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Financing lifelong learning: Funding mechanisms in education and training

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Financing lifelong learning: Funding mechanisms in education and training*

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Abstract

This report provides an overview of available evidence on funding mechanisms in education and training. The focus is on empirical evidence relevant for European education institutions. The report covers important research issues for primary and secondary education, higher education, and adult learning. We draw conclusions on the advantages and drawbacks of a wide range of funding mechanisms, including tax incentives, grants and subsidies, loans, and individual learning accounts. The advantages of funding schemes are evaluated with respect to efficiency, quality, equity, and sustainability.

JEL-codes: H23; H7; I2; J24;

Keywords: Lifelong learning; Education finance; Education performance

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Executive summary

This report presents major findings in the empirical literature on funding mechanisms in education and training. The focus is on evidence relevant for efficient and equitable provision within European education institutions. The report covers primary, secondary and higher education in addition to adult education and training.

Primary and secondary education

Centralized funding contributes to more equal education spending across regions and local governments than decentralized funding. On the other hand, decentralized funding seems to provide better incentives to improve school quality. In particular property taxation seems to be a discipline device for school providers, probably because school quality capitalizes into house prices and thereby increases property tax income. There is potentially an efficiency-equity trade-off in the choice of finance scheme.

The main funding mechanism with centralized finance and local provision is grants. The evidence indicates that grants are mainly used on public spending and not on reduced local tax rates; “the money stick where it hits”. This “flypaper effect” is essential for centralized finance to equalise spending; grants are not mainly used on tax reliefs. The size of the flypaper effect, however, depends on the degree of tax discretion for local governments. Thus, the efficiency-equity trade-off in the choice of finance scheme is not easily avoided since the leakage of grants to tax reliefs seems to be highest when local governments have high tax setting discretion.

Another potential discipline device is financial incentives to students. It does not exist much evidence for primary and secondary education in industrialized countries, but all the evidence clearly indicates that such incentives improve student performance.

Optimal school size in terms of spending is large and about the size of the largest schools observed. However, the importance of school size for student performance is mixed. Some evidence indicates that small schools have lowest performance even in cases where school consolidations imply less competition across schools.

Demographics affect the demand for education spending. One may be concerned about the willingness and possibility to fund education in an aging society. The empirical evidence on the demand for education spending suggests that such a concern is misplaced. Even though the evidence clearly indicates that a larger share of elderly in society *decreases* education spending per student, the evidence also shows that a smaller share of students in the population *increases* spending per student. Since a larger share of elderly and a smaller share of students in most cases go hand-in-hand in an aging society, the effect on spending per student will tend to cancel out.

Higher education

Higher education is investment in future wage premiums. It is heavily subsidized in Europe despite the fact that the private return to higher education is significant.

We review the literature on how students react on changes in tuition fees and student aid. Evidence on student behaviour is critical in order to judge different arguments for subsidizing higher education to the present extent. The typical finding is that rising annual tuition fees with 1000 euro or reducing student aid with 1000 euro decreases enrolment in higher education by about 5 percentage points. The responses to aid and tuition are of about the same magnitude, and the evidence indicates that student behaviour in this respect is independent of socioeconomic background. The results are consistent with students considering education as an investment and behave rationally.

Public student loan systems will provide liquidity to the students and overcome inefficiencies in private provision. The systems with the best equity features are income contingent loans and graduate taxes. With income contingent loans, repayment depends on achieved income. With graduate taxes, students receive a grant that they repay as a special tax on income after graduation.

The literature includes several arguments for subsidizing higher education. The least controversial argument is the income tax-wedge. Regarding all other arguments it is possible to question whether they are real at all. The best argument is probably that higher education might foster dissemination of knowledge. It is however difficult to quantify the size of such externalities, and it may even be argued that they are very limited. Overall, the literature clearly shows that the costs should be shared between the governments and the individual students. In addition, decentralizing decisions on tuition fees to the higher education institutions may enhance competition as a discipline device.

Adult learning

In line with the approach in Schlotter et al. (2009), we focus on evidence that comes from studies that make use of a credible comparison group. Doing so reveals that the available evidence is very fragmented. That is, however, not due to our approach but is the current state of knowledge. Not hiding this, for instance by over-interpreting results from studies that do not meet the standards, makes clear that more and often a different type of research is needed.

To stimulate lifelong learning activities of adult workers, it is often believed that simply making such activities available at a low price provides insufficient incentives. Instruments such as vouchers and individual learning accounts give potential learners a very explicit confirmation of their increased purchasing power. This should strengthen people's awareness of the availability and importance of learning activities. Evidence

from England confirms that simply making training available at a low price (or even for free) indeed does not provide sufficient incentives, at least not to the low skilled employees at which this program was targeted. Perhaps even more surprising is that this is the case despite the fact the program included an element of information, advice, and guidance to employers and employees.

The most convincing evidence regarding vouchers comes from a policy targeted towards American veterans. The evaluation finds significantly positive effects of vouchers on college attainment. It is questionable, however, to what extent the results would carry over to the current situation in Europe. After all, the policy took place more than 35 years ago, veterans are a rather specific group, and the education system in the US is markedly different from that in Europe.

In Switzerland and the Netherlands, interesting experiments have been conducted to measure the effects of individual learning accounts. Although the experiments differ in the people being eligible, the studies find a remarkably similar inefficiency. The studies conclude that more than half of the redeemed vouchers used for training would have been paid by the individuals (or their employers) themselves.

A less explicit way of subsidizing learning activities is in the form of tax deductions. Existing evidence is restricted to the Netherlands. An age dependent tax deduction for firms appears to have led to postponement of training activities rather than to an increase. An income tax deduction for individuals appears to have substantially positive effects on training participation. This may be due to the fact that this instrument is available to everyone while the other policies are typically aimed at specific groups of low skilled workers.

1. Introduction

Education and training is an important policy area. In economic terms, about 11 percent of total public expenditures are used on education on average across the EU countries (EU, 2009), ranging from below 10 percent in Germany, Italy and Luxembourg to above 15 percent in Cyprus and Denmark. This review discusses education finance issues for education and training; from compulsory schools to adult learning.¹ The focus is on empirical evidence relevant for European education institutions. Our interest is on efficient and equitable provision of education and training. The concept of efficiency relates inputs and outputs in a production process. In our context the inputs of interest are funding mechanisms of education and training, while relevant output measures include student achievement, educational attainment, employment opportunities, and wages.

Research questions in the literature are extensive and typically specific to each educational level. For primary and secondary education, our focus is on financing systems and demand for spending. For higher education, we cover the issue of private versus public funding. Adult training is at the outset a private responsibility, and our focus will be on the effects of subsidies and tax incentives. All these issues are lively research areas, and we concentrate on studies that make use of carefully constructed comparison groups (cf. Schlotter et al., 2009).

2. Financing primary and secondary education

Primary and secondary education can be financed in many different ways. When education is the responsibility of the central government, it is financed directly by national tax income. In most countries, however, local governments are at least partly responsible for this educational level. Then the financing can be based on local taxes or on grants from the central government. The grants can take two principally different forms; they are either unconditional or conditional on local government decisions. Conditional grants are typically related to how much the local government spend. The typical setting is that local governments are financed by all these means.

Decisions on education spending are taken by elected politicians in political institutions. Citizens' preferences for educational services and education spending are transformed into actual policies through some kind of political processes. In order to understand aspects of these processes empirically, a theoretical framework to guide specifications

¹ Early childhood education prior to compulsory education is not captured by this review. For surveys of the literature on economic impacts of early childhood education, see for example Wössmann (2008) and Heckman et al. (2010).

of empirical models would be helpful.² In the lack of stringent theoretical models, however, empirical papers typically confine themselves to establish empirical regularities. Such empirical models include important elements in the budget constraint of governments in addition to various demographic characteristics.

The main interest is in causal effects on education spending and on student achievement. Revealing causal effects requires careful empirical designs as explored in, e.g., Schlotter et al. (2009). Policy interventions, which have become standard to exploit in order to estimate causal effects in micro-econometric models, are however not used extensively in public finance. One is often interested in understanding the institutions deciding on interventions, and then the interventions cannot be regarded as exogenous. Several papers use a difference-in-difference approach instead based on panel data. For example, panel data on local governments include information for several years, and the difference-in-difference approach will difference out possible important unobserved and hard-to-measure factors, such as political tastes and geography. Another way to circumvent the potential flaws of unobserved variables has been to study responses of local governments to interventions decided by the central government. One example of such interventions is grant reforms. Finally, some papers use the instrumental variable approach in order to identify the causal effects of interest on a particular subset of the variation in data, i.e., variation that can be considered as exogenous.

This section firstly discusses results from demand functions for education spending, including responses to changes in income, grants, and demographics. Thereafter we present evidence on the allocation of resources across schools. Thirdly, since local governments are responsible for primary and secondary education in most countries, centralized financing of education spending via grants vs. decentralized financing by local taxes is discussed.

2.1. Demand functions for education spending

The first studies on demand functions in education utilized cross-section variation across school districts to estimate income elasticities, grant effects, and some other parameters. The typical income elasticity estimated is about 0.5, see for example

² The workhorse model to understand public sector decision making has been the median voter model in which the outcome is in accordance with the preferences of one decisive voter. Bergstrom and Goodman (1973) specify a set of assumptions in order to estimate demand functions for public sector services in the median voter framework. One of the critical assumptions is that the decision problem is unidimensional. Reviews of the appropriateness of the median voter model as a starting point of empirical work include Craig and Inman (1986) and Rubinfeld (1987). While the median voter model may be reasonable for school districts in the US which only purpose is to provide educational services, it is more problematic in a European setting since education is typically provided by multi-purpose governments. Political decisions involve bargaining within legislatures and with interest groups, restricted by institutional characteristics (Romer et al., 1992, Von Hagen, 1992). In addition, spending decisions may involve a common pool problem in which the benefits are concentrated to specific geographical areas (local government) or specific groups, while the costs are financed by general taxation (Weingast et al., 1981).

Ehrenberg (1973) and Feldstein (1975). The result implies that if the income increases by, say, 10 percent, education spending increases by 5 percent. Wealthy districts have higher education spending than poor districts, but the difference in education spending is smaller than the difference in private income. Later studies using cross-section data confirms that education is a normal good with income elasticity below unity.

Studies estimating dynamic models of education spending find higher income elasticities. Falch and Rattsø (1997) investigate the development of spending per student in primary education in Norway in the period 1880-1990. They use aggregate data and distinguish between spending components decided at the central and at the local level. They find that teacher wages is positively related to GDP per capita and that in particular the number of teachers per class responds strongly to the long run growth in GDP. The income elasticity with respect to total spending adds up to above two. Heinesen (2004) estimate a dynamic panel data model for Danish local governments for the period 1984-1996. He finds a long run income elasticity of about 1.3 when income is measured as the sum of private income and grants. However, the effect of grants is much larger than the effect of private income.

2.1.1. Grants

In most countries, grants are the main income source of local governments. It is an important distinction between lump-sum grants and matching grants. Lump-sum grants, often called block grants, are unconditional for the local government. Decisions on how to spend the grants are independent decisions. Lump-sum grants can be used on education or other local public services. In addition, increased lump-sum grants can be used to reduce local taxes. In fact, economic theory based on traditional utility maximization behaviour implies that one additional euro in private income and one additional euro in lump-sum grants have exactly the same impact on spending on local public services. In the former case the number of euro taxed will increase while in the latter case it will decrease, but in such ways that private after-tax income will be the same. A critical assumption for this result is that there is some degree of local tax discretion.

Matching grants are conditional on some specific local government behaviour. They affect the relative prices facing the local government. Matching grants typically pays the local government a share of the spending on a particular service.

The usual finding in the local public finance literature is that the effect on spending is larger of increased lump-sum grants than of increased private income. This is labelled the flypaper effect; “money stick where it hits”. Early contributions are Pommerehne and Schneider (1978) on Swiss data and Wyckoff (1991) on Michigan school districts data. Hines and Thaler (1995) and Inman (2008) present overviews of the flypaper literature.

More recent contributions have forcefully argued that grants are often endogenous in the sense that local governments can influence the grant they get. Traditional models do not take into account that grants can be decided in negotiations between central and local politicians and that some unobserved local socio-economic characteristics might affect both how the grants are allocated across local governments and the spending and taxation decisions.

Ladd (1993) appears to be the first attempt to overcome the potential endogeneity problem. She exploits a change in the federal taxation rules in the US in 1986 as a natural experiment. One part of the tax reform was to broaden the federal tax base. This implied a significant revenue windfall for the states which used the federal tax base for their own income taxes. Without any flypaper effect, the states would reduce the tax rate such that private consumption and state spending did not change. However, Ladd finds a significant flypaper effect. One additional dollar in tax windfalls led states to retain 40 cents more than they have in the absence of the windfalls.

Evans and Zhang (2007) utilize that many US states with state lotteries earmark lottery profits for primary and secondary education. Using the yearly variation in lottery profits, they find that 50-70 percent of an additional dollar in earmarked lottery profits is transferred to local school districts, and that spending per student increases by 80-100 percent of these grant windfalls. Gordon (2004) investigates the effect of exogenous changes in the US federal grant to primary and secondary education. The grant is determined by decennial census data on child poverty which changes every 10 years. The grant level for the individual school districts changed in 1993 as a result of new census data available. Exploiting this discontinuity, she finds that increased grants boost total instructional spending about dollar for dollar the first year. Three years later, however, the local revenues seem to have declined considerably, and the instructional spending is not significantly different from the initial level.

Another study that also finds limited support for the flypaper effect is Lutz (2010). He exploits a school finance reform in 1999 in New Hampshire that increased state grants by about 200 percent, a reform mandated by a New Hampshire Supreme Court decision. New Hampshire has no state-imposed limitations on the taxing or spending behaviour of local governments, and school districts budgets are set directly by voters in referendums and not by elected representatives. Lutz (2010) finds that about 90 cents per grant dollar are spent on tax reduction and only 10 cents on education.

Few European studies on causal effects of grants seem to exist. The exception is some studies from Sweden. Dahlberg et al. (2008) exploit a discontinuity in the Swedish grant system. Local governments with out-migration rate above a certain level receive extra

grants. Identifying grant effects on this discontinuity, they find that federal grants increase local spending about one-to-one without any effect on local taxes.

Overall, it seems like there is a flypaper effect in most cases, but that there are instances where higher grants are used to mainly reduce taxes such that increased grants have about the same effect on education spending as increased private income. The evidence indicates that the size of the flypaper effect is related to local political institutions. Dahlberg et al. (2008) argue that flypaper effects can be “rational” when the central government has better tax instruments than local governments. Other studies have found that the size and existence of flypaper effects depend on the political and bureaucratic structure of the local governments (Strumpf, 1998, Tovmo and Falch, 2002). In addition, one would expect to find flypaper effects when there are important restrictions on local tax policy.

2.1.2. Demographics

Another central issue in demand functions for education spending has been the effects of demographic factors. An aging population will increase the political pressure to tilt the composition of social spending in favour of the elderly, which potentially sacrifice on education. On the other hand, the number of students per capita is a cost factor in educational production. When the student share increases, it becomes more expensive to provide a given school quality. The young and the old “compete” for scarce public sector resources.

Poterba (1997) examines total spending on primary and secondary education at the US state level in a panel data framework. States that experience high growth in the population above 65 years appear to have lower growth in education spending than other states. All else equal, states with more elderly spend less on public schools. Regarding the share of the population of school-age children, Poterba finds a very strong negative effect on spending per student. His results indicate that spending per capita is almost independent of the number of students. Harris et al. (2001) estimate a similar model using school district data instead of state level data. They find smaller effects than Poterba (1997) both for the share of elderly and the share of school-age population.

There are a number of reasons why elderly may support public education. The elderly are altruistic to some degree, better education are likely to be capitalized into the value of the homes, and quality education may boost economic growth which in turn helps finance public pension schemes and health care. Brunner and Baldson (2004) use survey data from California in an attempt to distinguish between potential mechanisms. Similar to the findings of Poterba (1997) and Harris et al. (2001), they find that older voters relative to younger voters are more willing to support local spending on schools than state spending. They also find that homeowners to a larger degree than others support

local spending but not state spending, in accordance with the hypothesis that capitalization of school quality into housing values motivates elderly to vote for education spending. The latter difference in support is most common for elderly, which is in accordance with the altruistic behaviour hypothesis.

A negative effect of the share of students in the population on spending per student is the typical finding also in European studies. That is the case in panel data analyses of Norwegian primary and lower secondary education (Borge and Rattsø, 1995) and upper secondary education (Falch and Rattsø, 1999), general education in Russia (Verbina and Chowdhury, 2004), and for primary and lower secondary education in Denmark (Heinesen, 2004, Borge and Rattsø, 2007) and Switzerland (Grob and Wolter, 2007). These results clearly suggest that it is a disadvantage to be in a large cohort. For example, using data for Swiss cantons during the period 1990-2002, Grob and Wolter (2007) find that when the share of school-aged population decreases by 10 percent (about 1 percentage point), spending per student increases by 4 percent.

The European studies find in addition typically that the share of elderly decreases spending per student. For example Grob and Wolter (2007) find about the same numerical effect of the share of retired people as the share of school-aged population.

Kempkes (2010) analyses a case that has close similarities with a natural experiment. After the German unification, the fertility rate dropped considerably in East Germany, but did not change much in western Germany. The number of primary school students in East Germany dropped by 50 percent from 1993 to 2002. This is clearly a large shock to the education system. Kempkes find a relatively fast adjustment in spending per student. The elasticity of spending per student with respect to the number of students during this period is estimated to about -0.27, which implies that a fall in the number of students by 50% decreases total spending by 36.5 percent. This is a stronger response in total spending than the typical estimate in the literature predicts. In particular, the number of full-time equivalent teachers responded strongly to the fall in the number of students, while spending on school infrastructure adjusted more sluggish.

Overall, the evidence shows that education spending does not adjust proportionately to changes in the student cohort size. Small cohorts experience higher spending per student than large cohorts, all else equal. Most studies find that education spending adjusts slowly to the change in the number of pupils, but the evidence from the East German shock in the number of students indicates that the point estimates must be interpreted with care. The evidence also shows that aging of the population works in the opposite direction. More elderly will put pressure on spending per student.

2.2. Allocation of education resources

Set aside the political processes determining overall spending on education, how are resources distributed across schools, and how should they be distributed? Interesting questions include: What does it cost to deliver education of a certain quality? What does it cost to bring specific demographic groups to a certain level of achievement? In economic terminology, such questions can be addressed by knowledge about the “cost function”. A cost function is defined as the minimum cost necessary for production of every output level. The concept is originally developed for profit-maximizing firms.

For example Duncombe and Yinger (2005, 2011) claim to estimate an educational cost function for education. Unfortunately, it is hard to imagine the possibility of estimating reliable cost functions for education (Costrell et al., 2008, Falch et al., 2008). Education production is as yet only partly understood, and important aspects of the production technology in education remain a “black box”. One problem is that the outcome is hard to measure in a complete way. Even though student achievement and some other measures are used in the present research, such measures do not capture the full set of the cognitive and non-cognitive skills of the students. Secondly, it is by no means clear that the objective of the decision-makers (e.g., school principals and local governments) is to produce skills in a least cost way. One interpretation of the seemingly weak link between resource use in schools and student achievement found in the literature (see below) is that the decision-makers take other objectives into account. In addition, it is in general not easier to estimate the effect of skills on costs than to estimate the effect of resource use on achievement. In the literature on the latter, the empirical results are mixed even with reasonable credible identification strategies.

Even though school level data hardly can be used to estimate cost functions, they may yield other interesting insight. Models of costs that do not include outcome measures can be seen as reduced form models in the sense that the same factors determine both the costs and the outcomes.

One issue that has received considerable attention in the literature is economies of scale. Andrews et al. (2002) review the literature from the US at the school district level and conclude that costs per student are minimized for about 2000–6000 students in the school district. For England, Taylor and Bradley (2000) use school-level data on staff hours per student. They find that the cost-minimizing school size is around 1600, which is about the size of the largest schools in England. They also find a strong negative effect on spending per student of school capacity utilization. Falch et al. (2008) finds that teaching hours per student in Norway is sharply decreasing for school size up to about 200 students in a model only utilization variation across schools within the same local government. They conclude that the optimal school size is above 800 students, which is largest school size in the country.

Both Taylor and Bradley (2000) and Falch et al. (2008) include characteristics of the student body composition in their models. Both papers find that the teacher intensity for students with special needs is about twice the average intensity, and that the teacher intensity is larger for minority students than for other students. The effect on costs of minority students is found to be larger in Norway than of having English as the second language in England.

These studies implicitly estimate parameters of the models used to allocate funding across schools. Little evidence exists, however, on whether funding models and school size have an impact on student achievement. Some education production function studies have simply included school size as a control variable, and the overview in Andrews et al. (2002) shows that the estimated effect of this variable is mixed. Berry and West (2008) use a more credible identification. They utilize that school consolidation in the US has occurred in different time periods in different states. Their findings indicate that increasing school size by school consolidation reduces both the years of completed education of the students and the return to education in terms of earnings.

The analysis of de Haan et al. (2011) is related both to school size, school choice, and competition. They exploit a change in the funding model of schools in the Netherlands to estimate the effect of the number of schools in a given geographical area (municipality) on student achievement. Dutch schools are funded by the state according to a formula based on the number of students enrolled. The same rule applies for private schools (mainly religious schools), which is in majority, and public schools. There is no additional funding from local governments, no tuition fees, and parents can freely choose the school for their child. The formula determining the minimum school size in order to be eligible for government funding changed in 1994. Both the new and the old formula were related to the density of the population, but the new formula implied that the minimum school size increased for almost all school locations. As a result, some schools closed, some school merged, and the average school size increased. At the same time, since the number of service providers decreased, the competition in the market decreased. de Haan et al. find that the reduction in the number of schools induced by the change in the funding formula significantly increased student achievement. They interpret the finding as evidence of scale economies; educational quality is increasing in school size. The economies of scale dominates potential negative effects of reduced school competition.

The apparently different effect of school size in Berry and West (2008) and de Haan (2011) must be interpreted with respect to the variation in school size they use for identification. Berry and West use variation around mean school size while de Haan et al. exploit variation at the bottom of the distribution of school size.

2.3. Centralized vs. decentralized finance

Should financing of education be the responsibility of central or local governments? The share of funds towards primary and secondary education provided by the central government varies greatly across the European countries. According to OECD (2010), central government funds financed over 70 percent of the spending in primary and secondary education in Austria, Ireland, Italy, Luxembourg, the Netherlands, the Slovak republic and Slovenia. On the other hand, central government funds finance less than 30 percent in Belgium, the Czech Republic, Germany, Iceland, Norway, Poland, Spain, Switzerland and UK. For the latter countries, the finance responsibility is mainly at the regional level in Belgium, Czech Republic, Germany and Spain, but at the local level in Iceland, Norway, Poland and UK. It must also be noted that even though the funds formally are raised at the local level, the local tax rates may be regulated by the central government.

Oates (1972) argues that more decentralized political decision-making allows better adjustment of supplies to locally heterogeneous demands. For services without spillovers across local governments, decentralized decisions contributes to allocation efficiency. There are several other arguments for decentralisation put forward (Oates, 2005). For example Seabright (1996) argues that the main advantage of decentralization is that it makes it is easier to hold decision-makers accountable. Hoxby (1999) provides a related argument. In her model, public school efficiency is higher with decentralized finance by local property taxes than with centralized finance since mobility decisions of the citizens reveal important information on local preferences and work as a discipline device for school providers. With property taxation, Tiebout mobility generates verifiable demand information that is useful in order to manage the productivity of local schools, information which is costly or impossible to gather with centralized finance. Property taxation links school quality to school finance. Fischel (2001) notes that with property taxation adults without children at school have an interest in schools using their resources efficiently since education quality is capitalized in house prices.

In the US, primary and secondary education is traditionally financed by local property taxes. During the latest decades, state grants have become increasingly important to a large part because of legislative decisions that find local finance unconstitutional. Hoxby (2001) argues that this school finance equalization reform is “probably the reform that has most affected American schools over the past 30 years” (p. 1189).

2.3.1. Education spending

A court case in California in 1971, which ordered the state to develop a system where school spending did not depend on school district wealth, launched the school finance reform. The following reform in California has motivated a large research literature. Fernández and Rogerson (1999) use a model where the quality of education is a

function solely of spending per student, and the families care about the quality of education in addition to consumption, to compare pre-reform and post-reform school finance systems. In the model, education finance and tax decisions are taken according to a majority rule (the median voter model). They conclude that the distribution of spending is more equal with centralized finance, mainly at the cost of reduced spending in wealthy school districts. Only a small fraction of the school districts will experience significantly higher spending under centralized finance than under local finance.

Silva and Sonstelie (1995) clarify the mechanisms. Given that citizens partly sort themselves across school districts with respect to their income (Tiebout mobility), the difference between median income and average income is larger at the state level than in the typical school district. In a majority rule model where the decisive voter has median income, the effect on overall spending of a change from decentralized to centralized finance depends on the size of an income effect relative to a price effect. The income effect is negative because the median income is further below the mean income, while the price effect is positive in a progressive tax system since the tax share of the median voter becomes lower. The relative size of these effects depends on the income distribution and the tax system. Little progressivity of the tax system and large income differences between school districts work in the direction of a large income effect and a small price effect, and thus low spending in a centralized system.

In a setting not relying on a particular decision making model, but merely on a description of the changes in school finance equalization schemes, Hoxby (2001) reaches a similar conclusion. She shows that whether equalization reforms decrease or increase spending depends on how grant and tax regimes are designed.

The finding for California that spending declined is, in fact, not replicated in studies comparing US states with decentralized and centralized finance. Murray et al. (1998) and Card and Payne (2002) find that court-ordered finance reforms reduced within-state inequality in spending by raising spending in the poorest school districts, mainly leaving spending in the richest districts unchanged. Thus, average spending per student is higher in states that increase the funding responsibility of the state. Card and Payne (2002) interpret this finding as a flypaper effect. They find that a one-dollar increase in state grants increases district education spending by 50-65 cents. Local taxes only slightly decline. The estimates are based on models that identify the grant effect by court rulings.

The US evidence clearly indicates that the geographical distribution of the education resources is lower under centralized finance than under decentralized finance. The evidence also shows that there is not a monotonic relationship between education finance systems and total resource use in education. Centralizing the funding responsibility seems to have decreased spending in the California but increased

spending in a typical state. The design of local tax systems is probably important. As a response to the court lead reform in California, strict limitations were imposed on property taxes which essentially turned the local property tax into a state-wide tax (Sonstelie et al., 2000).

In Europe, education finance has traditionally been a responsibility for the central government. Using arguments for political accountability and efficiency, several countries, including Spain and Sweden, have initiated processes of decentralization.

Sweden decentralized education finance in the early 1990s. The formal responsibility for primary and secondary education was transferred from the central government to the local governments. The local governments became financed by lump-sum grants and local income taxes (Björklund et al., 2004, Ahlin and Mörk, 2008). The wage setting of teachers was decentralized in the same period. Sweden is now considered to have one of the most decentralized schooling sectors in the OECD. Björklund et al. (2004) find that the distribution in education resources across local governments widened during the 1990s, in particular at the bottom of the distribution. This result is in line with the US evidence. Ahlin and Mörk (2008) investigate whether the local tax base and grants affected school resources differently as decentralization took place. They find that the reform did not change the effect of the local tax base on education resources per student. However, the effect of grants decreased. The results for the grants are probably at least partly related to the fact that the decentralization reform replaced matching grants with lump-sum grants.

2.3.2. Education performance

An important question is whether the finance system per se influences student performance. The incentive to local governments and schools to use resources efficiently may depend on the finance system as suggested by, e.g., Hoxby (1999) and Fischel (2001). Sonstelie et al. (2000) finds that the achievement of students in California relative to the rest of the US declined after the centralizing reform, but conclude that the decline cannot necessarily be blamed on state finance. Disentangle the effect of the school finance reform from the effect of other changes, including changes in overall resource use, is challenging.

Husted and Kenny (2000) use state level panel data on student achievement during the period 1987-1993, a period of finance reforms in many states. They find that state-induced spending equalization lowers student achievement. Hall (2007) uses a cross-section of school districts in Ohio to investigate a similar issue. He investigates whether the percent of school districts' revenue from local sources and the share of the property that is classified as residential or agricultural have an impact on student achievement. The latter measure, conditional on the percent of local revenue, is strongly related to the

importance of property taxation. Hall (2007) finds that both measures are related to higher test scores.

Since a variety of unobserved factors are likely to be correlated both to the design of the equalization regimes, local tax policy, and student achievement, the result of studies such as Husted and Kenny (2000) and Hall (2007) must be interpreted with care. Card and Payne (2002) overturn this problem by investigating effects on the difference in achievement across groups of students with different level of parental education. They investigate whether school spending equalization within a state influence the achievement gap across the groups. They interpret their results tentatively, but the results indicate that centralization reforms reduce the achievement gap between students with highly-education and poorly-educated parents.

Hoxby (2001) look at high school dropout rates. Like Card and Payne (2002) she avoids investigating the effects of school finance reform directly. Hoxby estimates the effect of changes in the funding equalization schemes implicit in the state specific financial system, and finds weak effects. She concludes that the results “hint that equalization improves student achievement the most (perhaps only) in schools that would have very low spending if left to their own devices” (p. 1228). The results on average achievement by Husted and Kenny (2000) and on the distribution of achievement in Hoxby (2001) and Card and Payne (2002) are consistent only if equalization is achieved by reduced performance at the top of the student achievement distribution.

Fiva and Rønning (2008) exploit that in Norway only some local governments have property taxation. In their empirical period the law restricted property taxation to urban areas. Since levying property tax or not was a local government decision, they use official status as town in 1911 and settlement pattern in the local government as instruments. They find that existence of property taxation increases student achievement.

Falch and Fischer (2010) use repeated international comparative achievement tests (TIMSS and PISA) to investigate whether countries’ relative ranking is related to decentralization of the public sector. They measure decentralization as the percentage of sub-national government spending in general government spending, an indicator provided by the World Bank. The relationship is identified by comparing within-country changes in decentralization with changes in student achievement (the difference-in-differences approach). They find that countries decentralizing spending decisions tend to increase the performance of their schools. This result confirms the finding for Switzerland in Barankay and Lockwood (2007). In Switzerland, the cantons are responsible for education, but the share of education spending carried out by the counties in contrast to the cantonal level varies across the cantons. Barankay and Lockwood show that spending decentralization within the cantons is highly correlated

with legal local autonomy. In their empirical analysis using panel data, they find that the change in the share of the population obtaining university entry qualification is positively related to increased spending decentralization.

The Spanish constitution of 1978 laid down the foundations for decentralized responsibilities. According to Peña and Solé-Ollé (2009), the decentralization process, however, lasted for almost two decades. Historic autonomous regions, as for example Catalonia, got power over education policy right after the new constitution was established, while the decentralization of power to the other regions, as for example Madrid, was achieved much later. Peña and Solé-Ollé (2009) utilize the different timing of decentralization to identify the effect on educational attainment measured as the rate that stay-on in education after the end of compulsory education. They find no effect on the total stay-on rate. However, decentralization decreased the share of the cohorts enrolling in vocational training programs while the share of the cohort which stay-on to study *Bachillerato* increased.

2.4. Financial incentives for students

Financial rewards to students depending on achievement or attainment may be an efficient way to improve student performance. Several systems with conditional cash transfers have been in place in developing countries (see Oosterbeek and Patrinos, 2008, for an overview), but such incentive systems are less common in OECD countries.

A conditional cash transfer program was introduced in 15 out of 150 local education authorities in England in 1999 for 16- to 18-year-olds who remained in full-time education (the Education Maintenance Allowance, EMA). The benefit was means-tested and only available to students with low-income parents. The maximum weekly payment was £40. Deardon et al. (2009) evaluate the pilot and find that the cash incentive substantially raised the stay-on rates after the end of compulsory education. In the first year (year 12 of education), the participation rate increased by about 4,5 percentage points, while the proportion receiving two years of education increased by about 6.7 percentage points. EMA became available nationwide in 2004.

Angrist and Lavy (2009) analyse a randomized trial towards low-achievers in Israeli high schools enrolled in the academic track. Passing the matriculation requirements in Israel qualify for post-secondary education. The maximum cash benefit for matriculation was about \$1400. They find that the cash benefit generated a substantial increase in the matriculation rate for girls, but had no effect on boys. They argue that the achievement award clearly had positive social return.

Bettinger (2010) investigates a randomized experiment in a poor community in Ohio which provided cash payments to students in grades 3-6 for successful completion of their standardized testing. Each year the students take five different achievement tests.

Eligible students received \$15 for each test on which they scored proficient or better. Bettinger find a strong effect of the cash incentive on test scores in mathematics, but no effect in reading, science, and social science.

2.5. Concluding remarks

Education spending is of interest at least because; (i) it constitutes a large part of government budgets; (ii) analyses of spending behaviour helps understand public sector decisions making; and (iii) spending must at some level be related to education quality. The literature on the latter issue, the effect of resource use on student achievement, is large and is not covered by the present paper. However, literature reviews, as offered by for example Hanushek (2003) and Krueger (2003), clearly indicate that there are great many circumstances in which increased spending do not improve student achievement.

The literature reviewed here clearly indicates that centralized funding of education contributes to more equal education spending across local governments. On the other hand, decentralized finance by property taxation provides better incentives to improve school quality. There is potentially an efficiency-equity trade-off in the choice of finance scheme which is not easily avoided since the leakage of grants to tax reliefs seems to be highest when local governments have high tax autonomy.

The centralizing movement of education finance in the US equalized education spending partly because grants to a large degree where used on spending and not on reduced local tax rates. Such a “flypaper effect” seems to be depended on political structure and the efficiency of local taxes available for local governments, and in many states local property taxation became less efficient for the local governments as part of the centralizing reforms. It is a challenge to restore local incentives when the central government heavily redistributes resources. One important discipline device for school providers in a decentralized system is that inhabitants can choose to move to another local government. This indicates that some other discipline device is necessary for efficient provision of education under centralized finance. One such device that show some promise is school choice of some degree for students and parents. Another is financial incentives geared towards the students.

One may be concerned about the willingness and possibility to fund education in an aging society. The empirical evidence on the demand for education spending suggests that such a concern is misplaced. Even though the evidence clearly indicates that a larger share of elderly in society *decreases* education spending per student, the evidence also shows that a smaller share of students in the population *increases* spending per student. Since a larger share of elderly and a smaller share of students in most cases go hand-in-hand, the effect on spending per student will tend to cancel out.

3. Financing higher education

Higher education is heavily subsidized in the European countries despite the fact that the private return to higher education is significant. Some arguments for subsidies can be found in the optimal tax literature. A redistributive income tax implies that the after-tax return to education is lower than the effect of education on productivity as reflected in gross wages. Income tax is a distortion to education decisions, and education subsidies can be used to restore the distortion. Intuitively, the more progressive the income tax, the higher is the optimal education subsidy to eliminate the tax-wedge on education (Bovenberg and Jacobs, 2005). Obviously, this argument alone cannot account for very low tuition fees, or even absence of tuition fees, as one observes in many European countries.

Education subsidies can also be used to correct for non-tax distortions of various kinds. One argument for subsidy is that education has positive externalities by fostering dissemination of knowledge as in endogenous growth models (Lucas, 1988, and Romer, 1990), but education may also have elements of signalling information yielding over-investment since the true return to education is lower than observed wage differences suggest (Spence, 1973). Another issue is risk. The return to education is uncertain at the individual level, and thus risk-averse students will underinvest (Levhari and Weiss, 1974). The case that education hedges against labour market risks works in the opposite direction (Jacobs et al., 2009). Other popular arguments for education subsidies are; (i) imperfections in the capital market implies that families with low parental income cannot afford tuition fees and living costs of students; (ii) students are myopic in the sense that they give too low value to future outcomes relative to the outcomes close in time; (iii) students are debt averse; (vi) education contributes to income equality since the supply of high-skilled labour increases and the supply of low-skilled labour decreases.

The size of non-tax distortions influencing human capital investment decisions cannot be established by theoretical work. It is even uncertain whether externalities, risks, labour supply effects, and equity considerations work in the direction of high or low optimal subsidies. Stringent empirical work on these issues is, however, difficult. To a large part the relevant theoretical concepts are hard to observe, and universities and study programs are heterogeneous such that learning can only be indirectly observed in the labour market, but then with a time-lag.

The literature review here is restricted to empirical work on student behaviour. How do students react to increases in tuition fees and student aid? Evidence on whether student behaviour is rational in a sense that is in accordance with viewing education as investment in future income is important in order to judge the relevance of the arguments above. We end this section with a short consideration of those arguments.

3.1. Tuition fees

Underlying all theoretical work is that higher tuition fees, all else equal, reduce enrolment in higher education. The return to human capital investment is reduced since the investment cost increases. The US evidence supports the hypothesis. According to Heller's (1997) review, a typical finding in the literature is that rising tuition by \$100 decreases enrolment by 0.5-1.0 percentage points. Hilmer (1998) estimates an ordered probit model distinguishing between attendance at university, attendance at community college and non-attendance using a national representative sample of senior students at high school. The modelling framework considers average tuition by universities and colleges in the student's home state as exogenous. The results indicate that an annual increase in tuition fees by \$100 reduces university attendance by 1.0 percentage point and college attendance by 0.3 percentage points. Hilmer also find positive cross-price elasticities. Higher tuition at universities increases college attendance, while higher tuition in colleges increases university attendance.

Tuition fees were introduced in England in 1998, and has increased and made more flexible in the recent years. Apparently, the fee changes have been parts of major national reforms in ways that make it difficult to disentangle their effects from other reform elements (Greenaway and Haynes, 2003, Dearden et al. 2008). During this period, England has introduced income contingent students loans, changed the mechanisms for disbursing public funds across universities, introduced grants and bursaries to students, etc.

Two recent papers have analysed the introduction of tuition fees in some German Ländern in 2007. In Germany, universities are the responsibility of the Ländern, and private universities are almost non-existent. In 2005 the German constitutional court ruled that the federal ban on tuition fees was unconstitutional. Shortly after, 7 Ländern passed a law which introduced tuition fees at state universities. The fact that it is within-country variation in fees makes it easier to evaluate their effects. The fees were relatively low, typically 500 euro per semester. To avoid liquid constrained students, the same Ländern also introduced subsidized loan schemes.

Hübner (2009) uses data on all high-school graduates qualified for university studies in Germany and employs a difference-in-difference strategy. The strategy takes into account all factors of each Länder that do not change over time. He finds that the probability to enrol in higher education declined by 2.7 percentage points in the states introducing the fee. This is the relevant effect for the country, but is a lower bond for the Ländern since the high school students could choose to enrol in non-fee states. Taking mobility into account, Hübner finds an average treatment effect on the treated of 4.8 percentage points. The results are of the same magnitude as the US evidence. Dwenger et al. (2009) also use a difference-in-difference approach, but use only East

German Ländern as control group since there historically has been very little student migration between east and west. They use application data for medicine and dentistry studies, and focus on whether mobility decisions are sensitive to the introduction of tuition. The findings indicate that introducing tuition reduces the probability of applying in the home Länder by about 2 percentage points.

A related issue is whether tuition fees have an impact on time to complete a degree. Gariabaldi et al. (2011) use data from Bocconi University, a private university in Milan. The Bocconi students in their data are assigned to one of 12 different tuition levels based on parental income. Gariabaldi et al. compare students close to the kinks in tuition levels in a discontinuity framework. They find that increasing fees by 1000 euro decreases the probability of late graduation with 5.2 percentage points.

3.2. Student aid

Student aid lowers the cost of higher education. Aid schemes are therefore expected to have exactly the opposite effect as tuition fees. Grant and scholarships are typically targeted towards students from low socioeconomic backgrounds. Dynarski (2000) investigates the introduction of a scholarship program in Georgia. In a difference-in-difference framework comparing Georgia to neighbouring states, she finds that an aid of \$1000 increases college attendance rates by 4-6 percentage points. Dynarski (2002) summarizes the US literature and conclude that the best estimates are in the lower bound of the finding in Dynarski (2000). She also shows that subsidy does not have a consistently different impact on low-income individuals than others. The evidence is also mixed on whether the effect of aid is larger or smaller for students from disadvantage backgrounds than for students from the middle class.

Fredriksson (1997) performs a time-series analysis on the demand for higher education in Sweden. In his empirical period, 1967-1991, the interest rate subsidy on student loans and the amount of non-repayable grant varied. The reform in the study allowance scheme in 1989 contributes to this variation. He finds positive effects of predicted university wage premium, relative employment prospects, and the generosity of the study allowance scheme.

Nielsen et al. (2010) investigate the effect of a reform in the Danish student aid system in 1988. Prior to 1988, grants to students below 22 years of age were mean-tested. In addition, the 1998-reform increased the aid considerably. Nielsen et al. exploit that the mean-testing rule prior to the reform implied that the reform had different financial impact on seemingly identical individuals. They find that increasing the aid by about \$1000 increases enrolment by 1.35 percentage points. They argue that one reason why they find a lower response than other studies might be that relatively large grants were in place already prior to the reform.

A change in the federal student aid scheme in Germany in 2001 both increased the number of students eligible for the aid and increased the amount of student aid for those eligible. Baumgartner and Steiner (2006) use a difference-in-difference strategy on data from the German Socio-Economic Panel Study to estimate the enrolment response to the reform. They find a positive but statistically insignificant effect of the reform. Steiner and Wrolich (2008) use the same data source, but relate the educational choice to the predicted student aid based on parents' income. They find a significantly positive effect on enrolment into university of the same size as the US evidence.

Thus, the evidence indicates that students' responses to tuition fees and aid are similar with opposite signs. This is in accordance with a hypothesis that students respond rational on economic incentives. However, some evidence point to some peculiarities in student behaviour. Student loan systems have relative low interest rates compared to all other kinds of loans. Given this feature, it seems to be surprisingly low up-take rates. In the Netherlands, only about 35 percent of available credit is taken out. Booiij et al. (2011) conduct a field experiment where they manipulate the amount of information students have about the student loan conditions. They find that the information provided did increase the knowledge about the student loan conditions, but did not increase the take-up rate. This result indicates that lack of information about loan conditions is not a constraint. In a field study in the US, Bettinger et al. (2009) find that providing information about eligibility is not enough to induce students to apply for grants when the application is complex. The number of applications increases only when students receive direct help in the complicated application process.

3.3. Student loans

The private market for loan to studies is small and almost non-existing. Human capital cannot serve as collateral due to its illiquid and non-trading nature. If a borrower becomes unable to repay the loan, lenders have no security. Another imperfection in a private student loan market is the so-called adverse selection mechanism. Facing the possibility of large losses, lenders will try to discriminate between borrowers. They will offer a higher interest rate to students with the least expected future income and to students that cannot offer some security as for example the parents' house. Thus, a traditional bank market will offer both inefficiently little student loans and inequity since students from low socioeconomic backgrounds will be faced with the worst loan conditions.

Consequently, there is a role for public student loan arrangements to overcome these imperfections. A public student loan system can offer a lower interest rate than private loans without providing subsidies. By covering the whole population of students, public loan arrangements can overcome both the problem of non-collaterals and the problem of adverse selection. This is not an argument for a low and subsidized interest rate that

yields overall losses of the system, but simply that public student loan arrangements will be more efficient and equitable than private alternatives.

Public student loan arrangements take different forms, see, e.g., Oosterbeek and Patrinos (2008). They can be of the mortgage-type, which in principle is equal to traditional loans and is used in the Nordic countries and the Netherlands, or they can be income contingent, such as in England. Mortgage-type loans are required to be repaid in the form of fixed instalment after graduation. Repayment of income contingent loans depends on achieved income. Students repay a percentage of their earnings after graduation. Strong arguments for the income contingent loans are provided by Barr (1993, 2004). One main feature of income contingent loans is that they to some extent insure against low future income. Loans are repaid when the return to education materialize. The risk associated with higher education is therefore reduced.

A third variant is graduate taxes. With graduate taxes, students receive a grant while studying, which they repay in the form of a special tax on income after graduation. Graduate taxes and income contingent loans have many similarities, but graduate taxes provide funding to all students whether they want it or not, and graduates with high income will end up paying more in tax than the grant they received. Graduate taxes are not used in any country (Oosterbeek and Patrinos, 2008).

Another issue is whether students are credit constraints in the sense that some do not enter higher education because they do not have the financial means to pay the tuition fees and the living costs. Research from the US indicates that family credit constraints in a child's college-going years are of little importance in explaining a child's enrolment in college. Carneiro and Heckman (2002) argue that only up to 8 percent of the total US population is credit constrained. The main reason for low enrolment rates of students from disadvantaged background is that they lack required qualifications for higher education studies. Family income during a child's college-going years plays only a minor role in determining socioeconomic differences in college participation. With much lower tuition fees, it is likely even fewer individuals in Europe that do not take higher education because they cannot afford it in the short run. Indeed, this is the finding by Chowdry et al. (2010) for England.

3.4. Concluding remarks

Higher education is investment in future wage premiums. The empirical literature on student behaviour indicates that students mainly react in accordance with an investment model. Enrolment in higher education rises with student aid and declines with tuition. The responses to aid and tuition are of about the same magnitude, and the evidence indicates that student behaviour in this respect is independent of socioeconomic background.

The literature includes several arguments for subsidizing higher education. The least controversial argument is the income tax-wedge. Regarding all other arguments presented above it is possible to question whether they are real at all. This is discussed in, e.g., Barr (2004), Jacobs and van der Ploeg (2006) and Wössmann (2008). Education is a risky investment, but the income uncertainty is probably lowest for individuals with higher education. In addition, the risk can be reduced by income contingent student loans or a system with graduate taxes. Credit constraints do not seem to be important, and imperfections in the capital market are in any case only an argument for public student loan arrangements and not an argument for student subsidies.

Potential students may be short-sighted and count income today too heavily compared to income in the future. However, this argument does not seem to be in accordance with the evidence that students underutilize subsidized student aid and student loan arrangements despite they are well informed (Bettinger et al. 2009, Booij et al. 2011).³ Regarding equity mechanisms, labour market responses to increased relative supply of high skilled labour will give smaller wage differentials. However, such benefits need to be balanced against tax incidence for paying the subsidies (Dur and Teulings, 2004). Low educated will have to pay higher taxes to finance the education subsidy.

The best argument for subsidy in addition to the tax distortion is probably that higher education might foster dissemination of knowledge. It is however difficult to quantify the size of the externalities. Jacobs and van der Ploeg (2006) argue that they are very limited. In a survey of the literature on macroeconomic benefits of a more educated labour force, de la Fuente and Ciccone (2003) conclude that the externalities are likely to be quite large. However, there are imperfections also in other markets, in particular imperfect mobility of capital across countries. Thus, de la Fuente and Ciccone go on arguing that the present economic incentives for investment in education at the individual level are at least not too low in Europe.

There is a substantial return to education for the individual student. Higher education increases earnings and employability (Card, 1999, and Harmon et al., 2003). Then it is indeed reasonable that students bear some of the educational costs. It seems difficult to defend on empirical grounds that higher education funding is a responsibility for governments alone. However, the empirical evidence on the size of non-tax distortions is limited, and thus the optimal division of education costs between graduates and governments is open for discussion. But there is no reason why governments should not provide student loan schemes that hedge against future income risk, in addition to some direct subsidies to higher education institutions.

³ More direct evidence of debt averse students is reported by Field (2009) and Rothstein and Rouse (2010). Field exploits a random experiment for law students at New York University while Rothstein and Rouse use a natural experiment in a US university. The presence of debt aversion is an argument for providing reduced tuition instead of subsidised student loan schemes.

Giving higher education institutions more autonomy by decentralizing the tuition fee decisions could further improve the efficiency of higher education. Few rigorous studies of outcome and efficiency in higher education studies exists, but the cross-country evidence reported in Aghion et al. (2010) and Jacobs and van der Ploeg (2006) indicates that productivity is enhanced by competition in the education market. Student mobility can work as a discipline device for the higher education institutions. Since competition implies that students can choose between real alternatives, competition requires autonomy of the universities.

4. Funding mechanisms for adult learning

This section provides an overview of available evidence and draws conclusions on the advantages and drawbacks of various mechanisms for the funding of adult learning. In reviews of financial arrangements in the field of education, the empirical analysis confines itself often to a description of alleged success stories. We will move away from that custom and instead focus on empirical results coming from studies that use credible strategies to identify the causal impact. By emphasizing this, we will also show that much is still unknown.

The first part of this section briefly discusses what we believe is required to label a study as being credible and why we think this is important. Section 4.2 then reviews the available evidence regarding various funding mechanisms for adult learning. These mechanisms include subsidies, vouchers, individual learning accounts and various tax instruments. Subsidies to providers of education and training and training funds are not included because we are not aware of any study that uses a credible strategy to identify the causal impact of these funding mechanisms. Section 4.3 summarizes and concludes.

4.1. Evidence-based policies

In recent years, the evaluation of policy intervention has gained much attention in scholarly papers, especially in the field of microeconometrics. To identify the impact of an intervention one has to know what would have happened to persons who were exposed to the intervention in its absence. The construction of a credible counterfactual is a difficult task. Just comparing outcomes of those who were treated by the intervention with the outcomes of those who were not treated is likely to be misleading. The reason is that almost always treatment is not provided randomly, but is based on (self-) selection.

An experimental setup with randomized assignment to treatment and control groups is regarded by many as the gold standard to estimate the impact of an intervention. While this is probably true in many relevant applications, it is important to realize that even

such a setup can give biased results if applied mechanically. This is, for instance, the case when there are spillover effects in which outcomes of untreated people are also affected by the policy. An example is that the provision of training for some unemployed persons can reduce the employment prospects of unemployed people who did not receive the training. A design that simply compares treated to controls without being aware the potential spillovers would in this case overestimate the effect of treatment. Another potential problem with the experimental setup is that untreated persons may attempt to obtain substitute treatment. Experimental designs should be set up in a way that such potential problems are addressed.

In addition to the randomized design, other methods operate in the same spirit. In such natural or quasi-experiments, researchers exploit circumstances in which comparable observations are treated differently. In the ideal situation, subjects cannot affect their treatment status. The challenge is to find a source of exogenous variation that affects treatment and has at the same time no direct effect on the outcomes of interest. Attention to evidence-based policies requires consideration about how the counterfactual was constructed. There is only evidence in favour or against policy interventions if it results from research with a carefully constructed control group.⁴

We are aware of the fact that some regard this approach as somewhat rigid. By excluding studies that do not include a carefully constructed comparison group, our approach makes explicit the available evidence is very fragmented. That is, however, not due to our approach but is the current state of knowledge. Not hiding this, for instance by over-interpreting results from studies that do not meet the standards, makes clear that more research is required.

4.2. Results

4.2.1. Subsidies

A simple instrument to try to stimulate participation in adult training is through direct subsidies from the subsidy to reduce the private costs of such training. By restricting eligibility the subsidies can be targeted to certain groups, such as low skilled workers. This is exactly what has been done in England when Employer Training Pilots (ETP's) were established. This program has been evaluated by Abramovsky et al. (2011). The following discussion is based on this study.

Between September 2002 and September 2004, around one third of the English workforce was covered by this instrument, which consisted of four elements:

1. Free or subsidized training to a basic skills or NVQ level 2 qualification

⁴ For an extensive account of this argument, see the excellent review paper of Schlotter et al. (2009).

2. Paid time off for training (funded for either 35 or 70 hours in total)
3. Wage compensation (paid to the employers for a total of 35 or 70 hours time off)
4. Information, advice, and guidance to employers and employees.

The program was run in different Local Learning and Skills Council (LLSC) areas in England, and the generosity of the program varied somewhat across these areas. Depending on the area and the size of the firm, the maximum per trainee compensation varied between GBP 87.50 (for trainees in firms with at least 250 employees in Derbyshire) to GBP 525 (for trainees in firms with less than 50 employees in East London). Tuition fees were paid directly to the training providers, and it ranged from GBP 500 for a basic “Skills for Life” qualification to GBP 1,200 for an NVQ2 in construction. Training providers often played a role in recruiting employers into the ETP program.

The setting of ETP’s in England is of particular interest since 1 in 3.5 employees in Great Britain lack skills equivalent to the basic school-leaving qualification. The United Kingdom has a significantly larger proportion of adults with low qualifications and a smaller proportion holding intermediate level qualifications than countries such as Sweden, Finland, the United States and Germany.

To evaluate the impact of the program on take-up of training, Abramovsky et al. (2011) use a difference-in-differences approach that has been increasingly exploited over the years for the evaluation of public interventions. They compare the change in the take-up of training (whether by employers or employees) in pilot areas from before to after the program to the change in the take-up of training in control areas, conditional on observed characteristics. This approach relies on the assumption that, conditional on observed characteristics, the changes in the provision of training in pilot and control areas would have been the same in the absence of the program. Throughout their analysis, Abramovsky et al. assume that the difference of the outcome growth over time between pilot and control areas, conditional on pre-program observed characteristics, identifies the average effect of the ETP program in pilot areas.

Abramovsky et al. (2011) show that the ETP had no statistically significant effect on the take-up of training among eligible employers and employees in the first 3 years of the program. This implies that the program was associated with very high levels of deadweight (i.e., training that would have been undertaken even in the absence of the ETP). The authors explain this finding by pointing to the fact that it is likely that the program attracted a considerable number of employers who would also have provided this type of training without the ETP offer. And since employers were often recruited by training providers, providers may have approached their usual clients first. Moreover, the amount of funding available under the ETP was capped during the period of this evaluation, potentially limiting the scale of the program.

Abramovsky et al. (2011) also point to the potential drawback that the program led to certified NVQ2 qualification. Certification may make employers reluctant to stimulate this type of training since it may reduce retention by making an employee's skills more verifiable by alternative employers.

4.2.2. Vouchers

The most elaborated and consistent voucher plan applicable to post-compulsory education was proposed by Levin (1983). As in all voucher models, participants receive the entitlements and the funding follows their choices. Implementation will affect both the supply- and demand-side of the schooling market. On the supplyside, new courses will be offered which are aimed at persons who currently do not enrol in post-compulsory schooling.

That such new supply will indeed be offered is shown by experience in the United States with the so-called GI Bill. In a sense, this law constitutes a pilot study with vouchers (O'Neill, 1977). Under the GI Bill, veterans of war are entitled to attend up to 45 months of education during a 10-year period after their active duty. They are entitled to receive an allowance if they attend an accredited schooling or training program. The allowance may be used either to meet the direct schooling costs or to cover costs of living. Many newly established courses have been approved in relation to the GI Bill. Many of these courses were geared towards low-ability veterans, and these courses are believed to have a positive effect on earnings. This contradicts the belief that the voucher mechanism leads to the supply of inferior quality.

Bound and Turner (2002) and Turner and Bound (2003) have looked at the effects of the GI Bill on educational attainment of veterans. Using variation in service during World War II between cohorts, Bound and Turner (2002) estimate significantly positive effects on years of college completed and on the probability of college completion. Turner and Bound (2003) show that this has been accompanied by a widening of the gap in educational outcomes between African-Americans and others.

4.2.3. Individual Learning Accounts

Individual learning accounts (ILA's) encourage savings for education while providing vouchers to people interested in pursuing training. An ILA is a base amount of resources set aside for an individual to use for his or her learning. ILA's can be used to develop knowledge, skills and abilities that increase their human capital.

An ILA initiative ran in the Netherlands since 2001. It involves eight pilot projects, each serving up to 150 people. The project includes contributions from learners, employers, and the state. State contributions are budgeted at about \$400 per learner; employers contribute about \$130-\$400 per learner. The pilots have been confined to

particular training fields. Renkema (2006) conducted an in-depth study of the effect of ILAs on recipients' educational intentions. To this end, he focused on two sectors: elderly care and technical installation services. In the first sector he fails to find any effect at all, for the second sector he reports modest positive impacts on intentions; the experimental condition of respondents accounted for only 5 percent of the variation of educational intention, compared to 27 percent for age and 10 percent for prior participation.

Hidalgo et al. (2011) analyse the impact of training vouchers of d'1000 on the training participation and related outcomes of low-skilled workers in The Netherlands. To this end they exploit data from a randomized experiment that was conducted in four sectors with a majority of low-skilled workers.⁵ Relative to a base training participation rate of 37 percent, receiving a voucher increases training participation by 5 percentage points after one year and up to 17 percentage points in the second year. Together with information about the number of vouchers redeemed, this implies a deadweight loss close to 60 percent. This means that more than half of the ILA's that were used would otherwise have been financed by private parties.⁶

Hidalgo et al. (2011) analysed which characteristics the workers have who participate in training due to receipt of the ILA. It turns out that these workers differ from the people that would also have participated in training without an ILA by being more risk averse, less likely to have an immigrant background and more likely to be unmarried. They also examined the types of training the ILA-recipients and non-ILA recipients participate in, and find that ILA recipients more often participate in training that is general instead of specific. This difference is not only due to the types of training chosen by compliers but mainly to the different types of training chosen by always-takers in response to getting an ILA. This result is consistent with the human capital theory which assumes that workers can reap the benefits from general training while they have to share the benefits from specific training with their employers. It is therefore natural that workers will invest their ILA mainly in general training.

Hidalgo et al. (2011) also analysed the impact of ILA's on workers' wages, their job mobility and their future training plans. Consistent with other recent studies, they find no significant (short-run) impact from ILA's (or training participation) on wages. This may be due to the short time spell elapsed between training participation and the moment wages are measured. It may also be due to the relatively small size of the

⁵ Doets and Huisman (2009) analyse the same experiment. These authors assign people who received the ILA's but in a follow-up survey report to be not aware of that, to the control group. This may bias the results since these unaware persons are probably also less motivated. Because of random assignment such less motivated people were already present in the control group, in which the share of these people is now doubled.

⁶ This deadweight loss is substantially above the estimate reported in Doets and Huisman (2009).

investment. While d'1000 is not an ignorable amount, it is too small to realistically translate into a wage increase of more than some tenths of a percent (recall that the return to one entire year of full-time education is often not above 7 or 8 percent). The authors also find no impact on job-mobility, neither within or across sectors, but do find a significant and substantial impact on future training plans.

Messer and Wolter (2009) and Messer et al. (2010) analyse a program in Switzerland where ILA's were allocated randomly. Both papers use a sample of 2,437 individuals who had previously participated in the Swiss Labour Force Survey. This sample is more heterogeneous than the Dutch sample, including unemployed individuals, as well as workers with all levels of education. Different amounts of money (200 CHF, 750 CHF or 1500 CHF; equivalent to d'124, d'465 and d'930) to be used for a training course were randomly assigned to some individuals and others went to a control group. Messer and Wolter (2009) looked at the impact of these ILA's on training participation and at the deadweight loss it creates. They find that the 1500CHF-ILA's increased the participation in training by 6 percentage points (from a base of 34%). They find no impact of the smaller ILA's, after one year of the program. They report a deadweight loss of 60%, meaning that more than half of the redeemed ILA's used for training would have been paid by the individuals (or their employers) themselves. This share is remarkably close to the one found by Hidalgo et al. (2011).

In a follow-up paper, Messer et al. (2010) added three additional outcomes: the impact on earnings, on employment status and on subsequent training after one year of the program. They analyse the impact of training on these outcome variables using the random assignment of the ILA as an instrument. It is debatable, however, whether the exclusion restriction is satisfied. This is not the case if ILA's affect the type of training courses people enrol in, and if the type of training has a separate effect on wages. Messer et al. also report the impact of the program directly on the same three outcomes and find no significant impact on earnings, employment status (employed or unemployed) or subsequent training.

4.2.4. Tax instruments

Some countries subsidize training participation through tax instruments. This can be done either by allowing firms to deduct training expenditures from the tax bill, or to allow individuals (workers) to deduct their training expenditures from their income tax. As firms' training expenditures are part of their normal operation costs, firms will normally be allowed to deduct such costs from their tax bill. This is possible in many countries including for instance the Netherlands, Japan, Chile and Canada.

To study the extent to which firms' tax deduction for training expenditures affects training participation, Leuven and Oosterbeek (2004) exploited the feature that the Dutch tax scheme allowed firms to deduct an extra amount in case the training

expenditures pertained to the training of workers older than 40 years. This policy created a discontinuity in firms' training costs at the age of 40. For a worker (just) over 40 years old, training is 14 percent cheaper than for a worker (just) under 40 years old. While the policy was implemented with the aim to stimulate training participation among older workers, the empirical results suggest that this did not happen. Training participation among workers just above 40 is substantially above training participation among workers just below 40. This difference is, however, not the result of increased training rates among older workers but results from decreased training rates among younger workers. Apparently, training participation by workers just below 40 was postponed.

Another possibility is to allow individuals to deduct direct training expenditures from their taxable income. Such tax deduction of training expenditures is possible in various countries including Germany, Italy and the Netherlands (in Italy against the lowest marginal tax rate), but not in other countries such as France, Sweden, Norway and the United Kingdom (where it was recently been replaced by the now abandoned individual learning accounts). In some other countries, including the United States, Canada and Australia, training expenditures can be deducted as long as they are made to maintain existing skills. The differences across countries show that tax (non-)deductibility of training expenditures is a policy variable, which is used by some countries, but not by others, as an instrument to stimulate training participation.

The deductibility of direct training expenditures from taxable income was evaluated using two different approaches (Leuven and Oosterbeek, 2007). The main challenge is to isolate the effect of tax deductibility of direct training expenditures from the (implicit) tax deductibility of opportunity costs of training investment and from the taxation of returns to training investments. The first method exploits differences in deductibility rates around kinks in the tax schedule. By choosing the intervals around the kinks such that average net wage rates are equal, they get rid of the tax deductibility of opportunity costs. They also show that future marginal tax rates for individuals who are above and below kinks in a given year are very similar. This eliminates differences in taxation of returns to training. Results based on this approach indicate that a 10 percentage point increase in the tax deductibility rate of direct training expenditures increase training participation by 0.33 percentage points (10 percent increase in training rate).

Their second method takes advantage of the 2001 tax reform, which implied a substantial change in marginal tax rates. Investment costs in 2000 were subject to the old tax code, while investment costs in 2001 were subject to the new tax code. Because returns to training materialize with some delay, returns to investments made in 2000 and 2001 were both subject to the new tax code. Accordingly, this method isolates changes in taxation of costs from changes in taxation of returns. It does not, however, isolate tax

deductibility of direct training expenditures from tax deductibility of opportunity costs. This method identifies the joint effect of these two deductibility rates, and since these operate in the same direction, it will overestimate the effect of interest. Results based on this approach indicate that a 10 percentage point increase in the tax deductibility rate of training costs increase training participation by 0.8 percentage points (a 25 percent increase in training rate). The authors show that the ratio of the results from the two methods are informative about the ratio of the opportunity costs of training investments and the direct expenditures of training investments, implying that opportunity costs are 1.5 times as large as direct expenditures.

There is reason to believe the true effect of tax deductibility of direct training expenditures is somewhere in between the estimates from the two methods. To the extent that the first approach does not fully neutralize differences in the taxation of returns, the estimates based on this method underestimate the true effect. Moreover, this method assumes that individuals are fully aware of the marginal tax rate applicable to their training expenditures. If this assumption does not hold for some individuals with incomes close to a kink, these individuals will not act on their tax treatment and their responsiveness will thus be zero. This also biases the estimate from the local identification method downwards.

On the other hand, the estimate from the reform method is interpreted as the joint effect of tax deductibility of direct training expenditures and tax deductibility of opportunity costs. The underlying economic model assumes that an individual's opportunity costs of an hour spent on training changes abruptly if this person's taxable income passes a kink in the tax schedule. For people who work full-time (as most people with incomes at least just below the first kink will do) and have little scope to adapt their working hours marginally, this assumption implies that these persons experience an abrupt change in the valuation of their leisure. To the extent that one is unwilling to believe this, a larger share of the effect estimate from the reform approach is attributable to the tax deductibility of direct training expenditures.

The reported effect sizes are evaluated at an average marginal tax rate equal to 0.4. If it is assumed that effects are constant over tax rates the low estimate of 0.3 percentage points change in training participation per 10 percentage point change in deductibility rate, suggests that abolishing the tax deductibility of direct training expenditures reduces the share of individuals who spend money on training for career purposes by almost one half: from 3 percent to 1.7 percent. Using the high estimate of 0.8 percentage points change in training participation per 10 percentage point change in deductibility rate, even suggests that without tax deductibility of direct training expenditures no one would spend money on training for career purposes. In any case, tax deductibility of direct training expenditures appears to be an effective instrument to enhance human capital accumulation. At a marginal tax rate of 0.4, every Euro invested by the

government in the form of a tax deduction, leads to 0.75 to 1.5 euros of private expenditures on training investments.

It should be noted that these results are obtained from people who are close to a kink in the tax schedule or for whom the reform caused a substantial change in their marginal tax rate. These people do typically not belong to the disadvantaged groups to which training policies of governments are often targeted.

4.4. Concluding remarks

This paper provides a fresh attempt to take stock of the available knowledge and insights regarding schemes to finance lifelong learning. We focus on findings that pass the test of being based on a research design that includes a proper control group. Doing so reveals that much is still unknown.

To stimulate lifelong learning activities of adult workers, it is often believed that simply making such activities available below marginal costs provides insufficient incentives. Instruments such as vouchers and individual learning accounts give potential learners a very explicit confirmation of their increased purchasing power. This should strengthen people's awareness of the availability and importance of learning activities. The evidence from the English Employer Training Pilot confirms that simply making training available below marginal cost (or even for free) indeed provides not sufficient incentives, at least not to the low skilled employees at which this program was targeted. Perhaps even more surprising is that this is the case despite the fact the program included an element of information, advice, and guidance to employers and employees.

The most convincing evidence regarding vouchers comes from the experience of American veterans under the GI Bill. Even if the internal validity of the studies analysing this "pilot" would be uncontested, it is questionable to what extent results would carry over to the current situation in Europe. After all, the veterans are a rather specific group, the pilot took place more than 35 years ago, and the education system in the US is markedly different from that in Europe.

Several studies report about two randomized experiments that were conducted in the Netherlands and Switzerland to assess the impact of individual learning accounts. Although the experiments differ in the people being eligible for an ILA, the studies find a remarkably similar deadweight loss. The studies conclude that more than half of the redeemed vouchers used for training would have been paid by the individuals (or their employers) themselves. An interesting result in the Dutch study is that ILA's appear to shift the type of training from firm-specific to more general.

A less explicit way of subsidizing learning activities is in the form of tax deductions. Existing evidence is restricted to the Netherlands. An age dependent tax deduction for

firms appears to have led to postponement of training activities rather than to an increase. An income tax deduction for individuals appears to have substantially positive effects on training participation. This may be due to the fact that this instrument is available to everyone while the other policies are typically aimed at specific groups of low skilled workers.

5. Conclusions

This report has discussed various funding mechanisms for lifelong learning, including decentralized vs. centralized financing responsibility for primary and secondary education, tuition in higher education, and subsidy and tax instruments for adult learning. The focus has been on empirical evidence relevant for European education institutions. We draw conclusions on the advantages and drawbacks of a wide range of funding mechanisms with respect to efficiency, quality, equity and sustainability.

We argue that discipline devices are important for local providers of primary and secondary education. Such devices might be difficult to implement with centralized funding via grants. In higher education, the costs should be shared between the governments and the individual students. Decentralizing decisions on tuition fees to higher education institutions may enhance competition as a discipline device for the institutions. Regarding adult learning, the most promising funding mechanism seems to be income tax deductions. This instrument is available to everyone and not only to specific groups of low-skilled workers.

References

- Abramovsky, L., Battistin, E., Fitzsimons, E., Goodman, A., and Simpson, H. (2011). Providing employers with incentives to train low-skilled workers: Evidence from the UK Employer Training Pilots. *Journal of Labor Economics*, 29:153–193.
- Aghion, P., Dewatripont, M., Hoxby, C., Mas-Colell, A., and Sapir, A. (2010). Universities. *Economic Policy*, 25: 7-59.
- Ahlin, Å., and Mörk, E. (2008). Effects of decentralization on school resources. *Economics of Education Review*, 27:276-284.
- Andrews, M., Duncombe, W., and Yinger, J. (2002). Revisiting economies of size in American education: Are we any closer to consensus? *Economics of Education Review*, 21:245-262.
- Angrist, J., and Lavy, V. (2009). The effects of high stakes high school achievement awards: Evidence from a randomized trial. *American Economic Review*, 99:1384-1414.
- Barankay, I., and Lockwood, B. (2007). Decentralization and the productive efficiency of government: Evidence from Swiss cantons. *Journal of Public Economics*, 91:1197-1218.
- Baumgartner, H. J., Steiner, V. (2006). Does more generous student aid increase enrolment rates into higher education? Evaluating the German student aid reform of 2001. DIW Berlin Discussion Paper 563.
- Barr, N. (1993). Alternative funding resources for higher education. *Economic Journal*, 103:718-728.
- Barr, N. (2004). Higher education funding. *Oxford Review of Economic Policy*, 20:264-283.
- Bergstrom, T., and Goodman, R. (1973). Private demand for public goods. *American Economic Review*, 63:286-296.
- Berry, C. R., and West, M. R. (2008). Growing pains: The school consolidation movement and student outcomes. *The Journal of Law, Economics, & Organization*, 26:1-29.
- Bettinger, E. P. (2010). Paying to learn: The effect of financial incentives on elementary school test scores. NBER Working Paper 16333.
- Bettinger, E. P., Long, B. T., Oreopoulos, P., and Sanbonmatsu, L. (2009). The role of simplification and information in college decisions: Results from the H&R block FAFSA experiment. NBER Working Paper 15361.
- Björklund, A., Edin, P.-A., Fredriksson, P., and Krueger, A. (2004). Education, equality and efficiency – An analysis of Swedish school reforms during the 1990s. Report 2004:1, Institute for Labour Market Policy Evaluation, Uppsala
- Booij, A., Leuven, E., and Oosterbeek, H. (2011). The role of information in the take-up of student loans. *Economics of Education Review*. Forthcoming.
- Borge, L.-E. and Rattsø, J. (1995). Demographic shift, relative costs and the allocation of local public consumption in Norway. *Regional Science and Urban Economics*, 25:705-726.

- Borge, L.-E. and Rattsø, J. (2007). Young and old competing for public welfare services. Working Paper No. 3/2007, Department of Economics, Norwegian University of Science and Technology.
- Bound, J. and Turner, S. (2002). Going to war and going to college: Did World War II and the G.I. Bill increase educational attainment for returning veterans? *Journal of Labor Economics*, 20:784–815.
- Bovenberg, A. L., and Jacobs, B. (2005). Redistribution and education subsidies are Siamese twins. *Journal of Public Economics*, 89:2005-2035.
- Brunner, E., and Baldson, E. (2004). Intergenerational conflict and the political economy of school spending. *Journal of Urban Economics*, 56:369-388.
- Card, D. (1999). The causal effect of education on earnings. In Ashenfelter, O., and Card, D. (Eds.) *Handbook of Labor Economics*, Vol. 3A:1801-1863. North-Holland.
- Card, D., and Payne, A. A. (2002). School finance reform, the distribution of school spending, and the distribution of student test scores. *Journal of Public Economics*, 83:49-82.
- Carneiro, P., and Heckman, J. J. (2002). The evidence on credit constraints in post-secondary schooling. *Economic Journal*, 112:705-734.
- Chowdry, H., Crawford, C., Dearden, L., Goodman, A., and Vignoles, A. (2010). Widening participation in higher education: Analysis using linked administrative data. IZA Discussion Paper No. 4991.
- Costrell, R., Hanushek, E., and Loeb, S. (2008). What do cost functions tell us about the cost of an adequate education? *Peabody Journal of Education*, 83:198-223.
- Craig, S. and Inman, R. P. (1986). Education, welfare and the 'new' federalism: State budgeting in a federalist public economy. In H. Rosen (ed.) *Studies in State and Local Public Finance*. University of Chicago Press.
- Dahlberg, M., Mörk, E., Rattsø, J., and Ågren, H. (2008). Using a discontinuous grant rule to identify the effect of grants on local taxes and spending. *Journal of Public Economics*, 92: 2320-2335.
- de Haan, M., Leuven, E., and Oosterbeek, H. (2011). Scale economies can offset the benefits of competition: Evidence from a school consolidation reform in a universal voucher system. IZA Discussion Paper No. 5528.
- de la Fuente, A. and Ciccone, A. (2003). Human capital in a global and knowledge-based economy. Report for the European Commission.
- Dearden, L., Fitzsimons, E., Goodman, A., and Kaplan, G. (2008). Higher education funding reforms in England: The distributional effects and the shifting balance of costs. *The Economic Journal*, 118:F100-F125.
- Dearden, L., Emmerson, C., Frayne, C., and Meghir, C. (2009). Conditional cash transfers and school dropout rates. *Journal of Human Resources*, 44:827-857.
- Doets, C. and Huisman, T. (2009). Effectiveness of individual learning accounts. Technical report, Ecto.
- Duncombe, W., and Yinger, J. (2005). How much more does a disadvantaged student cost? *Economics of Education Review*, 24:513-532.

- Duncombe, W., and Yinger, J. (2011). Are education cost functions ready for prime time? An examination of their validity and reliability *Peabody Journal of Education*, 86:28-57.
- Dur, A. J., and Teulings, C. N. (2004). Are education subsidies an efficient redistribution device? In J. Agell, M. Keen & A. Weichenrieder (Eds.), *Labor market, institutions and public regulation*. MIT Press, Cambridge.
- Dwenger, N., Storck, J., and Wrohlich, K. (2009). Do tuition fees affect the mobility of university applicants? Evidence from a natural experiment. IZA Discussion Paper No. 4421
- Dynarski, S. (2000). Hope for whom? Financial aid for the middle class and its impact on college attendance. *National Tax Journal*, 53:629-61.
- Dynarski, S. (2002). The behavioral and distributional implications of aid for college. *American Economic Review*, 92:279-285.
- Ehrenberg, R. (1973). The demand for state and local government employees. *American Economic Review*, 58:366-379.
- EU (2009). Key data on education in Europe 2009. Audiovisual and Culture Executive Agency (Eurydice).
- Evans, W. N., and Zhang, P. (2007). The impact of earmarked lottery revenue on K-12 educational expenditures. *Education Finance and Policy*, 2:40-73.
- Falch, T., and Fischer, J. A. V. (2010). Public sector decentralization and school performance: International evidence. Hamburg Contemporary Economic Discussions No. 31.
- Falch, T., and Rattsø, J. (1997). Political economic determinants of school spending in federal states: Theory and time-series evidence. *European Journal of Political Economy*, 13:299–314.
- Falch, T., and Rattsø, J. (1999). Local public choice of school spending: Disaggregating the demand function for educational services. *Economics of Education Review*, 18:361–373.
- Falch, T., Rønning, M., and Strøm, B. (2008). A cost model of schools: School size, school structure and student composition. In Soguel, N. C., and Jaccard, P. (Eds.). *Governance and Performance of Education Systems*. Springer.
- Feldstein, M. S. (1975). Wealth neutrality and local choice in public education. *American Economic Review*, 65:75–89.
- Fernández, R., and Rogerson, R. (1999). Education finance reform and investment in human capital. Lessons from California. *Journal of Public Economics*, 74:327-350.
- Field, E. (2009). Educational debt burden and career choice: evidence from a financial aid experiment at NYU law school. *American Economic Journal: Applied Economics*, 1:1-21.
- Fischel, W. A. (2001). Homevoters, municipal corporate governance, and the benefit view of the property tax. *National Tax Journal*, 54:157-174.
- Fiva, J., and Rønning, M. (2008). The incentive effects of property taxation: Evidence from Norwegian school districts. *Regional Science and Urban Economics*, 38:49-62.

- Fredriksson, P. (1997), Economic incentives and the demand for higher education. *Scandinavian Journal of Economics*, 99:129-142.
- Garibaldi, P., Giavazzi, F., Ichino, A. and Rettore, E. (2011). College cost and time to complete a degree: Evidence from tuition discontinuities. *Review of Economics and Statistics*, forthcoming.
- Gordon, N. (2004). Do federal grants boost school spending? Evidence from Title I. *Journal of Public Economics*, 88:1771-1792.
- Greenaway, D., and Haynes, M. (2003). Funding higher education in the UK: The role of fees and loans. *The Economic Journal*, 113:F150-F166.
- Grob, U., and Wolter, S. C. (2007). Demographic change and public education spending: A conflict between young and old? *Education Economics*, 15:277-292.
- Hall, J. (2007). Local school finance and productive efficiency: Evidence from Ohio. *Atlantic Economic Journal*, 35:289-301.
- Hanushek, E. A. (2003). The failure of input-based schooling policies. *Economic Journal*, 113:F64-F98.
- Harmon, C., Oosterbeek, H., and Walker, I. (2003). The returns to education: Microeconometrics. *Journal of Economic Surveys*, 17:115-155.
- Harris, A. R., Evans, W. N., and Schwab, R. M. (2001). Education spending in an aging America. *Journal of Public Economics*, 81:449-472.
- Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., and Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94:114-128.
- Heinesen, E. (2004). Determinants of local public school expenditures: A dynamic panel data model. *Regional Science and Urban Economics*, 34:429-453.
- Heller, D. E. (1997). Student price response in higher education: An update to Leslie and Brinkman. *The Journal of Higher Education*, 68:624-659.
- Hidalgo, D., Oosterbeek, H., and Webbink, D. (2011). The impact of training vouchers on low-skilled workers. In progress.
- Hilmer, M. J. (1998). Post-secondary fees and the decision to attend a university or a community college. *Journal of Public Economics*, 67:329-348.
- Hines, J. R., and Thaler, R. H. (1995). The flypaper effect. *Journal of Economic Perspectives*, 9:217-226
- Hoxby, C. (1999). The productivity of schools and other local public goods producers. *Journal of Public Economics*, 74:1-30.
- Hoxby, C. (2001). All school finance equalizations are not created equal. *Quarterly Journal of Economics*, 116:1189-1231.
- Hübner, M. (2009). Do tuition fees affect enrollment behavior? Evidence from a 'natural experiment' in Germany. CDSE Discussion Paper No. 69, University of Mannheim.
- Husted, T. A., and Kenny, L. W. (2000). Evidence on the impact of state government on primary and secondary education and the equity-efficiency trade-off. *Journal of Law and Economics*, 43:285-308.
- Inman, R. P. (2008). The flypaper effect. NBER Working Paper 14579.

- Jacobs, B., and van der Ploeg, F. (2006). How to reform higher education in Europe. *Economic Policy*, 21: 535-392.
- Jacobs, B., Schindler, D., and Yang, H. (2009). Optimal taxation of risky human capital. CESifo Working Paper No 2529.
- Krueger, A. B. (2003). Economic Considerations and Class Size. *Economic Journal*, 113:F34-F63.
- Ladd, H. (1993). State responses to the TRA86 revenue windfalls: A new test of the flypaper effect. *Journal of Policy Analysis and Management*, 12:82-103.
- Kempkes, G. (2010). Rapid demographic change and the allocation of public education resources: Evidence from East Germany. Discussion Paper Series 1: Economic Studies No 16/2010, Deutsche Bundesbank.
- Leuven, E. and Oosterbeek, H. (2004). Evaluating the effect of tax deductions on training. *Journal of Labor Economics*, 22:461–488.
- Leuven, E. and Oosterbeek, H. (2007). The responsiveness of training participation to tax deductibility. Unpublished working paper.
- Levin, H. (1983). Individual entitlements. In Levin, H. and Schutze, H. (Eds.), *Financing Recurrent Education*. Beverly Hills: Sage.
- Levhari, D., and Weiss, Y. (1974). The effect of risk on the investment in human capital. *American Economic Review*, 64:950–963.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22:3-42.
- Lutz, B. (2010). Taxation with representation: Intergovernmental grants in a plebiscite democracy. *The Review of Economics and Statistics*, 92:316-332.
- Messer, D., Schwerdt, G., Woessmann, L., and Wolter, S. C. (2010). Labor market effects of adult education vouchers: Evidence from a randomized field experiment. Unpublished working paper.
- Messer, D. and Wolter, S. (2009). Money matters: Evidence from a large-scale randomized field experiment with vouchers for adult training. Technical report, IZA Discussion Paper 4017.
- Murray, S. E., Evans, W. N. and Schwab, R. M. (1998). Education-finance reform and the distribution of education resources. *American Economic Review*, 88:789-812.
- Nielsen, H. S., Sørensen, T., and Taber, C. (2010). Estimating the effect of student aid on college enrollment: Evidence from a government grant policy reform. *American Economic Journal: Economic Policy*, 2: 185-215.
- Oates, W. E. (1972). *Fiscal Federalism*. Harcourt Brace Jovanovich, New York.
- Oates, W. E. (1972). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance*, 12: 349-373.
- OECD (2010). *Education at a glance 2010*. OECD
- O'Neill, D. (1977). Voucher funding of training programs: Evidence from the GI Bill. *Journal of Human Resources*, 12:425–445.
- Oosterbeek, H., and Patrinos, H. A. (2008). Financing lifelong learning. Policy Research Working Paper 4569, The World Bank.

- Peña, P. S., and Solé-Ollé, A. (2009). Evaluating the effects of decentralization on educational outcomes in Spain. *Còl·lecció d'Economia E09/228*, Universitat de Barcelona.
- Pommerehne, W. W., and Schneider, F. (1978). Fiscal illusion, political institutions, and local public spending. *Kyklos*, 31:381–408
- Poterba, J. M. (1997). Demographic structure and the political economy of public education. *Journal of Policy Analysis and Management*, 16:48–66.
- Renkema, A. (2006). Individual learning accounts: a strategy for lifelong learning? Den Bosch: CINOP.
- Romer, P. M. (1990). Endogenous Technical Change. *Journal of Political Economy*, 98:71-102.
- Romer, T., Rosenthal, H., and Munley V. (1992). Economic incentives and political institutions: Spending and voting in school budget referenda. *Journal of Public Economics*, 49:1–33.
- Rothstein, J., and Rouse C. (2010). Constrained after college: Student loans and early career occupational choices. *Journal of Public Economics*, 95:149-163.
- Rubinfeld, D. L. (1987). The economics of the local public sector. In A. J. Auerbach and M. Feldstein (eds.), *Handbook of Public Economics*, vol. II. Elsevier Science Publisher B.V.
- Schlotter, M., Schwerdt, G., and Wössmann, L. (2009). Methods for causal evaluation of education policies and practices: An econometric toolbox. Report for the European Commission.
- Seabright, P. (1996). Accountability and decentralisation in governments: An incomplete contracts model. *European Economic Review*, 40:61-89.
- Silva, F., and Sonstelie, J. (1995). Did Serrano cause a decline in school spending? *National Tax Journal*, 48:199-215.
- Sonstelie, J., Brunner, E., and Ardon, K. (2000). *For better or for worse? School finance reform in California*. Public Policy Institute of California.
- Spence, M. (1973). Job market signalling. *Quarterly Journal of Economics*, 87:355-374.
- Steiner, V., and Wrolich, K. (2008). Would Increased Financial Aid for Students Raise Enrolment into Higher Education? - New Evidence for Germany. Mimeo, Free University of Berlin
- Strumpf, K. S. (1998). A predictive index for the flypaper effect. *Journal of Public Economics*, 69: 389–412.
- Taylor, J., and Bradley, S. (2000). Resource utilization and economies of size in secondary schools. *Bulletin of Economic Research*, 52:123–150.
- Tovmo, P., and Falch, T. (2002). The flypaper effect and political strength. *Economics of Governance*, 3:153-170.
- Turner, S. and Bound, J. (2003). Closing the gap or widening the divide: The effects of the G.I. Bill and World War II on the educational outcomes of black Americans. *Journal of Economic History*, pages 145–177.
- Von Hagen, J. (1992). *Budgeting procedures and fiscal performance in the European communities* (Economic Paper 96). Commission of the European Communities.

- Verbina, I., and Chowdhury, A. (2004). What determines public education expenditures in Russia? *Economics of Transition*, 12:489-508.
- Weingast, B., Shepsle, K., and Johnsen, C. (1981). The political economy of benefits and costs: A neoclassical approach to distributive politics. *Journal of Political Economy*, 89:642-664.
- Wyckoff, P. G. (1991). The elusive flypaper effect. *Journal of Urban Economics*, 30:310-328.
- Wössmann, L. (2008). Efficiency and equity of European education and training policies. *International Tax and Public Finance*, 15:199-230.

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