help to gain more insight into both long-term effects of particular interventions in terms of labour market outcomes and the costs, provided sufficient data can be collected. This knowledge may help governments decide which interventions to carry out and which not.

1 Introduction

Governments all over the world intervene substantially in education in terms of public support for educational institutions and students, and by means of extensive regulation of the schooling system. This paper reviews the main arguments for government interference with education, and discusses the effectiveness of the commonly used instruments. The two most often mentioned arguments are market failures and equity considerations. Spillovers from education have been identified in the theoretical literature as an important source of market failures, which may drive a wedge between the social and private rate of return on education. The empirical literature, however, is ambiguous about the existence of these externalities at current levels of policy efforts.

Effectiveness of education policy instruments is generally measured in terms of their impact on enrolment levels (i.e. *quantity* of education) and student performance (i.e. the *quality* of education). These two broad measures are used to review commonly used policies at different stages of the education life cycle. Hereby we confine ourselves to studies with a rigorous evaluation design, that is, studies that make use of controlled or natural experiments in order to identify the causal effects of a particular intervention. In these studies, early childhood interventions consistently appear to be very effective.

This paper serves as a background study of a broader research project carried out at the CPB Netherlands Bureau for Economic Policy Analysis, called “Micro-macro”. This project aims to investigate how insights from studies at the micro level about human capital (of which education is a major component), research and development (R&D), and competition can be applied to a macroeconomic context, and more specifically, how these insights can be implemented in the large macroeconomic models used at the CPB to forecast economic developments. The main findings are presented in Canton et al. (2005).

The proposed research strategy of this paper is as follows. In Section 2 we discuss the rationale for public intervention in education. In particular, we review the empirical literature on spillovers from education. Further, this section sheds some light on equity motives. Section 3 reviews the literature on the effectiveness of various education policy instruments. We focus on evaluation studies based on controlled and natural experiments. Section 4 concludes and presents some suggestions for further research.

2 Rationale for policy intervention in education

2.1 Introduction

Various reasons for public intervention in education have been identified in the literature. The most important motivation for public intervention in education is the occurrence of market failures. The presence of market failures may lead to underinvestment in education, at least relative to the social optimum. Spillovers from education are often be seen as the most important market failure. These education externalities form the central issue of Section 2.2. We first briefly pay attention to three other types of market failures that have been identified in the literature as well: capital market constraints, insurance market imperfections, and imperfect information and transparency problems.[1]

Capital market constraints emerge because students may not be able to borrow money from private banks with their future human capital as collateral. Talented students may decide not to enrol in higher education because they cannot find sufficient possibilities to finance their education. This would implicate underinvestment in education relative to the social optimum. Public provision of loans (or grants) to students would be a solution to this type of market failure.[2]

Insurance market imperfections can be linked to asymmetric information: it is costly for insurance companies to observe behaviour of students, or their risk profile. This may trigger problems of moral hazard and adverse selection (cf. CPB, 2002).

Imperfect information and *transparency problems* arise when it is difficult for students to observe the quality of educational programs before they choose in which institution to enrol. Moreover, part of the quality of educational programs may remain unobserved by students and their future employers during their study or after completion (cf. CPB and CHEPS, 2001). This may lead to a situation in which students pay tuition fees for studies of insufficient quality.

We would like to emphasise that the three market failures discussed above are most often mentioned in the context of *tertiary* (i.e. higher) education in particular. This relates to the fact that, in a great number of countries, students enrolled in tertiary education need to finance part of the costs of their education themselves. In contrast, primary education and - to a smaller extent - secondary education are generally completely financed by public means, so that these types of market failures are (to a large degree) already overcome.

[1] The reader is referred to CPB and CHEPS (2001) for a more elaborate discussion of these three market failures in the context of higher education and their relevance for government policy.

[2] An illustration of an intervention that is designed to solve capital market constraints is the public loan system with income-contingent repayments after graduation that was introduced in Australia's higher education sector in 1989. The interested reader is referred to CPB and CHEPS (2001) for a more detailed description of this program.

Aside from market failures, other reasons for government intervention have been mentioned in the literature, such as equity (i.e. income distributional) considerations, paternalistic motives,[3] and fiscal considerations[4]. The equity argument will be discussed in more detail in Section 2.3.

2.2 Education spillovers

The idea of education externalities is that the benefits of individually acquired education may not be restricted to the individual, but might spill over to others as well (e.g. the public). The economic relevance of external effects of education lies in the fact that these spillovers may drive a wedge between the social return and the private return to education.

Aside from education externalities, the literature (e.g. Temple, 2001) also mentions some other factors that may drive a wedge between the social and private return to education. For example, education may lead to more efficient *matching* between workers and jobs in labour markets, so that the social return may become higher than the private return. On the other hand, s*ignalling*[5] (also called *screening*), and *rent-seeking* activities[6] serve as explanations why the private return may exceed the social return to education.

Evaluation of the optimal level of social (i.e. private plus public) investment in education and the optimal public-private balance in financing education requires a comprehensive assessment of all returns to schooling, both market and non-market effects (cf. Wolfe and Haveman, 2002). Table 2.1 presents an overview of the main effects of education. These effects have been classified into private effects and non-private effects. Private effects of education are effects that are reaped by the individuals receiving education themselves, whereas non-private effects are defined as effects that accrue to others. Non-private effects can be further decomposed into effects on the government budget, effects on income inequality, and external effects.[7] Within all

[3] Paternalism refers to the situation that people do not know exactly what is best for themselves; the government knows better, and considers education to be a merit good.

[4] It has been argued that education subsidies are an important instrument to reduce the negative incentives for the decision to invest in education that follow from a progressive tax system. This would implicate that education subsidies improve the trade-off between equity and efficiency, because the fiscal distortion on the schooling decision is reduced. Following this line of reasoning, education subsidies enable governments to impose more progressive taxes (cf. Bovenberg and Jacobs, 2001).

[5] Models of signalling start from the observation that individuals have characteristics that employers value but do not observe at the time of hiring (ability, determination, and so on). If there is a systematic association between these traits and the costs and benefits of education, this may lead to an equilibrium in which high-ability individuals stay in school longer because this decision signals their ability to employers. Stated otherwise, if educational attainment indeed acts as a screening device, there is a risk that further expansion of learning opportunities would simply increase the supply of credentials and produce only limited social returns. The signalling argument provides a plausible reason for a correlation between ability and years of schooling, and suggests that earnings may be correlated with educational attainment even if educational attainment has no effect on productivity (Temple, 2001).

[6] Rent-seeking activities do occur when differences in wage levels do not properly reflect differences in labour productivity (on a competitive market, gross salary is equal to labour productivity). For instance, it could be that highly educated workers have better access to jobs in which they appropriate part of profits earned in markets under imperfect competition.

[7] External effects and effects on income inequality are two important arguments for (more) government intervention in education. Income-distributional effects form the central issue of Section 2.3.

categories, we distinguish among costs and benefits, if existent. We now briefly discuss each category in term.

2.2.1 Private effects

Financial effects

Private effects of education can be classified into private financial and private non-financial effects.[8] Private *financial* returns have been subject of considerable analysis and measurement over recent decades. Most widely studied is the impact of educational attainment on an individual's market productivity and thereby on gross earnings. This impact is generally found to be positive, even after having controlled for the correlation between characteristics such as innate ability, determination/motivation and family background on the one hand, and educational attainment on the other hand.[9] Temple (2001) has reviewed the international literature and concludes that estimates of the private rate of return to a year's extra schooling typically lie somewhere between 5% and 15%.[10]

Several explanations can be given for this variety in estimates of the private rate of return to education. First, it is important to notice that the size of the private return to education may vary over different levels of education. For instance, it is found that the private rate of return to upper secondary education is slightly higher than to tertiary education (cf. OECD, 1998).[11] Second, estimates differ because of differences in study scope (e.g. countries under study) and time period under study. Third, the assumptions (e.g. on the size of the opportunity cost of education) and statistical methods (e.g. instrumental variables (IV) or ordinary least squares (OLS) estimates) used often vary.[12]

Aside from the much-studied effects of education on productivity and hence earnings, other private financial effects have been identified in the literature. Higher non-wage labour market remuneration (e.g. fringe benefits) has been mentioned in the category of private benefits (cf. Wolfe and Haveman, 2002). Higher income tax payments (due to higher earnings) and direct

[8] Financial effects may also be interpreted as effects that are valued on a market.

[9] Studies omitting these important variables that are correlated with both schooling and earnings tend to overestimate the real impact of schooling on productivity and earnings. Omitting innate ability yields so-called *ability bias*.

[10] Temple states that there are some studies that have not detected an effect of education on productivity at all, but argues that there are some convincing reasons (e.g. measurement error, incorrect specification) to doubt such results.

[11] A study carried out by the OECD in 1997 on the basis of data for 1995 finds that the private annual rate of return for men in The Netherlands lies at 14.1% for upper secondary education versus 10.8% for university education (OECD, 1998). It appears that the higher wage premium associated with tertiary education is offset by higher costs incurred with this education level.

[12] A discussion of the empirical findings of the private (labour) market returns to education lies beyond the scope of this paper. We refer to Card (1999), Temple (2001), Carneiro et al. (2001), and Carneiro (2002) for a thorough discussion of the different methods used to estimate private rates of return (e.g. through natural experiments) and their implications for the results. Further, these papers also present some cautions against treating these estimates as precise estimates, following from considerations of *heterogeneity* (in terms of different rates of return for different social groups or fields of study), *causality*, *ability bias* and *measurement error*.

costs of education (e.g. tuition fees; study materials; forgone earnings during the study period) can be seen as private financial costs of education (cf. OECD, 1998).

Non-financial effects

Private *non-financial* effects include benefits in terms of a better personal health position or increased personal satisfaction. There is considerable evidence (e.g. Grossman and Kaestner, 1997; Wolfe and Zuvekas, 1997) showing that persons with higher levels of educational attainment tend to have better health than those with lower levels.[13] This relationship appears to hold even when controlling for the effects of education on increased earnings, hence money available to spend on health care and the likelihood of having employer-provided benefits. Hartog and Oosterbeek (1997) have controlled for the effect of a person's IQ on its health situation in a study for the Netherlands, and find that particularly university education raises the chance of a good health status.

2.2.2 Non-private effects

Government budget

Regarding positive effects of education on the government budget, we mention two items. First, the government can collect higher income taxes due to enhanced earnings. This is also called the 'fiscal return to education'. Second, there is some tentative evidence that a more educated workforce is associated with a lower dependence - and hence lower public expenditures - on disability-related benefits or welfare (Wolfe & Haveman, 2002). Negative impacts of education on the government budget cover public spending on the education system.[14]

Income inequality

The traditional view is that education may contribute to a more equal income distribution. The recent literature, however, shows that the impact of education on income inequality is not unambiguous. Section 2.3 discusses the equity argument for public intervention in education into more detail.

External effects

Education externalities form an important efficiency argument for public intervention in education. The lower-right part of Table 2.1 gives an overview of the potential spillovers from

[13] McMahon (2001) explains this relationship by stating that more secondary education permits wider awareness of potential causes of illness, greater capacity to access information if illness occurs, entry into safer occupations, and secondary education also encourages adoption of healthier life styles.

[14] The marginal cost of public funds (MCPF) is higher than public expenditure on education, because we have to include the distorting effects of the tax collection needed to finance these public expenditures. A reasonable estimate for the MCPF would be 1.25 (cf. Lattimore, 1997). This means that 1 euro public expenditure would cost 1.25 euro in a welfare perspective.

education, following the relevant literature.[15] The relevant question is whether there is any empirical evidence for the presence of positive externalities of education, and if so, how large these spillovers are. Stated otherwise, at given levels of education policy efforts, do social returns to education exceed private returns, and if so, by how much?

Based on reviews of the recent literature on human capital spillovers by Venniker (2000), Temple (2001), and CPB and CHEPS (2001) (on tertiary education in particular), we can draw the following conclusions. First, empirical evidence is rather scarce. Second, the economic literature is ambiguous about the existence of human capital externalities *at current levels of policy efforts*, delivering some indications for positive externalities, but not very strong and undisputed. Examples of studies finding that private and social returns to education are roughly the same are Gemmel (1997), Blundell et al. (1999), Ciccone and Peri (2000), and Acemoglu and Angrist (2001).

It may be useful, however, to distinguish among different types of externalities. Along the lines of Venniker (2000), we distinguish among *static*, *dynamic* and *non-pecuniary* externalities. Traditionally, the majority of literature on education externalities has focused on *static* externalities.

Static human capital externalities

The idea behind *static* human capital externalities is that an individual's human capital raises the productivity of *other* factors of production, like physical capital and the human capital of others, through channels that are not internalised by individual families or firms (Lucas, 1988). In this context, Lucas states that the human interaction within cities is a prominent channel. There is some recent work carried out by Moretti (2004a; 2004b) arguing that education spillovers at the city level are indeed significant. Moretti uses city demographic structures and geographical presence of colleges to estimate education externalities, and finds significant effects of (growth in) the number of college graduates on *wages* (Moretti, 2004a) and *productivity* (Moretti, 2004b) of workers in the city, particularly workers with lower schooling levels.[16]

Another prominent paper by Acemoglu and Angrist (2001) finds conflicting results. Acemoglu and Angrist regress wages on schooling and on average schooling in state of

[15] The list of externalities presented in Table 2.1 is not an exhaustive list of all the potential education externalities. For a more comprehensive overview of externalities to education, we refer to Wolfe and Haveman (2002).

[16] For instance, Moretti (2004a) finds that a percentage point increase in the supply of college graduates raises high school drop-outs' wages by 1.9%, high school graduates' wages by 1.6%, and college graduates wages by 0.4%. However, it has been argued that Moretti's theoretical framework cannot be used to estimate the strength of education externalities, because he ignores aggregate scale effects and does not control for the supply of other, possibly complementary, types of workers (Ciccone and Peri, 2002).

residence.[17] They instrument individual schooling with quarter of birth and average schooling with compulsory schooling laws, and find that education externalities in terms of higher wages are small and statistically insignificant in the US.

Another frequently used method to explore the existence of human capital spillovers in production is to compare *cross-country* macro-Mincer regressions (i.e. log GDP per capita versus log average years of schooling) with *cross-individual* micro-Mincer regressions (i.e. log wages versus log years of schooling). The difference between the macro-coefficient and the micro-coefficient would indicate the size of the (static) human capital externality.[18] This method makes it possible to capture nationwide externalities of education. It should be noted, however, that reverse causality (i.e. from GDP per capita to average educational attainment), measurement errors, and omitted variables may create problems at the country level of analysis, as pointed out by Krueger and Lindahl (2001). These problems may provide an important explanation for the fact that estimates of social returns to education based on this method vary widely. All in all, we may conclude that empirical evidence for significant *static* human capital spillovers is inconclusive.

Dynamic externalities

The following two externalities have been identified in he literature as belonging to the category of *dynamic* externalities to education. First, learning-by-doing (i.e. 'learning-to-learn') is more effective with higher average human capital. Second, as emphasised by Nelson and Phelps (1966) and Romer (1990), creating and adopting new technologies is more effective at higher levels of human capital. This implicates that schooling may lead to technological progress, and thereby to higher economic growth.[19] A couple of cautious remarks are in place here. First, the externality relates solely to (overall) technological progress not captured in the private return to education. Second, as noted by Krueger and Lindahl (2001), this externality is more likely to occur if human capital is expanded at *higher* levels of education. Finally, the *direction* of causality, running from education to economic growth (via technological progress), is not undisputed in the literature.

[17] Acemoglu and Angrist use US states as the geographical area, whereas Moretti uses US cities as the relevant community. Another difference is that Acemoglu and Angrist, by using child labor and compulsory schooling laws as instruments, focus on the effect on educational attainment in the *lower* part of the distribution, mostly in the middle school or high school. Moretti, on the other hand, identifies spillovers using variation in the number of college graduates, i.e. the *upper* part of the distribution. According to Moretti, there is no theoretical reason to expect that a one year increase in a city average education obtained by a rise in the number of those who finish high-school has the same effect as a similar increase in average education obtained by a rise in the number of those who graduate from college.

[18] The study of Heckman and Klenow (1998) provides an illustration of this method. After controlling for technology differences among countries, they find that the macro-coefficients are roughly in line with micro-estimates, indicating that there is no strong case for education externalities in production.

[19] An elaborate discussion of the literature on the relationship between human capital, technical change and economic growth lies beyond the scope of this paper. The interested reader is referred to Canton et al. (2005).

Non-pecuniary externalities

Much attention has been given in the literature to static and dynamic education spillovers, which can be characterised as direct *economic* benefits of education, in the sense of being related to performance at work. However, it should not be neglected that the creation of knowledge, skills and aptitudes through education affects *social* behaviour as well, which in turn may have important indirect economic effects. Wolfe and Haveman (2002) present an extensive list of these so-called *non-pecuniary* externalities of schooling, whereby they distinguish among intra-family externalities and externalities that accrue to others in society.[20] Within the former category, which encompasses intergenerational effects, they mention the following impact channels: intra-family productivity,[21] child education[22] and cognitive development, infant health[23] and daughters' fertility. The latter category, among others, encompasses positive externalities in the form of reduced crime, better public health situation and greater social cohesion.

Evidence for the existence of positive non-pecuniary externalities seems most conclusive in the domain of crime reduction and improvements in health. For instance, Lochner and Moretti (2004) find that schooling significantly reduces the probability of incarceration and arrest in the US, especially for Afro-Americans. They estimate that the social savings from crime reduction associated with high school completion for men amount to around one fifth of the private return. Raising educational attainment, for instance by means of a reduction of the rate of early school dropouts, may therefore help to avoid crime and anti-social behaviour amongst young people.

It should be stressed that non-pecuniary externalities are not incorporated in standard estimations of the social return to education, which typically measure effects on GDP and not on welfare. This would imply that, provided non-pecuniary externalities are prevalent, current estimates give an underestimation the *true* social returns to education, which in turn means that there could still be room for more government intervention in education. The magnitude of this downward bias is unclear, however, since we are unaware of any attempts to incorporate these non-pecuniary spillovers in any econometric analysis of the social returns to education.

[20] Prior studies that also try to assess the social effects of schooling are Haveman and Wolfe (1984), Wolfe and Zuvekas (1997), Behrman and Stacey (1997) and McMahon (2001).

[21] Wolfe and Haveman (2002) refer to some studies finding a positive relationship between own schooling and spouse's health and mortality.

[22] For instance, a recent paper by Oreopoulos et al. (2003) investigates the causality of the relationship between parents' education and child's educational performance. Their results indicate that a one-year increase in the education of either parent reduces the probability that a child repeats a grade by between two and seven percentage points. Among 15 to 16 year olds living at home, they also estimate that parental compulsory schooling significantly lowers the likelihood of dropping out.

[23] Currie and Moretti (2003), for example, find that higher maternal education improves infant health, as measured by birth weight and gestational age. It also increases use of prenatal care and reduces smoking, suggesting that these may be important pathways for the ultimate effect on infant health.

Table 2.1 Overview of outcomes of education

Private

financial

benefits:

- gross earnings
- non-wage labour market remuneration[1]
- quality of employment[2]

costs:

- direct costs of education[3]
- opportunity costs of education
- income taxes paid by individuals

non-financial

benefits:

- personal satisfaction
- personal physical and mental health

Non-private

government budget

benefits:

- income taxes collected by the government
- lower public transfers (e.g. disability-related benefits or welfare)

costs:

- public spending on education

external effects

benefits:

- static externalities
  - productivity of physical capital
  - productivity of human capital of others[4]
- dynamic externalities
  - effectiveness of learning-by-doing
  - technological progress
- non-pecuniary externalities
  - physical and mental health of others
  - crime reduction
  - public participation[5]
  - political participation[6]
  - child quality[7]
  - intra-family productivity

income inequality

effect not unambiguous

Sources: OECD (1998); McMahon (2001); Venniker (2000); Temple (2001); Krueger and Lindahl (2001); Wolfe and Haveman (2002).

Notes:

1 Wolfe and Haveman (2002) refer to some studies finding a positive relationship between the level of education and non-wage labour market remuneration (e.g. fringe benefits and working conditions).

2 Mincer (1993) finds that educated workers have greater upward mobility in income and greater employment stability.

3 One can think of tuition fees and study materials.

4 This occurs for instance when skilled workers use their education to devise improved production methods for less skilled workers (CPB and CHEPS, 2001).

5 This externality is also referred to as social cohesion or better citizenship.

6 Similarly, Krueger & Lindahl (2001) state that education (particularly at lower levels) may lead to more informed political decisions, whereas McMahon (2001) empirically finds a positive relationship between lagged secondary education enrolment rates and democratization. Milligan et al. (2004) review the relationship between educational attainment and political involvement in the US and the UK.

7 Wolfe & Haveman (2002) identify a positive impact of parents' education on the child's level of education and cognitive development, health situation and on fertility (e.g. lower probability that daughters will give birth out of wedlock as teens).

Cautions

Finally, we would like to point out some cautious remarks that are important in any analysis of education spillovers:

- As pointed out by Acemoglu (2002b) in his discussion of the paper of Wolve and Haveman (2002), a theoretical framework is needed that distinguishes effects affecting society as a whole, and thus can be properly called externalities, from effects of education that are already internalised by economic actors. Acemoglu stresses that many of the (non-market) effects of education presented in the literature may indeed be present in reality (and their magnitude is still useful to know), but may not correspond to any type of externality.[24] It is only *externalities* that governments should care about in the sense that these effects may provide a motivation to intervene in education.
- Another important issue that is brought up by Acemoglu (2002b) is that existing *correlations* in the data are frequently taken as the *causal* effect of education, for instance in the paper of Wolve and Haveman (2002). For example, he refers to the observed correlation between an individual's level of education and the quality of all kinds of social choices like fertility and consumption choices. Acemoglu states that it is likely that other factors (e.g. innate ability, parental and social background) - other than educational attainment - impact on the social choices made. A more general implication of this is that we should be aware of ability bias in estimates of external effects of education.
- The majority of empirical research on education spillovers focuses on the US. Further research on the existence and magnitudes of education externalities needs to be undertaken in other countries as well. It may well be that the size of these spillovers varies widely over countries, corresponding to differences in educational systems, or levels of development.
- We have presented an overview of potential external benefits of education in general. It is important for governments to realise, however, that the scale on which certain education spillovers can be reaped may differ across education levels and types, as well as across socio-economic groups.[25] This observation has important implications for governments' allocation decisions of the education budget over different levels and types of education. Considering differences in magnitudes of externalities over different education *levels*, for example, it has been suggested that technology spillovers may be reaped though investments in *tertiary* education (and technical education in particular), whereas a reduction in crime levels or a lower

[24] Acemoglu (2002b) puts forward the example of education leading to more efficient consumer choices. When making education choices, assuming rationality, consumers take into account that not only they will earn more in the future, but also that they will be able to get greater purchasing power from these wages because of better consumer choices. In this case, there is no reason for the government to intervene, since this non-market effect is already internalised.

[25] Considering the degree to which externalities can be reaped across different socio-economic groups, Krueger and Lindahl (2001) refer to some research papers on the US suggesting that positive externalities (e.g. in the form of reduced crime or welfare participation) are more likely to be reaped from investments in children from *disadvantaged* families than for those from advantaged families.

dependence on welfare is often attributed to *secondary* education, and improvements in public health can be assigned to *primary* education in particular.

- When we would observe that the social rate of return equals the private rate of return of education in a particular country with a particular level of public intervention, this does not necessarily imply that externalities are absent; existing subsidies to education may have completely *internalised* these education externalities, and in that case may have eliminated the gap between social and private rates of return that would have prevailed in the absence of these subsidies.[26] The existing level op policy efforts is optimal from an efficiency perspective in that case.[27]

2.3 Equity motives

The two most important motives for public intervention in education from an economic point of view are to promote efficiency and equity. Whereas efficiency motives in the form of spillovers have been dealt with extensively in Section 2.2, here we will focus on the potential effects of education on the income distribution of a country's workforce, or the degree of wage inequality.[28]

Tinbergen (1975) and Teulings (2000) argue that there is a role for governments in reducing wage inequality by means of education subsidies. The central idea is that education policies, if effective in raising the average number of years of education (or in increasing enrolment at *higher* levels of education), will make low-skilled workers scarcer, raising their wages, while at the same time increasing the supply of highly educated workers and reducing their wages. In other words, the higher relative supply of skilled workers resulting from education policy will reduce wage inequality by lowering the private monetary return to education.[29]

[26] Similarly, when we would observe that the social rate of return is lower than the private of return to education, positive externalities to education could still be in place, notably in the case when subsidies are too generous on efficiency grounds.
[27] However, obtaining good estimates of the private rate of return, and - even more so - of the social rate of return of education is not an easy task. Consequently, caution is required if one is to draw conclusions on the optimal scale of government intervention in education (i.e. if one is to answer the question if and by how much the current level of subsidies to education should be expanded or reduced).
[28] The idea is that (part of) the inequality in earnings can be attributed to differences in educational attainment between people. However, inequality in earnings may also be present among persons that have enjoyed the same number of years of education, resulting in part from differences in individual characteristics or differences in educational quality. Consider for instance the US, where in some states, the amount of public financing of schools offering primary education is based on the amount of tax revenues from local real estate taxes, thereby creating large inequalities in the education system, which explains part of the inequality in earnings. Therefore, both earnings gaps by education level (high educated versus low educated) as well as quality differences must be considered when analysing the impact of education on income inequality.
[29] This way, the private return to education (i.e. the return to skills) can be interpreted as a measure of the degree of income inequality across groups of workers with different levels of educational attainment. By definition, this indicator abstracts from income differences among persons having enjoyed the same number of years of education, because the private return to education is estimated as an *average* rate of return for all people having attained a certain educational level.

Is there any evidence that supports this mechanism? Dur and Teulings (2001) refer to several studies carried out for a number of countries showing that an increase in (average) educational attainment corresponds to a lower level of wage inequality. Furthermore, the results of a cross-country study by Teulings and Van Rens (2003) show that the private return of education falls by 1.5 percentage points when the average education level of the population increases by a year, which again would imply a reduction in wage inequality between groups with different educational attainment. These results seem to suggest that education policy may be used to reduce wage inequality, at least when it succeeds in raising average educational attainment of the population. However, the literature also mentions some reasons why education policy may not be effective in lowering wage inequality. A comprehensive overview of these factors is presented by Jacobs (2004). Here, we will confine ourselves to a brief discussion of two of the most eminent explanations.

First, some endogenous growth theories identify a positive relationship between the supply of skilled workers and the rate of so-called *skill-biased technological change*. It is assumed that an increase in the stock of skilled workers *induces* the development of new technologies that are more complementary to skilled workers.[30] Consequently, stimulating skill formation with education subsidies will not only increase relative *supply* of skilled workers, but also relative *demand* for skilled workers. The tendency for relative wages of skilled workers (i.e. the so-called 'skill premium') to fall is countered. This effect may be so strong that the skill premium even rises in the long run. Wage inequality may therefore increase rather than decrease in the wake of growth in the relative supply of skilled workers, which is demonstrated by Acemoglu (1998; 2002a)[31] and Nahuis and Smulders (2002)[32], among others.

The recent growth of the skill premium observed in some developed countries (particularly in the UK and US) can thus be explained by factors of *demand* that compensate for the growth in the supply of skills during the past decades. Opinions differ however, on the causes of this hike in relative demand for skilled workers. Whereas Acemoglu, as explained above, holds

[30] Endogenous growth models (e.g. Acemoglu, 2002a) argue that the development of technology is, at least in part, a response to *profit incentives*, and not so much stemming from coincidental (*exogenous*) advances in science. It is argued that a larger supply of skilled workers makes developing skill-biased techniques more profitable, because in that case there are more workers (i.e. greater market size) to use these technologies under increasing returns to scale (due to the presence of fixed costs of innovation and vacancies). Therefore, new techniques tend to become more and more skill-biased when the supply of skills in the economy grows.

[31] Acemoglu (2002a) states that the behaviour of wages and returns to schooling in the US indicates that technical change has been skill-biased during the past sixty years. Further, he concludes that the evidence points to an acceleration in skill-biased technical change during the past few decades, which is explained by the rapid increase in the supply of skills during this period.

[32] Nahuis and Smulders (2002) argue that skilled workers produce knowledge that affects the firm's productivity directly by reducing current production costs, as well as indirectly by reducing the cost of future R&D. Hence an increase in the supply of skilled workers would ultimately lead to an increase in the wages of these educated workers, provided that (1) the degree of appropriability of investment in knowledge capital is sufficiently large, (2) the investment costs do not rise too quickly, and (3) diminishing returns related to knowledge accumulation do not set in too strongly.

endogenous skill-biased technological change responsible for the observed increases in relative demand for skilled workers, others (e.g. Autor et al., 1998; Dur and Teulings, 2001; Oosterbeek, 2001) have pointed at rather coincidental (i.e. exogenous) advances in *information technology* (e.g. the emergence of the microchip, the personal computer and internet). This would explain the rise in the skill premium and thereby the higher income disparities observed between groups of skilled and unskilled workers.[33]

Let us present an illustration of how forces of demand and supply for skilled workers have evolved differently across the US and the Netherlands, as witnessed by differences in the trends in skill premiums. It has been observed that the (Mincer) return to education, and consequently income disparity between skilled and unskilled workers, has witnessed a steep rise in the US (see Acemoglu, 2002a) during the 1980s. In the Netherlands, however, the return to education remained more or less stable during this period.[34] Oosterbeek (2001) argues that, whereas both countries witnessed a hike in *demand* for skilled workers (due to skill-biased technical change and changes in international trade patterns, which are assumed to operate in both countries), *supply* of skilled workers has grown relatively faster in the Netherlands than in the US during the 1980s. According to Oosterbeek, this is mainly due to the large increase in participation of women with higher levels of education, as well as in higher segments of the labour market.

A second reason why education policy may not succeed in reducing income inequality follows from the fact that subsidies on education are not equally distributed. For instance, it is found that the 50% richest households receive about 80% of education subsidies in the Netherlands (SCP, 1994).[35] This may offset the reduction in inequality from changes in relative wages between skilled and unskilled workers. Thus, on the one hand, inequality increases, because these education subsidies turn out to be regressive, whereas on the other hand, education subsidies might compress wage differentials (because of their effect on the relative supply of

[33] However, there is some discussion in the literature whether the effects of information technology on (relative) demand for skilled workers are indeed that large. See for example Borghans and Ter Weel (2001), who notice that, although the implementation of computers has improved the position of more-skilled workers, there are several other findings that are inconsistent with the interpretation that computer use requires skills. For example, it is mentioned that while high-skilled workers use computers more frequently, a substantial fraction of low-skilled workers use computers as well. Furthermore, Acemoglu (2002a) argues that, despite the observed acceleration in skill bias, the recent advances in information technology do not imply that we are in the midst of a 'technological revolution'; what has changed is not necessarily the overall rate of progress, but the *types* of technologies that are being developed (notably, skill-biased technologies).

[34] The Mincer return to education in the Netherlands declined from 11% in 1962 to 5% in 1985 (Hartog et al., 1993), after which it remained more or less stable until 1996, as shown by Hartog et al. (1999). Recent research based on new data shows that the return to education has risen sharply after the mid-1990s, notably from 6% in 1994 to 8.5% in 1999 (Leuven and Oosterbeek, 2000).

[35] Moreover, it has been observed that the distribution of public expenditures on *higher* education is even more unequal in the Netherlands; SCP (2003) shows that the 20% richest households receive more than 40% of public expenditures on full-time education for students above 18 years (excluding student grants), which encompasses mostly university education and higher vocational training, whereas the 40% poorest households receive a little more than 15% of these expenditures. This relatively more unequal distribution can be explained by higher enrolment levels at post-compulsory schooling by richer income groups, as well as by the fact that this higher enrolment covers more expensive forms of education (particularly university education).

skilled workers) and thereby reduce inequality. Dur and Teulings (2001) show that the net effect of these two forces on income inequality is uncertain. They argue therefore that a strategy that focuses solely on raising enrolment rates in tertiary education will not be the most effective way to obtain a more equal income distribution. Instead, they suggest that education policy should be designated to either raising educational attainment at *all* levels of education, or a more selective growth of higher education by stimulating enrolment of students belonging to lower socio-economic groups.

We refer to Jacobs (2004) for a more elaborate discussion of some other factors identified in the literature explaining why education policies designated to reduce income inequality may be counterproductive.[36] We can conclude that, apart from efficiency motives, equity considerations may provide an additional motivation for public intervention in education. However, it is doubtful whether education policy is an effective instrument to reduce wage inequality. Jacobs (2004) argues that more direct instruments in the form of progressive income taxes are better suited to reduce income inequality than indirect instruments such as education subsidies.

[36] For instance, Jacobs mentions that education subsidies may lose their potential to affect the income distribution under free trade, because wage rates of workers with the same skills will then tend to converge to levels that are determined on global, rather than local markets.

3 Effectiveness of education policy

3.1 Introduction

How does policy affect education, and thereby the accumulation of human capital?[37] There are basically two channels through which education policy can operate: through educational quantity or through the impact on educational quality. Educational quantity is usually expressed in enrolment levels or average years of schooling. Educational quality has been traditionally measured by input measures such as teacher-student ratios, teachers' human capital or total public expenditures on education. A more recent strategy, however, is to evaluate educational quality in terms of output indicators measuring the performance of students and graduates. Towards this end, test scores in areas like maths, reading and science are often used. The idea is that when students in one country outperform students in another, provided these students are in the same grade, we can assume that they have enjoyed schooling of higher quality, irrespective whether this higher quality comes from higher teacher-student ratios, the quality of teachers, other expenditures on education or other unobservable factors specific to the production of human capital.

Several empirical studies find positive effects of (changes in) educational quantity (e.g. Barro and Sala-i-Martin, 1995; Krueger and Lindahl, 2001; Bassanini and Scarpetta, 2001), and educational quality (e.g. Hanushek and Kimko, 2000) on macroeconomic performance.[38] The apparent relationship between the state of an educational system and macroeconomic performance makes the question as to how policy affects the quantity and quality of education all the more relevant.

3.2 Outcomes of evaluation studies

Table 3.1 presents an overview of the outcomes of studies measuring the causal effect of various types of public interventions.[39] We distinguish among the effect on enrolment levels

[37] Though education is an important source of human capital formation, human capital is also accumulated in later stages of the life cycle, notably through work-related training, experience and learning-by-doing. Heckmann (2000) states that this post-school learning accounts for as much as one third to one half of all skill formation in a modern economy. However, it goes beyond the scope of this paper to discuss - the rationale for and effectiveness of - policy measures targeted at these other components of human capital formation. Moreover, the scope for public intervention in the market for (work-related) training is generally assumed to be more limited than in the market for education.

[38] However, the debate on the precise magnitude of these macroeconomic effects of education is far from settled, stemming from disputes on the choice of appropriate data sets (i.e. measurement problems) and econometric techniques. Moreover, the causality of the relationship between education and economic growth has even been challenged by some (cf. Bils and Klenow, 2000). The interested reader is referred to Canton et al. (2005) for an overview of the main findings of this growth-empirics literature.

[39] The majority of evaluation studies presented in Table 3.1 applies to the US. It appears that sound evaluations of interventions carried out in other countries are rather scarce, at least those with an experimental or quasi-experimental design.

(i.e. the quantity channel) and on measures of student performance (i.e. the quality channel).[40] Besides categorising education policies according to their particular *focus* (i.e. quantity versus quality), we also subdivide educational interventions according to the different stages of the education career in which they are carried out. To this end, we distinguish among interventions during pre-compulsory schooling (or early childhood interventions), compulsory schooling (i.e. primary and secondary education), and post-compulsory schooling (i.e. tertiary education), as indicated in the first column of Table 3.1. Finally, in the presence of a government education budget constraint, policymakers should not only be concerned with the *timing* of educational interventions (i.e. *when* to intervene?), but also with the choice of a particular *type* of intervention (i.e. *how* to intervene?). Table 3.1 therefore reviews various types of interventions at each stage of the education cycle.

How can the effects of a particular intervention best be measured? We argue that the majority of traditional evaluation studies is not able to identify the true causal effects of the education policies under study. The most important reason is the occurrence of so-called *endogeneity bias* (cf. Webbink, 2005). This endogeneity (or selection) bias takes place because there are often unobservable characteristics of educational inputs (e.g. students, schools), for instance innate ability or motivation, that are correlated with both the intervention and the performance indicator. An illustration of the occurrence of selection bias is if one is to evaluate the effects of a class-size reduction. Teachers often (deliberately) sort students into classes of different sizes according to assessments of their behaviour or intelligence, which makes the observed correlation between class size and student achievement hard to interpret. The ignorance of this selection bias can lead to seriously misleading conclusions on the effects of a reduction in class size.

This problem is tackled in evaluation studies with an *experimental* or *quasi-experimental* design, at least if the research design is set up properly. Experimental designs are based on controlled experiments in which the selection into treatment and control groups is determined completely at random, for instance by means of a lottery. Quasi-experimental research designs are based on so-called *natural experiments* that follow from naturally occurring circumstances or institutional rules that select students (or schools) into treatment and control groups in a manner akin to purposeful random assignment (cf. Angrist, 2003).[41] Comparing the relevant outcomes (i.e. student performance and enrolment) for the treatment group with those of the

[40] The interested reader is referred to Webbink (2005) and Webbink and Hassink (2002) for a more elaborate analysis of the particular outcomes of these evaluation studies.

[41] A nice example of a natural experiment can be found in the study of Leuven et al. (2004b) that assesses the effectiveness of extra funds for teachers on student achievement in the Netherlands. Schools with at least 70 percent minority students received additional funds destined for extra personnel. This cut-off at 70 percent provides a natural experiment based on a so-called regression discontinuity design. The causal effect of the program can be identified by comparing student achievement in schools just above the cut-off (i.e. the treatment group) with schools just below the cut-off (i.e. the control group).

control group will yield the causal effects of a certain intervention. Table 3.1 encompasses only those studies that make use of such rigorous methodological designs, that is, including control groups and random assignment. An important implication of this selection criterion is that our overview does not cover the whole spectrum of interventions that are currently carried out, because some interventions may be less suitable for (quasi-) experimental evaluations than others. We are aware of the fact that other types of evaluations exist, but we are not able to judge their relevance, since a counterfactual is lacking. Let us discuss the main findings from the (quasi-) experimental evaluation literature.

Quantity versus quality: focus on quality

It appears from Table 3.1 that the vast majority of interventions are designed to affect educational *quality*, which can be explained as follows. It could well be that some interventions of which the impact is reported solely on educational quality may indeed have affected (or were designed to impact upon) educational quantity as well, but that this impact was not studied. A more profound reason is that the studies in Table 3.1 evaluate the effectiveness of interventions carried out in advanced economies only (most of them in the US), and not in developing countries. Since advanced economies have often reached the upper limits of enrolment, at least in primary and - though somewhat less - in secondary education, recent public interventions in these countries have mainly focused on improving educational quality.[42] Stated otherwise, the scope for raising educational quantity (i.e. enrolment or average years of education) in developed countries is generally limited, at least when compared to developing countries. This is not to deny that there is still some potential to raise educational quantity in industrialized countries, for instance by raising enrolment in tertiary education or by lowering dropout rates in secondary education in particular. However, as argued by Sianesi and Van Reenen (2002), the incremental value of additional education in countries where average length of education is already high is less obvious, and probably largely depends on the type and quality of education.

Timing of intervention: early childhood interventions effective

Another important conclusion from Table 3.1 is that early childhood interventions appear to be unambiguously effective, both in terms of raising average years of education, as well as in improving student performance.[43] In contrast, the picture is mixed when looking at interventions in later stages of the education cycle (i.e. compulsory and post-compulsory schooling).

[42] In the Netherlands for instance, 92% of all people aged 16 were engaged in full-time education in the year 2000 (89% in 1980), and that of 18-year olds amounted to 64% (46% in 1980), whereas enrolment of 24-year olds stood at 17% (9% in 1980) (SCP, 2004).

[43] Another argument in favour of early interventions in education is that early investments raise the productivity of later investments, as argued by Carneiro and Heckman (2003): *'Learning begets learning, skills (both cognitive and non-cognitive) acquired early on facilitate later learning'*. Further, it should be mentioned that the benefits of early childhood interventions seem to be larger for more disadvantaged children (cf. Currie, 2001).

Heckman (2000) and Currie (2001) summarise the outcomes of several studies measuring the effects of a large number of early childhood intervention programs carried out in the US.[44] The most famous example of a thoroughly evaluated early childhood intervention is the large-scale Perry Preschool Program. Schweinhart, et al. (1993) show that even long-term effects of this program are positive, in terms of both higher employment and earnings, and a lower dependency on public assistance. Several other randomized evaluation studies of early childhood interventions also find positive effects.[45]

It is important, however, to realise that the lag between the early childhood intervention and labour market entrance of the targeted students is much longer than in the case of interventions during compulsory schooling or, even more obvious, during post-compulsory schooling. This means that the macroeconomic benefits of early childhood interventions, if any, materialise on a longer term as well.

Type of intervention matters

At each stage of the education cycle, the government can mostly choose from a large menu of interventions. The overview of the evaluation literature shows that the effectiveness of interventions differs across different types of interventions, particularly at the compulsory and post-compulsory stage of the education cycle. For example, extensions of instruction time appear to have a positive impact on student performance, whereas a larger availability of computer facilities inside the classroom or teacher training does not seem to have any significant positive impact at all. An important policy implication is that aside from timing, the choice of a particular type of intervention matters as well.

However, the impact not only differs *across* different types of intervention, but also *within* certain classes of intervention. Examples of categories of interventions for which the evaluation literature shows mixed results are the introduction of smaller class sizes at the compulsory schooling level (three studies showing a positive impact on student performance, whereas two studies report no significant impact at all), and the implementation of performance incentives for students in post-compulsory education. Possible explanations for this mixed evidence are discussed in Section 3.3.

[44] We have considered only those studies that use a random assignment (quasi-)experimental design to determine program impacts.

[45] Examples are Gray et al. (1983), Garber (1988), Johnson and Walker (1991), and Campbell et al. (2002).

Table 3.1	Effectiveness of public interventions in education by type and level (based on studies with an (quasi-) experimental approach)			
Timing (level)	Intervention (type) + country[3]	Literature	Effect Quality[7]	Effect Quantity[7]
Pre-Compulsory				
	early childhood interventions			
	several pre-school intervention programs (e.g. full-day child care, home visits, pre-school program) (US)	Heckman (2000);Currie (2001)[5]	+	+[16]
Compulsory[1]				
	'classical' education inputs			
	instruction time (school hours)			
	- Israel	Lavy (1999a)	+	
	- NL	Leuven et al. (2004a)	+[8]	
	- Sweden	Lindahl (2001)	+	
	expenditure per pupil (US)	Guryan (2001)	n.s./+[9]	
	class size reduction			
	- Israel	Angrist and Lavy (1999)	+	
	- NL	Dobbelsteen et al. (2002)	n.s.	
	- US	Krueger (1999, 2003)	+	
	- US	Hoxby (2000a)	n.s.	
	- US	Krueger and Whitmore (2001)	+	
	- various countries	Wößmann and West (2005)	n.s./+[10]	
	teacher training/acquisition			
	- Israel	Angrist and Lavy (2001)	n.s./+[11]	
	- US	Jacob and Lefgren (2004a)	n.s.	
	teacher testing/certification (US)	Angrist and Guryan (2003)	n.s.[12]	
	computer facilities			
	- in elementary and middle schools (Israel)	Angrist and Lavy (2002a)	n.s.	
	- in primary schools (NL)	Leuven et al. (2004b)	-	
	internet investment subsidy	Goolsbee and Guryan (2002)	n.s.	
	organisational changes			
	school-going age extension (Sweden)	Meghir and Palme (1999)		+
	competition (vouchers/school choice)			
	- US	Hoxby (2002)	+	
	- US	Cullen et al. (2003)	n.s.	
	- US	Krueger and Zhu (2003)	n.s.	
	performance incentives[4]			
	- merit pay for teachers (Israel)	Lavy (2003)	+	
	- merit pay for schools (Israel)	Lavy (2002)	+	n.s.[17]
	peer group (changes in class heterogeneity)			
	- Israel	Lavy (1999b)	+	
	- US	Hoxby (2000b)	+	
	teachers' grading standards (US)	Figlio and Lucas (2000)	+	

Table 3.1	**Continued**			
Timing (level)	Intervention (type) + country[3]	Literature	Effect Quality[7]	Effect Quantity[7]
	specific projects for students at risk			
	- cash bonus for high school matriculation for low-achieving students (Israel)	Angrist and Lavy (2002b)	+	
	- additional instruction to underperforming students (Israel)	Lavy and Schlosser (2004)	n.s./+[13]	
	- funding for extra personnel for primary schools with disadvantaged students	Leuven et al. (2004b)	n.s.	
	- student counselling and financial incentives for minority students (US)	Taggart (1995); Heckman (2000)	+	
	- several dropout prevention programs (US)	Dynarski et al. (1998)[6]	n.s.	n.s.
	- remedial summer education (US)	Jacob and Lefgren (2004b)	n.s./+[14]	
Post-Compulsory[2]				
	tuition fees			
	- US	Heckman et al. (1998),		-(0.07)[18]
	- US	Cameron and Heckman (2001)		-(0.02-0.05)[18]
	- US	Dynarski (1999)		-(0.03)[17]
	financial support (loans/ grants)			
	- California college grant program (US)	Kane (2003)		+
	- social security student benefit (US)	Dynarski (1999)		+
	- SOFES loan program (Mexico)	Canton and Blom (2004)	+	
	performance incentives for students			
	- reward for 1st year college completion(NL)	Leuven et al. (2003)	n.s./+[15]	
	- performance-based grant system (NL)	Belot et al. (2004)	+	

Sources: partly adapted from Webbink and Hassink (2002); Webbink (2005).

1 Primary and secondary education.

2 Tertiary education.

3 US = United States, NL =Netherlands.

4 The reader is referred to Canton and Webbink (2004) for a discussion of evaluations of interventions based on performance incentives.

5 Heckman and Currie have reviewed several (quasi-)experimental evaluation studies of various early childhood intervention schemes.

6 Dynarski et al. (1998) have reviewed sixteen dropout prevention programs carried out in the US, of which eight middle-school programs and eight high-school programs. These programs were generally ineffective in lowering the dropout rate or improving student performance. However, some positive results were found for a limited number of intensive middle school programs and for high school GED programs.

7 + significant positive effect on performance; n.s. no effect; - significant negative effect on performance.

8 Positive effects on test scores apply only to pupils with lower educated parents and minority children.

9 Test scores are positively affected for 4th-grade students, but increased spending showed no effect on 8th-grade test scores

10 Class-size effects are estimated on mathematics and science achievement in 18 countries. Significant positive effects of smaller class size were found for only two countries (Iceland and Greece). Wößmann and West (2005) conclude that class-size effects in one school system cannot be interpreted as a general finding for all school systems.

11 Positive effects are found for secular schools, but effects on student performance in religious schools are insignificant.

12 Effects have been studied on teacher quality as an indirect measure of educational quality.

13 Remedial education improved the performance of sixth graders, but not of third graders.

14 Cash bonuses for high school matriculation (this is a prerequisite for university admission) are effective when provided to an entire school, but not when given to individually selected students within the school.

15 Positive effects are found for students with high math skills and for students with higher educated fathers when given a 'high' reward.

16 The quantity effect of early childhood interventions refers to the direct effect on average years of schooling due to the extra classes in the pre-school stage, but also to the indirect effect caused by increased high school graduation rates and/or lower dropout rates.

17 The quantity effect refers to the impact on the dropout rate.

18 Presented numbers are enrolment elasticities.

3.3 A note of caution

We have seen in Section 3.2 that studies based on natural experiments or controlled policy experiments, in which some (randomly assigned) schools or students are exposed to a certain treatment, and others not, may help governments to gain valuable insights in what works and what not.[46] Nonetheless, several reasons can be identified why we should be cautious drawing too firm conclusions on the (relative) effectiveness of particular interventions on the basis of the outcomes of these evaluation studies.

First, the effectiveness of a particular intervention depends upon the (local) conditions under which the intervention is implemented, in terms of for instance the type and quality of education, or the demographics of the students targeted with it. Moreover, effects of similar interventions may differ due to differences in setup and management of the program in question. This implicates that effects found in one program need not occur when exactly the same program is implemented in another city, region, country or time period.

Second, a cost-benefit analysis has not been carried out in most evaluation studies presented in Table 3.1. Some interventions may yield positive effects in terms of improvements in student performance or enrolment, but may not be *cost-effective* due to the large expenditures incurred in those programs. Moreover, as argued by Carneiro and Heckman (2003), for many large-scale interventions it is essential to account for general equilibrium effects that may reverse or diminish partial equilibrium effects.

Third, comparing the effectiveness of particular interventions also requires to take into account the *timing* and *duration* of benefits. Table 3.1 only shows whether the impact of various education policies on educational quantity or quality is positive or not, but it is often unknown when effects start to materialise, or whether these effects are prolonged or not.

Fourth, a full analysis of the effectiveness of a particular intervention calls for insight into the long-term effects, in terms of wage levels, labour productivity and chance of employment. Knowledge of these long-term effects is often lacking, since there is often a long lag between the intervention and labour market entrance of the students targeted with it.[47] This lag may range from a couple of years in case of interventions in higher education to more than a decade in case of pre-school interventions.

[46] However, there are a couple of objections to controlled experiments, such as problems of implementing random assignment correctly, ethical objections (some students are denied access to a potentially beneficial program), the often large costs involved (in setting up the experiment), and the fact that it may be difficult to generalise results from an experiment to the wider population. The reader is referred to Heckman and Smith (1995) for a more detailed discussion of the pros en cons of social experiments.

[47] The majority of evaluation studies of educational interventions has not assessed long-term effects, which is often due to a lack of data (in turn due to time and money constraints). A clear exception can be found in the evaluation of the Perry Preschool Project by Schweinhart et al. (1993), who study the impact of this early childhood intervention on factors such as high school graduation rates, earnings, crime rates and welfare use, as of age 27.

4 Conclusion and suggestions for further research

In this paper we have reviewed arguments for government intervention in education, and discussed the effectiveness of commonly used policy instruments. The main policy implications are as follows:

- Evidence for significant positive spillovers from education, that is, social returns exceeding private returns, appears to be lacking, at current levels of policy efforts at least. This would imply that there is no rationale for more government intervention in education from an efficiency point of view. However, it should be mentioned that non-pecuniary spillovers are not incorporated in conventional measures of social returns to education. Indications of positive non-pecuniary spillovers are most profound in the areas of crime reduction and health situation;
- Securing a more equal income distribution through public support for education is often used as an important equity rationale for public interference with education. However, several (theoretical and empirical) factors have been identified in the literature as to why education policy may not lead to lower income inequality. An example of an important theoretical argument is endogenous skill-biased technological change;
- Early childhood interventions consistently appear to be very effective in terms of both higher educational attainment as well as improved student performance. Evidence on interventions in later stages of the education cycle (i.e. during compulsory and post-compulsory schooling) is much less unambiguous. This means that, aside from the timing of intervention, governments should also be concerned with the type of interventions they choose.

The main challenges for further research are twofold. First, though not an easy task, it seems worthwhile to direct research more towards the identification and estimation of all kinds of non-pecuniary spillovers, as they are not taken into account in conventional estimations of the social returns to education. Moreover, most estimates of social returns to education (relative to private returns) have been carried out for the US. This type of research should be extended to other countries as well, so that we can judge the case for more government intervention elsewhere.

Second, we have seen that the number of studies that evaluate all kinds of educational interventions based on a rigorous (quasi-)experimental approach has increased rapidly during the last decade or so. However, this new experimental literature does not cover the whole spectrum of interventions. Moreover, effects of a particular program found in one country need not to occur in another country, which may be due to differences in educational systems for example. This calls for setting up more controlled experiments domestically. An alternative is to broaden the search for so-called *natural experiments*, that may arise from certain discontinuities in the distribution of educational resources for example. This will improve our understanding of which interventions work and which not.

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