

Gundlach, Erich

**Working Paper**

## Investment in education: Some lessons from the international evidence for the Baltic states

Kieler Diskussionsbeiträge, No. 333

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Gundlach, Erich (1999) : Investment in education: Some lessons from the international evidence for the Baltic states, Kieler Diskussionsbeiträge, No. 333, ISBN 3894561815, Institut für Weltwirtschaft (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/1057>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## **Investment in Education: Some Lessons from the International Evidence for the Baltic States**

**by Erich Grundlach**

### CONTENTS

- The international empirical evidence on the economics of education reveals one central insight and two puzzles, which are all relevant for the case of the Baltic States. The central insight is that social rates of return to education tend to be higher than the social opportunity costs of capital, except for the case of higher education. Based on this microeconomic evidence, the case for public investment in education is well founded, especially at the primary and the secondary levels.
- The first puzzle is that at the macroeconomic level, the presumed positive link between increases in educational attainment and income growth is difficult to detect. One reason is that a high rate of absorption of well-educated workers by the government sector, typical for many developing countries, is likely to reduce the long-run growth rate.
- The second puzzle is that there is no clear link between higher spending on educational inputs and higher educational output in the form of improved performance of pupils. As it seems, higher spending on education is not sufficient to improve performance as long as inefficiencies in the schooling system remain.
- For the Baltic States, three basic lessons emerge from the international evidence: First, public investment in higher education does not show up as a top priority from a social point of view; second, the macroeconomic return to education could turn out to be low if better educated workers predominantly end up in the relatively large government sectors typical for the Baltic States. Third, the productivity of schooling could probably be improved, for instance by a different allocation of resources within the education sector. Most likely, such an outcome would require a fundamental reform of the schooling system itself, not only in the Baltic States.

## Contents

<b>I. Introduction.....</b>	<b>3</b>
<b>II. Rates of Return to Education.....</b>	<b>4</b>
<b>III. The Macroeconomic Productivity of Education.....</b>	<b>8</b>
<b>IV. The Quality of Education .....</b>	<b>12</b>
<b>V. Perspectives for the Baltic States .....</b>	<b>16</b>
<b>VI. Conclusion .....</b>	<b>18</b>
<b>References .....</b>	<b>19</b>

*Remark:* I would like to thank, without implication, Flemming Hedegaard, Rolf Langhammer, Peter Nunnenkamp, and Ian Whitman for helpful comments and suggestions on an earlier version and Michaela Rank for skillful arrangement of the figures.

## I. Introduction

The three Baltic States all appear to have managed the immediate challenges for macroeconomic stabilization arising from the transition to a market economy, despite some differences in the speed and scope of economic reform. Estonia, Latvia, and Lithuania have achieved relatively strong output growth since 1997, inflation is in the range of 10 percent or lower, and the government budget is close to balance. After the fairly successful transition phase, policy makers in the Baltic States begin to focus their attention on the determinants of long-run growth. Investment in education is one of them.<sup>1</sup>

Investment in education stands out as one of the most productive investments one can think of. Everyday experience confirms that better educated citizens generally have higher incomes and lower unemployment rates than less educated citizens. In addition, education may not only be productive from an individual point of view. Society at large may also benefit from public investment in education.

There are two strong arguments for public investment in education. Public investment in education is required if the private financing of education suffers from capital market imperfections. Capital market imperfections are likely because human capital cannot be collateralized for loans. Public investment in education is also required if education at universities produces positive spillover effects, that may establish a dynamic comparative advantage in high-technology sectors of the economy. Such sectors are considered to be the major engines of future prosperity.

Beyond these purely economic considerations, there is an even broader argument for public investment in education: Well-educated citizens are less likely to follow non-democratic ideologies. In this sense, public investment in education can be seen as a means to create democratic stability. Democratic stability may prove

to be the ultimate necessary condition for steady long-run growth if long-run means centuries instead of decades.

Against this backdrop, it is certainly difficult to argue against the case for investment in education. Yet, there can be too much of a good thing. Public investment in education is productive as long as the social rate of return to education exceeds the opportunity cost of capital. This condition holds in many cases, but not always. Policy makers should be aware that public investment in education is only one of many competing alternatives to spend taxpayers' money.

Besides an inefficient level of overall spending, the allocation of a given educational budget within the education sector will be inefficient if too little is spent on those forms of education with the highest rate of return and too much on those with the lowest. To guarantee its efficiency, every decision on spending for specific forms of education should be based on a comparison of expected costs and expected benefits. It seems that many educational systems are inefficient, in highly developed as well as in developing economies.

For the Baltic States, detailed empirical studies of the educational situation are not available. Any assessment has to be based on a rather limited amount of statistical information. Nevertheless, even a limited amount of information can be compared with the existing evidence for other countries and may provide some insights. Far from reaching definite conclusions, I hope that such a comparison will prove to be useful as a starting point for an in-depth discussion of the economics of education in the Baltic States.

I address three major issues. I begin with an overview of the empirical evidence on rates of return to education. By and large, the international microeconomic evidence supports the view that investment in education does produce fairly high private and social rates of return, especially in lower-middle-income countries like the Baltic States. Next I explain how the case for investment in education can be defended against recent criticisms based on a seemingly missing macroeconomic link between education and economic growth. There are important implications

---

<sup>1</sup> At least in Estonia, public debate on the future of education is already beginning. See Loogma et al. (1998) for alternative scenarios describing future systems of education in Estonia.

for the Baltic States. Then I briefly comment on the ongoing controversial debate on the determinants of the quality of education. The debate especially matters for economies with fairly high enrollment rates at all levels of education, such as the Baltic States. I summarize the arguments by drawing some tentative lessons from the international evidence for the Baltic States.

## II. Rates of Return to Education

The rate of return to education indicates whether investing in education is productive or unproductive. Investing in education is productive if its rate of return is higher than the opportunity cost of capital, which represents alternative investment opportunities in the economy. Without knowing the opportunity cost of capital, investment in education cannot be evaluated because there is no point of reference. To begin with, a benchmark value for the opportunity cost of capital is needed. Standard practice has been to use the rate of return to fixed capital.

For the policy maker, what matters for the allocation of investment is the social rate of return rather than the private rate of return. The social rate of return to fixed capital can be calculated from a formula that defines the share of capital in the total factor income of the economy. The factor share of capital equals the rate of return to capital times the capital-output ratio. At least for advanced economies, capital's factor share is known to be about 30 percent (Maddison 1987) and the capital-output ratio is known to be about 3 (Hall and Jones 1998). It follows that the social rate of return to capital is about 10 percent in advanced economies.<sup>2</sup> Hence more investment in education is socially desirable in advanced economies if the social rate of return to education is higher than 10 percent.

For less advanced economies, the same calculation can be applied. The factor share of capital is also about 30 percent in less advanced economies (Gollin 1998), but capital-output ratios seem to be lower in the range of 1.5–2. The implication is that in countries with a lower capital-output ratio a higher rate of return to education in the range of 15–20 percent is needed to justify increasing investment in education.

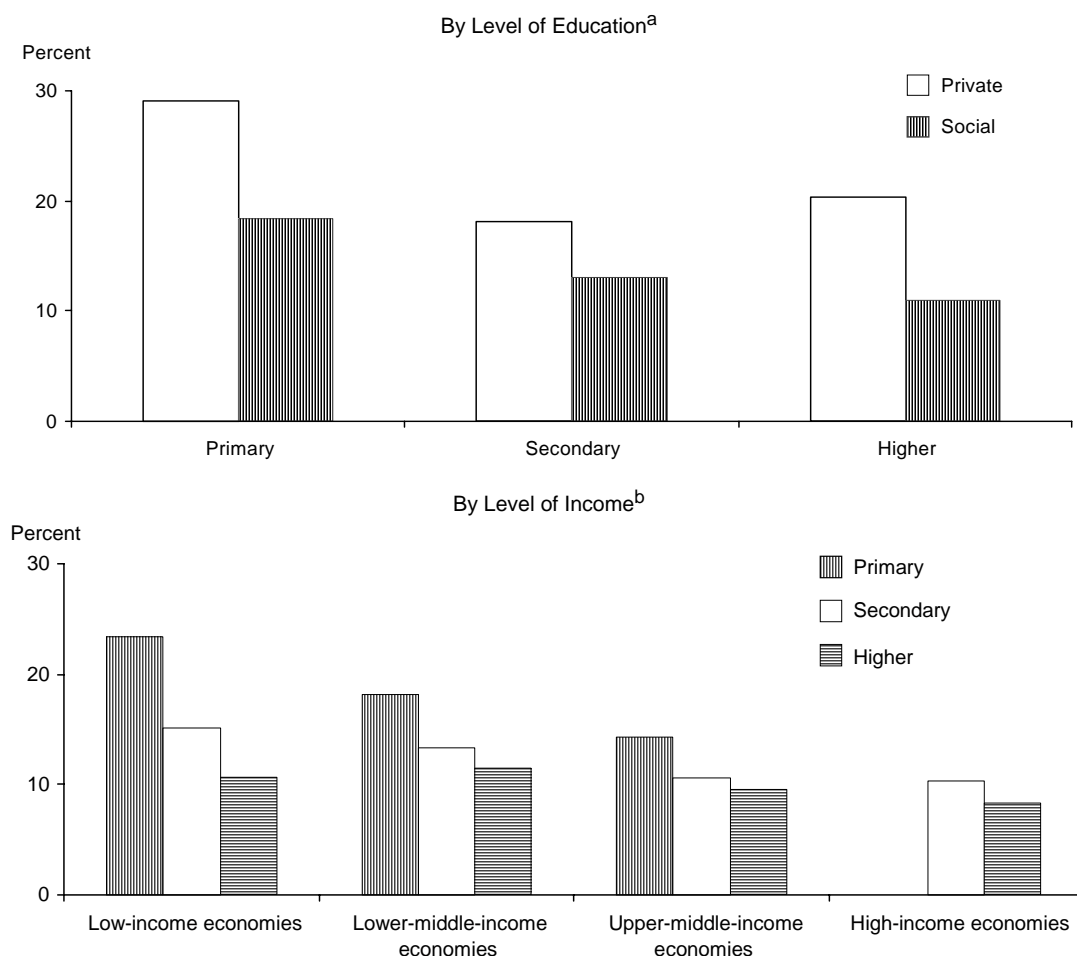
Several methods exist for estimating the rate of return to education. One method is the cost-benefit or external efficiency analysis. It compares the benefits of additional education in the form of a higher income with the social and private costs of additional education, including foregone earnings. More specifically, detailed age-earnings profiles by level of education can be used to find the discount rate that equates a stream of education benefits (higher incomes) to a stream of education costs (private and social expenditures for education and foregone earnings). This discount rate equals the rate of return to education.

The cost-benefit approach to calculating the rate of return to education is now the established tool for appraising the social desirability of an expansion of specific forms of schooling. It is considered to be the appropriate method because in contrast to other approaches, it takes into account the most important part of the early earning history of individuals (Psacharopoulos 1994). The rates of return shown in Figure 1 are based on this approach. They represent averages for a large number of individual country data for the 1970s and 1980s, collected and summarized by Psacharopoulos (1994).

The most remarkable overall empirical finding on the rates of return to education is that these returns obey the same rules as any other investment: there are diminishing returns to education by level of education and by level of income. The major difference to other forms of investment is that, except for one, rates of return to education are generally higher than the opportunity costs of capital.

<sup>2</sup> The formula reads: factor share equals rate of return times capital divided by output. For a constant factor share, the rate of return inversely varies with the capital-output ratio.

Figure 1: Returns to Investment in Education



<sup>a</sup>World averages for social and private rates of return to education (full method). — <sup>b</sup>Group averages for social rates of return (full method).

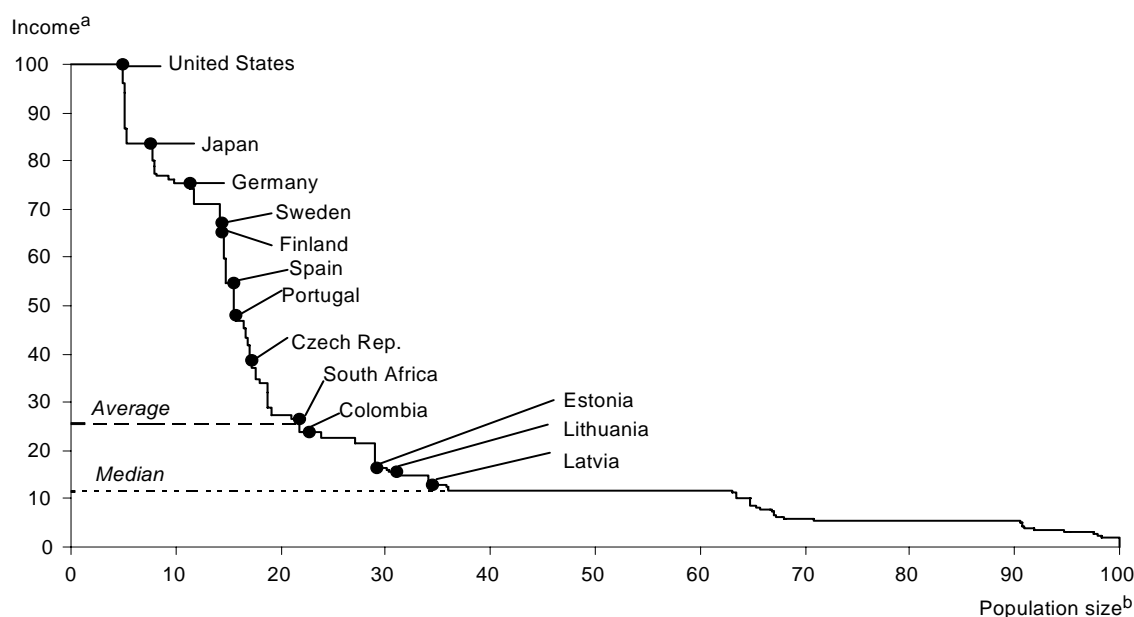
Source: Psacharopoulos (1994).

The upper part of Figure 1 confirms my reasoning for world averages. Rates of return to education tend to decline from primary to secondary to higher education. At all levels of education, private rates of return exceed social rates of return, which take into account the full costs of education not borne by the individual student. The social rate of return to higher education remains somewhat below the world average for the social opportunity costs of capital, which is about 15 percent for a presumed worldwide capital-output ratio of 2. Given the international evidence the case for private investment in education appears to be strong, as indicated by the high average rates of return.

Yet the case for public subsidization of higher education is more difficult to maintain.

The lower part of Figure 1 presents social rates of return to education by levels of income for various country groups as defined by the World Bank. Again, there is a clear pattern that within each country group, rates of return to education decline with rising educational levels. But even in poor economies, the social rate of return to higher education does not exceed 15 percent and it falls short of 10 percent in rich economies. For any income group of countries, expanding higher education is not necessarily a top priority from a social point of view.

Figure 2: The Baltic States in the World Economy



<sup>a</sup>Purchasing power parity estimates of Gross National Product per head 1996, 123 countries; United States=100. —

<sup>b</sup>Width represents share of world population in percent.

Source: World Bank (1998).

Substantially higher private rates of return to higher education (not shown in the lower part of Figure 1) than social rates of return within each country group indicate that public subsidization of higher education should be reduced. If so, private rates of return would fall and social rates of return would rise. A narrowing of the spread between social and private rates of return would be welcome for efficiency reasons because it would bring into line those who really pay for and those who really benefit from higher education among taxpayers at large.

In the absence of any detailed rate of return studies for the Baltic States, an assessment for these countries can only be based on average rates of return reported for economies with a similar level of economic development. The Baltic States have per capita incomes comparable to those of lower-middle-income economies (Figure 2). Applying a social opportunity cost of capital of 15 percent at this level of income, only public investment in primary education would be desirable from a social point of view. The open question is to what extent such a back-of-the-envelope calculation can realistically be applied for the case of the Baltic States.

On the one hand, formerly socialist countries usually display higher capital-output ratios than non-socialist countries with similar per capita incomes. With higher capital-output ratios, the social opportunity cost of capital is lower for given factor shares. Hence in the Baltic States, investment in education could be socially desirable at both the primary and the secondary levels.

On the other hand, the Baltic States tend to have enrollment rates in secondary and in higher education which are much higher than in low-income economies and only slightly below enrollment rates in high-income economies (World Bank 1998). With relatively high enrollment rates, social rates of return to education in the Baltic States can be expected to be lower than would be indicated by the averages for lower-middle-income economies in Figure 2 and are perhaps more similar to social rates of return in higher-income economies. In that case, the argument for increases in public investment in secondary education would be weakened.

Which argument prevails is difficult to say without further country-specific statistical information, which is not available. The interna-

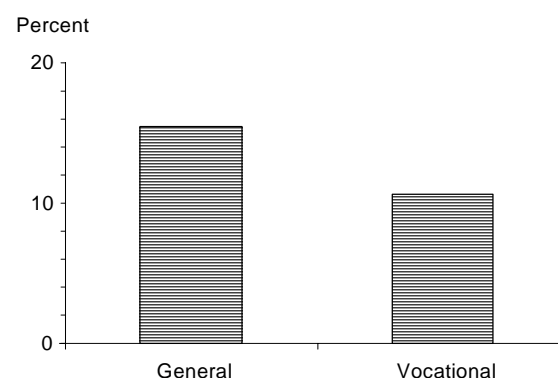
tional evidence suggests that a general increase of government-financed schooling schemes in the Baltic States is most likely to be inefficient. The reason is that in countries like the Baltic States there are other investment projects which also provide a reasonable social rate of return. For instance, one could think of a relative expansion of social policies like health care and pension schemes, or of infrastructure projects, or of a possible reallocation of funds within the education sector, before considering an across-the-board increase of government-financed secondary and higher education.

A reallocation of funds away from higher education should not be misread as a general argument against government-funded higher education. Since future human capital cannot be used to collateralize loans, there is a strong case for the government to provide the loans otherwise unavailable for students of higher education. A different question is whether the government should subsidize higher education by requesting a real interest rate substantially below the market rate for loans of a comparable maturity. If the government decides to subsidize higher education, still another question is whether the subsidies should not go to students directly rather than to universities in order to create stronger incentives for competition across universities.

At least two other aspects of investment in education at higher levels also deserve the attention of policy makers. One is the choice between the general/academic secondary school track and the vocational/technical secondary school track. Perhaps somewhat counter-intuitively, the international evidence points to substantially lower social rates of return in the vocational/technical track (Figure 3). Since these findings are based on relatively small and heterogeneous samples, with many developing countries included, they should not be overvalued and interpreted with care.

Notwithstanding such ambiguities, there is an argument that could rationalize the lower social rate of return of the vocational/technical track. Most likely there are strong complementarities between formal education at school and the subsequent training on the job. While basic edu-

Figure 3: Social Returns to General and Vocational Secondary Education

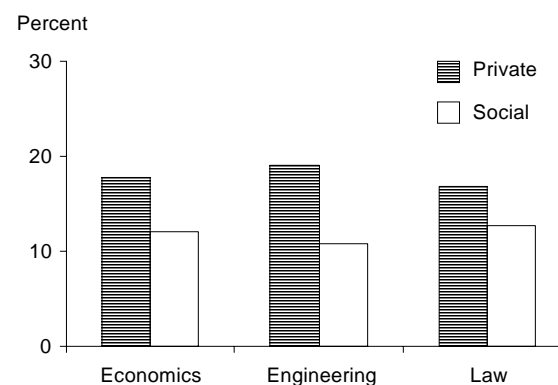


Source: Psacharopoulos (1994).

cation and learning on the job seem to complement each other, formal vocational/technical schooling may prove to be a bad substitute for specific professional requirements to be learned on the job. If this were the case, the higher measured social return to general/academic schooling clearly makes sense.

The return to higher education by field of study is the other aspect which is relevant for policy makers. My reading of the international evidence is that there are no large differences in the rates of return across faculties. Focusing only on those fields with a sufficient number of observations and deleting an apparent outlier in the case of engineering in the data provided by Psacharopoulos (1994), there are no obvious differences across social or private rates of return to the study of, say, economics, engineering, or law (Figure 4). These findings should

Figure 4: Returns to Higher Education by Field of Study



Source: Psacharopoulos (1994).



caution policy makers to reallocate resources among specific faculties of higher education as a reaction to temporary shifts in demand and supply. Within a given budget for higher education, necessary adjustments to supply and demand can safely be left to universities and students. But the relatively high private rates of return to various fields of study again disclose that students should bear a higher fraction of the social costs of higher education.

Of course one could argue that a lower rate of subsidization of higher education, especially in more advanced economies, does not appropriately account for potential positive externalities generated by higher education. Positive externalities could be conferred to society at large by fields of study like medicine, biotechnology, or communication technology, to name a few. Many new growth theories are built on presumed externalities in these fields, and the possibility of positive externalities can never be ruled out. However, empirical evidence in favor of such externalities is difficult to come by.

Even if higher education does generate positive spillovers the argument in favor of an increase of higher education remains weak because in political reality, expenditure decisions usually have to be made for a fixed educational budget. So a decision in favor of higher education almost always means a decision against other forms of education. Yet primary and secondary education probably also provide positive externalities for society at large, for instance in the form of less criminal activity or less drug abuse. Since no detailed empirical evidence is available on the relative size of either form of educational externalities, policy makers have to base their decisions on likely probabilities. With Psacharopoulos (1996), I would contend that based on externality arguments no strong case can be made for a relative increase of higher education at the cost of primary and secondary education.

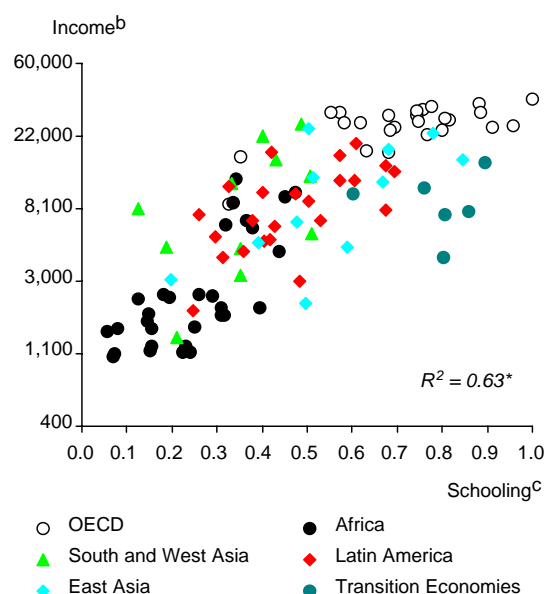
### III. The Macroeconomic Productivity of Education

Convincing macroeconomic evidence on the productivity of investment in education is difficult to establish. At present, the debate on the role of education at the macroeconomic level is far from being settled.<sup>3</sup> If there is no clear link between economy-wide education and income and output growth, the case for public subsidization of education is difficult to maintain. But if education has a strong role in economic growth, as suggested by the evidence on rates of return, more investment in education could help low-income economies to catch up economically with high-income economies.

In 1996 the Baltic States had an income per head in the range of 17–13 percent of the US level (see Figure 2). This is a low level compared to the poorest OECD members like Mexico, the Czech Republic, Greece, and Portugal. The poorest Scandinavian economy, namely Finland, is much further up the income ladder. Germany, with a reduced average income level after reunification, is even 10 percentage points above that level. The Baltic States display income levels comparable to those of developing countries like Namibia, Jamaica, and Jordan, which have about the same size in terms of population.

Because of their relative backwardness, there is an enormous potential for economic catching up of the Baltic States. Whether the Baltic States will succeed in realizing their growth potential depends first of all on their economic policies. Educational policies could play an important role but their impact will only be felt in the long run. Policies promoting investment in education will not gain the necessary long-term backing in the political process without convincing evidence on the macroeconomic productivity of education. And even then, it remains to be shown that the macroeconomic return to education is reasonable enough to justify a lower rate of present consumption: as with any other investment, investing in education means to forego consumption today.

<sup>3</sup> For a recent survey of the literature, see, e.g., Gundlach (1999).

Figure 5: Schooling and Income<sup>a</sup>

<sup>a</sup>106 countries; Cyprus and Israel included in OECD.—  
<sup>b</sup>Output per worker 1990(log).— <sup>c</sup>Average years of education in 1990 (United States=1).

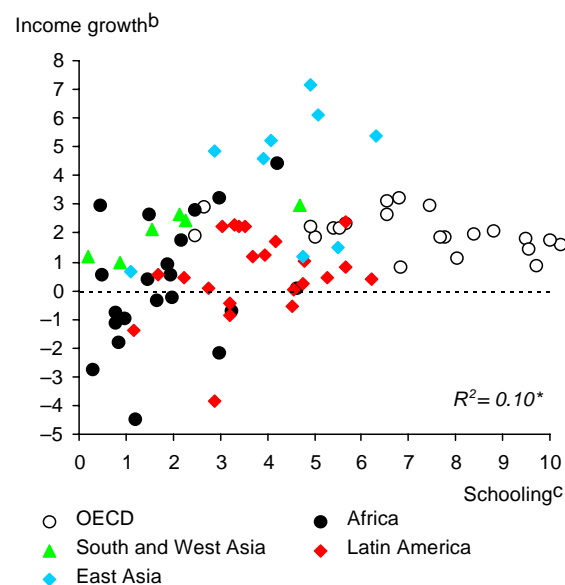
Source: PWT (1994); Barro and Lee (1996).

The international evidence suggests that there is a close statistical relation between the quantity of education and the level of per capita income (Figure 5). The quantity of education is measured by average years of schooling of the working-age population; the level of per capita income is measured by output per worker. High-income economies, such as the OECD countries, have a better educated workforce than low income economies in Sub-Saharan Africa and South Asia, with Latin America and East Asia in between. Transition economies (Baltic States not included because of missing education data) display rather high levels of education as compared to their income levels.

In a statistical sense, international differences in schooling alone can explain more than 60 percent of international income differences, as measured by the  $R^2$ -statistic. Taken at face value, the finding points to a strong role of education in the explanation of growth and development. But statistical correlation by itself is silent on the question of causality; that is, the data cannot tell whether education is the cause of economic development or rather its result.

Figure 6 indeed points to a more cautious interpretation of the international evidence. There is no simple direct relation between the level of schooling at an initial year and subsequent income growth. Given the international evidence, the link between a well-educated workforce and the rate of catching up appears to be rather weak, although it is still positive and significant in a statistical sense. But these macroeconomic data do not show that education plays an important role in economic growth.

The positive statistical correlation slightly improves if the OECD economies are deleted from the sample as a special case. The fact remains, though, that many countries with relatively high levels of education in 1970, for instance in Latin America, report a disappointing growth performance in 1970–1996. Long-run growth expectations cannot be based on the education of the workforce alone. The same interpretation also follows from a recent econometric reexamination of the link between the level of education and subsequent growth (Krueger and Lindahl 1998). The empirical evidence of a positive effect of the level of education on a

Figure 6: Schooling and Income Growth<sup>a</sup>

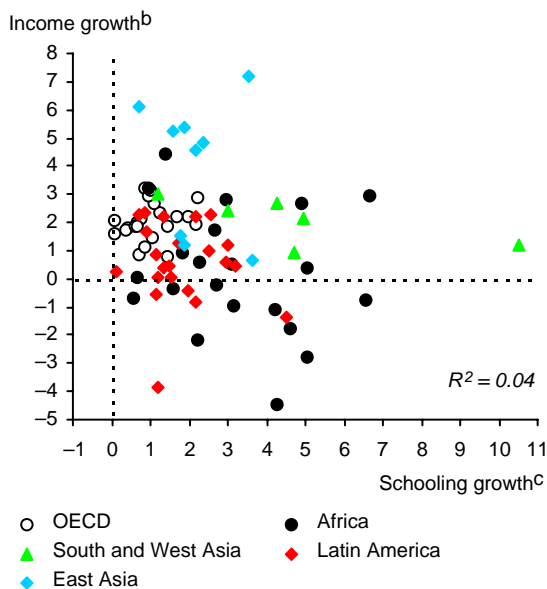
<sup>a</sup>80 countries; Cyprus and Israel included in OECD. —  
<sup>b</sup>Average annual growth rate of GNP per capita, 1970–1996 (percent). — <sup>c</sup>Average years of schooling of the population aged 15–64, 1970.

Source: World Bank (1998); Barro and Lee (1996).

country's growth rate is tenuous, despite a voluminous theoretical literature based on such a presumed effect. Possessing a relatively well-educated workforce, as the transition economies do, does not automatically guarantee subsequent high rates of growth.

Going one step further, no direct statistical correlation exists between the change in schooling and the change in income (Figure 7). This empirical fact has recently been noted in the literature. Education per worker has risen in almost all economies around the world, but only few economies have experienced persistent high rates of economic growth; and in countries where income growth was fastest, namely in East Asia, schooling did not increase over-proportionately. As one researcher puts it, the question arises where all the education has gone (Pritchett 1996). Other researchers (e.g., Benhabib and Spiegel 1994) even report a negative cross-country correlation between the growth rate of output and the growth rate of schooling once they also control for investment in physical capital.

Figure 7: Schooling Growth and Income Growth<sup>a</sup>



<sup>a</sup>80 countries; Cyprus and Israel included in OECD.—

<sup>b</sup>Average annual growth rate of GNP per capita, 1970–1996. — <sup>c</sup>Average annual growth rate of average years of schooling, 1970–1990.

Source: World Bank (1998); Barro and Lee (1996).

If these findings were the last word on the presumed link between schooling and growth at the macroeconomic level, at least public investment in education could be considered to be unproductive or, more to the point, to be a waste of resources. But before taking such an extreme position, it is worth remembering that simple bilateral correlations may hide a more complicated story. This brings back the central issue of how to measure correctly the macroeconomic productivity of education.

The main, and possibly only, approach to testing the productivity of education is to include it as a separate variable in a production function and to estimate its regression coefficient (Griliches 1996). In a well-specified production function, where the input variable “labor” is an education-based labor-quality index, the regression coefficient approximately equals the share of labor in total factor income. From the National Accounts, labor’s share in factor income is known to be about 70 percent. A regression exercise will produce the same result if education determines productivity, and not the other way round.

A number of empirical studies on the empirics of growth confirm the expected role of education in a production function.<sup>4</sup> The studies also support the idea that investment in education offers a relatively high macroeconomic return, given that additional heroic assumptions apply. Consider that in developed economies, about two thirds of the factor share of labor represent the return to education (Mankiw 1995). If so, the factor share of education results as about 50 percent. Consider further that the education-output ratio is slightly higher than the capital-output ratio, say about 4, because the stock of education — call it the stock of human capital — is expected to be worth more than the stock of fixed capital (OECD 1998).

Both assumptions together would imply that the macroeconomic return to education is 12.5 percent, which would perform well compared with an opportunity cost of capital of 10 percent. Needless to say, small changes in the un-

<sup>4</sup> See, e.g., Lau et al. (1991), Mankiw et al. (1992), Knight et al. (1993), and Gundlach (1995).

derlying assumptions could have a large impact on the implied macroeconomic rate of return to education. For instance, a substantially higher education-output ratio than 4, as estimated by Jorgenson and Fraumeni (1992), would reduce the rate of return to education below the opportunity cost of capital.

Recent studies do not find an important role of education at the macroeconomic level. Klenow and Rodriguez-Clare (1997) claim that international differences in educational attainment can only explain a very small fraction of international income differences. Bils and Klenow (1997), Prescott (1998), and Hall and Jones (1998) support their argument. All these studies report that international differences in technology are more important for an explanation of international income differences than differences in investment in education.<sup>5</sup>

The new macroeconomic findings resemble what is known as the screening or signaling hypothesis in the microeconomic literature. The underlying idea is that schooling does not change the inherent productivity of individuals, but is used by employers to screen the labor force for the most talented employees, who signal their talent by the relative amount of schooling they receive. At the macroeconomic level, no positive productivity effect of an increase in education would be expected if the screening or signaling hypothesis were true.

However, if the returns to schooling were largely confined to the informational content of a certificate and not to the accumulation of knowledge through schooling itself, one would expect that employers and employees would devise cheaper ways of testing for talent (Griliches 1996). Calculated returns to schooling should be zero among the self-employed if the signaling hypothesis were right because the self-employed cannot earn an income based on a false signal. If education were only a signal, then the returns to schooling should decline with age as the initial signal provided by schooling would

fade away and employers would learn about the true productivity of their employees.

These implications of the screening and signaling hypotheses are not confirmed by empirical evidence: Despite the postulated unproductivity of schooling, demand for well-educated workers continues to be higher than for less-educated workers, rates of return to schooling are not lower among self-employed than among employees, and the rates of return to schooling do not decline with age. All this supports the idea that investment in education does increase the productivity of individuals and, therefore, should show up at the macroeconomic level.

The strong microeconomic evidence in favor of a positive link between education and income again leaves open the question of what mechanism other than screening or signaling might explain the unconvincing evidence on the macroeconomic productivity of education. Poor data quality may be one reason for the missing link between additional education and the growth of national income. Temple (1998), for instance, shows that the missing correlation between increases in educational attainment and income growth in cross-country data (see Figure 7) heavily depends on some unrepresentative correlations among conditional variables. Krueger and Lindahl (1998) demonstrate that after accounting for measurement error, the effect of changes in educational attainment on income growth in cross-country data exceeds the microeconomic estimates of the rate of return to education discussed in Section II.

Beyond such statistical arguments, Griliches (1996) provides the most plausible economic explanation for the missing macroeconomic link between education and growth. He notes that most of the increase in better-educated workers has been absorbed by the government sector, especially in developing countries. The problem is that the government sector, like other sub-sectors of services, belongs to that part of the economy where output is by and large unmeasurable. In fact, output growth in the service sectors is often calculated as measured input growth plus a presumed rate of productivity change.

<sup>5</sup> The last word has not been said on these issues. See, e.g., Gundlach et al. (1998), who report that international differences in factor inputs, and especially differences in quality-adjusted measures of education, explain a larger fraction of international differences in output per worker than differences in technology.

This does not mean that government workers and other service sector workers do not contribute to overall productivity growth, quite the contrary. But it does mean that their true contribution to overall productivity growth is unlikely to be reflected by the data used in the above figures, except for their possible second-order effects. Second-order effects could result from positive spillover effects of better-educated government workers who contribute to a more effective functioning of the economy in many areas. But second-order effects are unlikely to outweigh first-order effects.

Except for educational and military expenditures, the estimated first-order effect of government expenditures on per capita income growth is negative (Barro 1991). The negative correlation is one of the most robust findings recent research on the empirics of growth has ever uncovered. The implication is that if increases in education end up as increases in government size, the first-order macroeconomic growth effect may turn out to be negative, despite an inherent positive individual productivity effect of education. As a result, variables measuring the output effect of a change in schooling cannot show up strongly in cross-country comparisons as long as the unintended side-effect on government size is not taken into account.

Policy makers should be aware that although improved schooling is almost certain to increase the productivity and income of individuals, its macroeconomic productivity may not show up if the government sector accounts for a large fraction of Gross Domestic Product (GDP). The share of government in GDP should be a matter of concern for the Baltic States, because it is significantly higher than in most countries with a comparable level of income (World Bank 1998). With a larger size of government, the probability increases that many of the young well-educated workers enter the public sector, with harmful consequences for long-run growth.

## IV. The Quality of Education

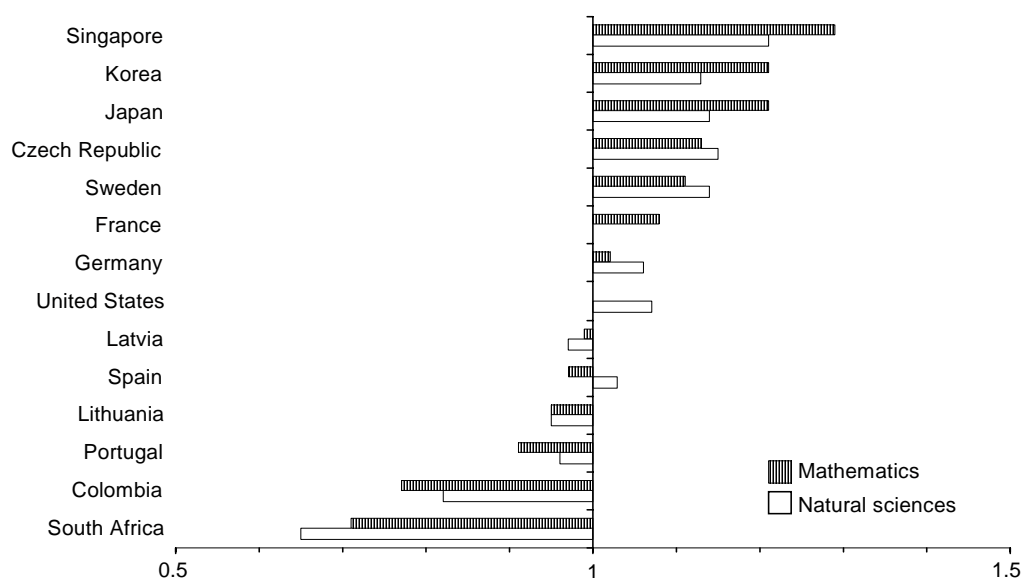
The output of the education sector has a quantitative and a qualitative dimension. The qualitative dimension describes the productivity of a year of education for a given subject as depending on, say, the availability of teaching material and the size and quality of the classroom, the pupil-teacher ratio, or the qualification of teachers. The apparent independence of the quality of educational outcomes from such educational inputs has puzzled researchers in the economics of education for long.

Measurement errors are one obvious reason for so far disappointing results. The quality of education is even more difficult to measure than the quantity of education. A first-best approach to estimate the quality of education would be based on observed labor income. Differences in the quality of education could show up in the different labor market performances of otherwise identical workers who received the same quantity of education at different places or at different times.

The value added from differences in the quality of education would be discovered by differences in income or employment among workers with, say, the same number of years of formal schooling. The obvious problem with such a measure is that labor market performance not only depends on the amount and the quality of schooling but on many other non-schooling factors such as physical capital and infrastructure, which are difficult to control for at the microeconomic level and in international comparisons.

At present, tests of the cognitive achievement of pupils in various fields at a certain grade provide the best source of information on international differences in the quality of education. The measure does not reveal whether international differences in educational quality are important in an economic sense because it is not based on a market value but on direct observation of educational outcomes. And it may also reflect the impact of non-schooling inputs such as family background, although the resulting bias is likely to be smaller than in the case of

Figure 8: Pupils' Performance in Mathematics and Natural Sciences<sup>a</sup>



<sup>a</sup>Test scores on standardized achievement tests in mathematics and natural sciences at the eighth grade in 1994/95; selected countries; international average = 1.

Source: TIMSS (1996).

income-based measures. The bottom line is simple: measures of pupils' performance are a bad proxy for measuring the quality of education, but they are the best international measures that are available.<sup>6</sup>

For instance, the Third International Mathematics and Science Study (TIMSS 1996) reports test scores of pupils at the eighth grade in mathematics and natural sciences for about 40 countries. Despite some possible limitations because of non-representative sample sizes, there are a number of remarkable findings. By and large, the quality of education seems to differ substantially across countries, but the reasons for the variation are not obvious. Figure 8 presents selected results:

- Asian pupils perform best. Especially in mathematics, the discrepancy between pupils from Singapore, Korea, and Japan and all other countries is large in terms of test scores.

- The international differences are more pronounced in mathematics than in natural sciences.
- There is no obvious link between pupils' performance and the organizational structure of schooling systems, which differ with regard to centralization, differentiation, and coverage.
- In some cases pupils from countries with similar levels of development perform rather differently, in other cases pupils from countries with different levels of development perform rather similarly.

Pupils from the two Baltic States covered by the sample (Latvia and Lithuania) perform much better than pupils from countries with similar or slightly higher incomes, except for pupils from the Czech Republic. Pupils from Germany and the United States, where income per person is many times higher (see Figure 2), do not substantially outperform pupils from Latvia and Lithuania. There is no clear link between average income and pupils' performance. In order to establish such a link, one would have to assume that income per person in the Baltic States is at least as high as in Portugal

<sup>6</sup> Recently, the OECD has launched the Programme for International Student Achievement (PISA), which will produce internationally comparable indicators of student achievement covering domains such as reading, mathematics, and science. Tests will be administered every three years, starting in the year 2000.

and Spain, and maybe even higher. This would imply that income per person in the Baltic States is about three times as high as indicated by international statistics. Other explanations of international differences in pupils' performance look more promising.

So-called cost-effectiveness studies are used to discover a link between various schooling inputs and pupils' performance. The method is also known as the internal efficiency analysis, which amounts to estimating an educational production function by regression analysis. Educational output in a specific field, say mathematics, is usually measured by the achievement of pupils in standardized tests. It is modeled as depending on several inputs such as the pupil-teacher ratio, classroom size, teaching materials, or teacher quality. The estimated regression coefficients on each of these variables can be interpreted as the marginal contribution to educational quality change of a unit change in the respective input. In principle, cost-effectiveness studies could guide the investment allocation within the educational sector in an attempt to improve the quality of education for a given amount of inputs.

Up to now, empirical research based on cost-effectiveness studies has not led to conclusive results. For instance, it is still controversial whether a systematic relationship exists at all between pupils' achievement and the amount of spending on education. Summarizing a vast literature, Hanushek (1986, 1995) concludes that there is no systematic relation between pupils' performance and commonly measured attributes of schools and teachers within countries. A first international study by Hanushek and Kim (1995) also finds that conventional measures of school resources, such as teacher-pupil ratios and educational expenditures, do not have strong effects on the performance of pupils as measured by internationally standardized achievement tests.

Figure 9 summarizes the results of a large number of empirical studies which tried to estimate the impact of various schooling inputs on student achievement. For all schooling inputs listed in Figure 9, a positive impact should be expected. However, the overall impression is

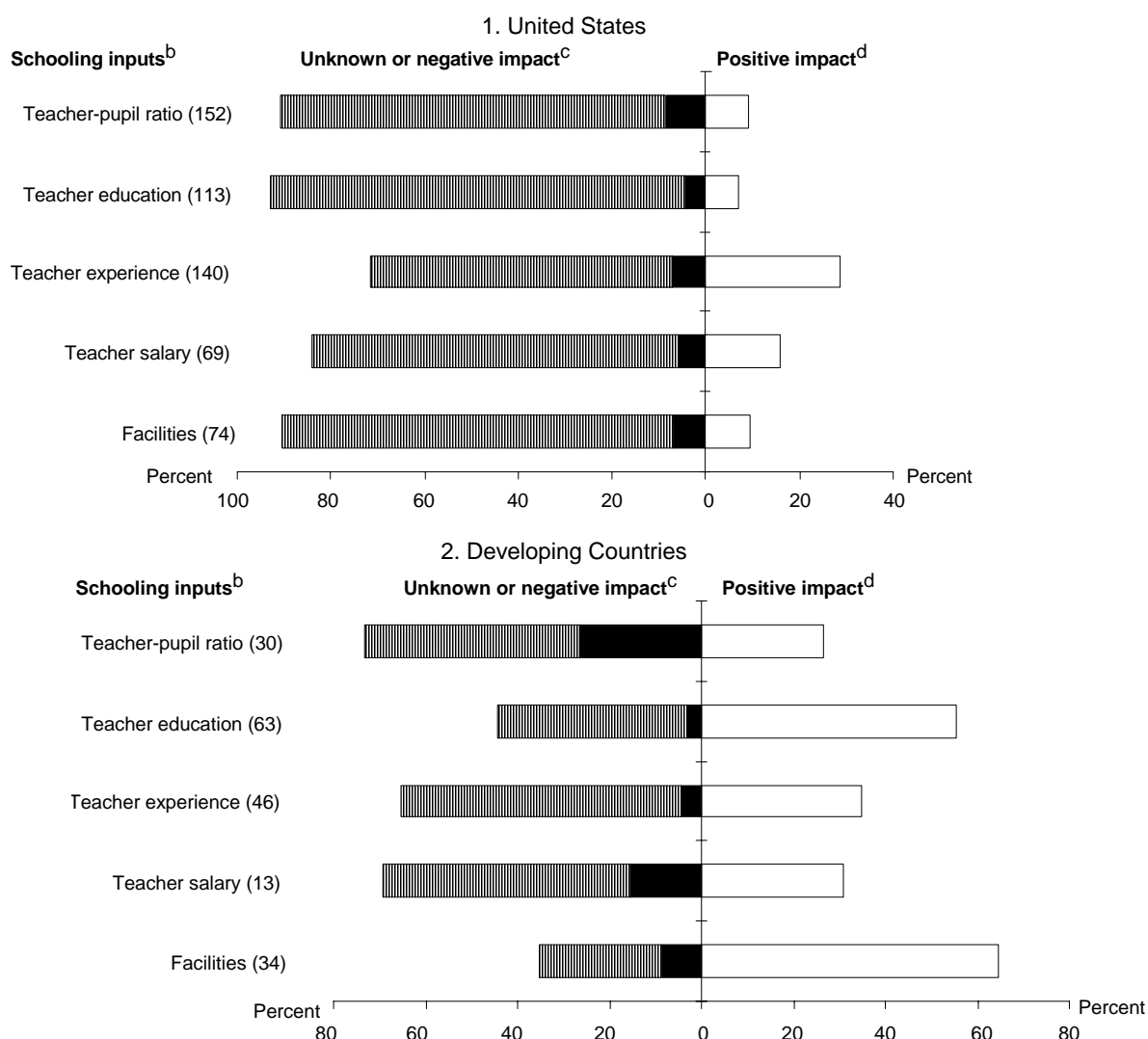
that the vast majority of studies could not detect a statistically significant positive impact of schooling inputs on student achievement.

For instance, of the 113 studies looking at the relation between teacher education and student achievement in the United States, only about 7 percent found a statistically significant positive impact. In developing countries, there is more evidence in favor of a positive link between schooling inputs and schooling output, especially with regard to teacher experience and facilities such as teaching materials and school buildings. Nevertheless, even these studies do not establish a compelling case for specific input policies. They indicate, however, that direct school resources might be more important in developing countries than in developed countries.

In support of these microeconomic estimates, Hanushek (1996) reports that the educational sector in the United States has received a dramatic increase in real resources while the test performance of US pupils has largely remained constant over the last 30 years or so. According to Hanushek, there is a "productivity collapse" in US schools. His findings have ignited an intensive debate on the pros and cons of school reform in the United States. Future research will show whether a similar productivity collapse in schools can also be observed in other countries.

Hanushek's findings are challenged by other researchers. Barro and Lee (1997) find that at least some school resources do have a positive impact on pupils' performance. Controlling for different family background, which also determines schooling success, they find that especially a smaller class size and higher salaries of primary school teachers are important in improving the quality of education. In line with the Hanushek findings, they also report that total educational spending per pupil again does not seem to have a significant effect on performance.

The bottom line is that nobody would seriously deny that higher spending on education could have a positive effect on the quality of schooling. But it is not enough to test for a statistical link between educational spending and pupils' performance to demonstrate such an ef-

Figure 9: The Empirical Productivity of Schooling Inputs<sup>a</sup>

<sup>a</sup>Summary of selected regression coefficients on various expenditure components estimated by educational production functions (dependent variable: student achievement). — <sup>b</sup>Number of studies in parenthesis. — <sup>c</sup>Percentage of studies reporting statistically *insignificant* (▨) or statistically *significant* (■) negative regression coefficients. — <sup>d</sup>Percentage of studies reporting statistically significant positive regression coefficients.

Source: Adapted from Harbison and Hanushek (1992).

fect. What seems to matter is how educational spending is done. If budget differences per se do not account for international differences in pupils' performance, the incentives within the schooling system that determine how well the budget is spent must play an important role in explaining quality differences.

The literature on educational production functions reveals that there are large differences in the cost effectiveness among different inputs.

Based on empirical evidence for a number of developing countries, Pritchett and Filmer (1997) show that inputs that provide direct benefits to educators (like teacher wages or low pupil-teacher ratios) play a much stronger role than inputs that contribute directly to pupils' performance (like books or teaching materials). Pupil-related inputs are obviously vastly under-used: their marginal product per dollar is 10–100 times larger than that of teacher-related inputs.



This is at odds with the idea that educational resources are allocated in order to maximize educational output. By contrast, the finding of large differences in marginal products of educational inputs points to an allocation of educational spending through the political process which is determined by teacher welfare rather than by school quality. In principle, a reallocation away from teacher-related inputs towards pupil-related inputs would improve pupils' performance. But a successful reallocation of resources would require a reform of the very educational system that produced the inefficient allocation in the first place.

The main role of the estimation of educational production functions is not to guide the educational allocation decisions of an optimizing policy maker but rather to indicate the need for fundamental educational reforms that change the structure of decision-making power in the education sector. An efficient schooling system would create a balance between the interests of pupils and teachers, as measured by similar marginal contributions of pupil-related and teacher-related inputs in an educational production function. If educational reform can achieve such a balance, higher spending on education may produce a higher quality of educational output.

But if the educational system itself is the reason for inefficiencies, then rising educational expenditures will not produce the expected output effects. Up to now, the admittedly limited international evidence points to enormous inefficiencies in education spending. Further research has to demonstrate whether the present findings on the (missing) link between schooling inputs and the quality of educational outcomes only reflect a sample of bad cases or whether they highlight a more or less systematic pattern which may also hold for countries like the Baltic States.

## V. Perspectives for the Baltic States

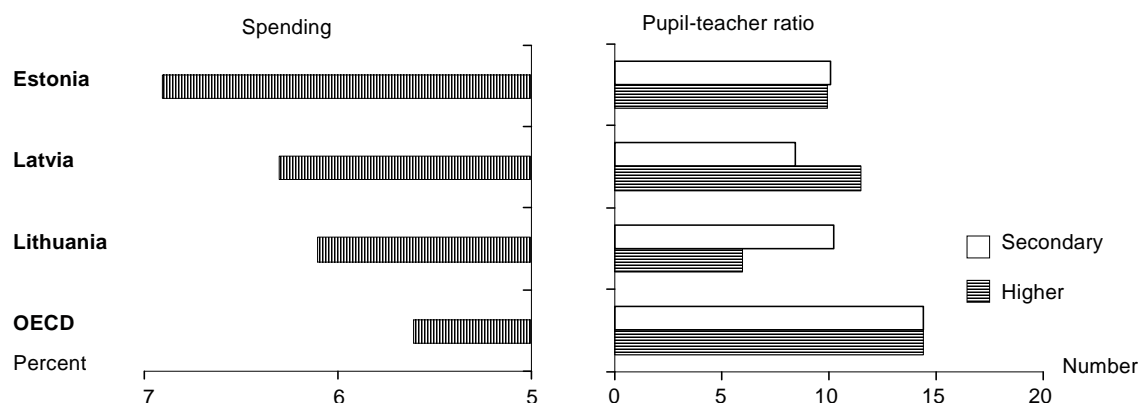
The productivity of the educational sector is most likely to be one of the decisive determinants of future prosperity. This is all the more so because over the last 20 years or so, new information and communication technologies have sharply increased the demand for qualified workers. Policy makers around the world are concerned about the widening income gap between low-skilled and high-skilled workers that has resulted. Investment in education is one obvious way to close the gap, at least in the long run. To achieve this goal, a proper understanding of the economics of education is essential.

Any detailed assessment of the educational situation in the Baltic States requires detailed rates-of-return studies and cost-effectiveness studies. At present, such studies are not available. The following assessment of the educational perspectives for the Baltic States relies on rather crude indicators. Unfortunately, these indicators do not shed light on the incentives within the schooling systems in the Baltic States, so one cannot reach definite conclusions for educational policy reform.

But at a highly aggregated macroeconomic level, some differences and similarities between the Baltic States and other countries are remarkable when it comes to a comparison of educational output and input. The international evidence may thus provide some tentative lessons that could be relevant for the Baltic States. Treating the Baltic States as an entity, which may be justified at this level of aggregation, one finds that the Baltic States as a group

- display much higher enrollment rates in secondary and higher education than developing countries with a comparable income per person, but lower rates than OECD economies (World Bank 1998),
- perform much better in terms of the quality of education than developing countries with a similar income per person (see Figure 8),
- spend more on education in percent of GDP than the average OECD economy (Figure 10), and

Figure 10: Spending for Education<sup>a</sup> and Pupil-Teacher Ratios<sup>b</sup> in the Baltic States, 1995



<sup>a</sup>Total educational expenditure in percent of GNP in 1995. — <sup>b</sup>Pupils and students enrolled per total teaching staff in 1995.

Source: UNESCO (1997).

- have a lower pupil-teacher ratio in secondary and higher education than the average OECD economy (Figure 10).

What is good news and what should be a matter for concern is difficult to say without any further information. Pending such detailed statistical information, I tend to conclude that the allocation of resources within the educational sector of the Baltic States could be improved because total educational expenditures (as a share of GDP) are above OECD average while quantity (enrollment rates) and quality (test scores) of education are below OECD average. My conclusion is in line with the international evidence on the social rates of return to higher education (see Section II), which indicates that at least at the level of development of the Baltic States higher priority should be given to primary and secondary education than to higher education.

In a way, the Baltic States can be compared with Sweden and the Czech Republic, which devote a similar fraction of GDP to education and employ similar pupil-teacher ratios (UNESCO 1997). But these two countries come up with much stronger output results in secondary education (see Figure 8). Japan and Korea are also among the top-performing countries, although they devote a much smaller fraction of GDP to education and employ much higher pupil-teacher ratios in secondary education than the Baltic States.

The below-average pupil-teacher ratio of the Baltic States in secondary and especially in higher education is not necessarily a sign of success. Results derived from educational production functions discover that a relatively low pupil-teacher ratio indicates an inefficient allocation of resources not in favor of pupils. The two countries with the presumably most prestigious higher education, the United States and the United Kingdom, employ an average pupil teacher ratio of 15.7 and 17.7, respectively, which is about 1.8 times higher than the average for the Baltic States in 1995. By contrast, the pupil-teacher ratio in higher education in Japan, which is not known for its high productivity, is similar to the average ratio in the Baltic States (UNESCO 1997).

While it may be grossly inappropriate to compare the Baltic States with countries like Japan and Korea, it is less inappropriate to compare the Baltic States with other European countries, despite large income gaps. One reason is a relatively similar share of government consumption in GDP. In the Baltic States, the government sector is substantially larger than in economies with a comparable income per person, and it is substantially larger than in economies that have experienced high growth rates in the past (World Bank 1998). As mentioned before, a relatively large government sector means that a large fraction of the well-educated workforce is likely to be absorbed by the public sector. Such

an outcome would limit the positive macroeconomic growth effects of any improvement in the educational attainment of the labor force in the Baltic States.

In addition, the longer-term development of the labor market in the Baltic States may suffer from a shortage of skilled labor combined with relatively high unemployment of formally high-skilled labor. Such a structural imbalance would reflect the specialization and training of the large majority of the workforce under a different economic system, which cannot easily be reversed. The Baltic States, like other European countries, display low birth rates and will be confronted with the aging of society relatively soon. For demographic reasons alone, the replacement of older cohorts of the workforce by younger cohorts will be slow.

Under the centrally planned economic system of the past, many skilled workers have been trained for jobs that are no longer required in a market economy. This history has a long reach: it will take about two generations from now on until the complete workforce has received a formal education guided by the requirements of a market economy. This is not to deny that in OECD economies as well, formal education at schools and universities is not always guided by the requirements of a market economy.

What exactly these requirements are is changing in the age of globalization, where low-skilled workers have had to face a decline in income growth and employment opportunities over the last twenty years. What employers want are flexible, trainable employees who have received a maximum of general rather than narrow vocational training. Core qualifications required today reach from reading and mathematical capabilities at the ninth-grade level and beyond to the ability to work in groups with persons of various backgrounds and familiarity with the use of personal computers (Murnane and Levy 1996). One might add that for small open economies like the Baltic States, knowledge of an international language is most important. In economics, English is essential; Russian may not be that helpful for most purposes except for trade in low-value-added goods.

Where pupils cannot live up to international standards set by a globalizing market economy, educational reform should be high on the agenda of policy makers. Especially because the positive effects of educational reform will only be felt in the distant future, the importance of a high productivity of education should be realized right now. As some Asian examples show, basic education can be highly successful for an overwhelming majority of pupils, even if only a comparatively small amount of educational resources is available (Stevenson and Stigler 1992). Learning from the international diversity of educational outcomes may be a good start for thinking about educational reform. Such a reform is necessary in many countries, not only in transition economies, in order to avoid a polarization of society.

## **VI. Conclusion**

The international evidence on the economics of education reveals one central insight and two puzzles. The central insight is that social rates of return to education tend to be higher than the social opportunity costs of capital, except for the case of higher education. Based on the microeconomic evidence, the case for public investment in education is well founded, especially at the primary and the secondary levels.

The first puzzle is that at the macroeconomic level, the presumed positive link between increases in educational attainment and income growth is more difficult to detect. One reason is the doubtful quality of cross-country educational data. Another reason is that a high rate of absorption of well-educated workers by the public sector, typical for many developing countries, is likely to reduce the long-run growth rate.

The second puzzle is that there is no clear link between higher spending on educational inputs and higher educational output in the form of pupils' improved performance. Most likely the reason is that in many countries, schooling systems cannot be considered efficient in an economic sense. Therefore, higher spending on education is not sufficient to improve pupils' performance as long as it is not accompanied by a schooling reform.

As long as detailed empirical evidence on the educational situation in the Baltic States is not available, it should be useful to summarize the international evidence as a point of reference for educational policies. Reconsidering their educational policies, the Baltic States could learn from the international variation in educational outcomes. Three basic lessons emerge which should be confronted with detailed empirical studies for the Baltic States before definite conclusions for educational policies can be reached.

*First*, public investment in higher education in the Baltic States does not show up as a top priority from a social point of view. Public investment in primary and secondary education can be justified more easily. Especially in countries with a relatively low level of development such as the Baltic States, public investment in infrastructure and in other fields of social policy like health and old-age pension schemes is likely to produce higher social rates of return than public investment in higher education.

*Second*, additional investment in education will only produce higher aggregate incomes at the macroeconomic level if better educated workers do not predominantly end up in the government sector. Since the Baltic States do have relatively large public sectors, the macroeconomic return to education could prove to be lower than would be indicated by the microeconomic evidence.

*Third*, improving the quality of education seems to be a question of schooling reform rather than a question of additional educational expenditures. The good news for countries like the Baltic States is that it is not necessarily the total amount of resources that determines educational outcomes. Nevertheless, the productivity of the schooling system in the Baltic States can probably be improved, for instance by a different allocation of resources within the educational sector. One way or another, the Baltic States would not be the only candidates for schooling reform.

## References

- Barro, R.J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics* 106 (2): 407–443.
- Barro, R.J., and J.-W. Lee (1996). International Measures of Schooling Years and Schooling Quality. *American Economic Review* 86(2): 218–223.
- (1997). Schooling Quality in a Cross Section of Countries. NBER Working Paper 6198. National Bureau of Economic Research, Cambridge, Mass.
- Benhabib, J., and M.M. Spiegel (1994). The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country and Regional U.S. Data. *Journal of Monetary Economics* 34 (2): 143–173.
- Bils, M., and P.J. Klenow (1997). Does Schooling Cause Growth or the Other Way Round? NBER Working Paper 6393. National Bureau of Economic Research, Cambridge, Mass.
- Gollin, D. (1998). Getting Income Shares Right: Self Employment, Unincorporated Enterprise, and the Cobb-Douglas Hypothesis. Williams College (mimeo), available from: dgollin@williams.edu
- Griliches, Z. (1996). Education, Human Capital and Growth: A Personal Perspective. NBER Working Paper, 5426. National Bureau of Economic Research, Cambridge, Mass.
- Gundlach, E. (1995). The Role of Human Capital in Economic Growth: New Results and Alternative Interpretations. *Weltwirtschaftliches Archiv* 131 (2): 383–402.

- (1999). Human Capital in Economic Development: Problems and Perspectives. In J. Tan (Ed.), *Human Capital Formation as an Engine of Growth: The East Asian Experience*. Singapore: Institute of Southeast Asian Studies (forthcoming).
- Gundlach, E., D. Rudman, and L. Wößmann (1998). Second Thoughts on Development Accounting. Working Paper 895. Institute of World Economics, Kiel.
- Hall, R.E., and C.I. Jones (1998). Why Do Some Countries Produce So Much More Output per Worker than Others? Available at: <http://www-leland.stanford.edu/~chadj/funddet.html>. Forthcoming in *Quarterly Journal of Economics*.
- Hanushek, E.A. (1986). The Economics of Schooling: Production and Efficiency in Public Schools. *Journal of Economic Literature* 24 (3): 1141–1177.
- (1995). Interpreting Recent Research on Schooling in Developing Countries. *World Bank Research Observer* 10: 227–246.
- (1996). The Productivity Collapse in Schools. W. Allen Wallis Institute of Political Economy Working Paper 8. University of Rochester.
- Hanushek, E.A., and D. Kim (1995). Schooling, Labor Force Quality, and Economic Growth. NBER Working Paper 5399. National Bureau of Economic Research, Cambridge, Mass.
- Harbison, R.W., and E.A. Hanushek (1992). *Educational Performance of the Poor. Lessons from Northeast Brazil*. A World Bank Book: Oxford University Press.
- Jorgenson, D.W., and B.M. Fraumeni (1992). Investment in Education and U.S. Economic Growth. *Scandinavian Journal of Economics* 94 (Supplement): S51–S70.
- Klenow, P.J., and A. Rodriguez-Clare (1997). The Neoclassical Revival in Growth Economics: Has It Gone Too Far? *NBER Macroeconomics Annual* 12: 73–102.
- Knight, M., N. Loayza, and D. Villanueva (1993). Testing the Neoclassical Theory of Economic Growth: A Panel Data Approach. *IMF Staff Papers* 40 (3): 512–541.
- Krueger, A.B., and M. Lindahl (1998). Education for Growth: Why and For Whom? Princeton University, mimeo.
- Lau, L.J., D.T. Jamison, and F.F. Louat (1991). Education and Productivity in Developing Countries. Policy Research Working Paper 612. World Bank, Washington, D.C.
- Loogma, K., R. Ruubel, V. Ruus, E.-S. Sarv, and R. Vilu (1998). Estonia's Education Scenarios 2015. Tallinn, mimeo.
- Maddison, A. (1987). Growth and Slowdown in Advanced Capitalist Economies. *Journal of Economic Literature* 25 (2): 649–698.
- Mankiw, N.G. (1995). The Growth of Nations. *Brookings Papers on Economic Activity* (1): 275–326.
- Mankiw, N.G., D. Romer, and D.N. Weil (1992). A Contribution to the Empirics of Growth. *Quarterly Journal of Economics* 107 (2): 408–437.
- Murnane, R.J., and F. Levy (1996). *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy*. New York: The Free Press.
- OECD (1998). *Human Capital Investment. An International Comparison*. Paris.
- Prescott, E.C. (1998). Needed: A Theory of Total Factor Productivity. *International Economic Review* 39 (3): 525–552.
- Pritchett, L. (1996). Where Has All the Education Gone? Policy Research Working Paper 1581. World Bank, Washington, D.C.
- Pritchett, L., and D. Filmer (1997). What Education Production Functions Really Show: A Positive Theory of Education Expenditures. Policy Research Working Paper 1795. World Bank, Washington, D.C.
- Psacharopoulos, G. (1994). Returns to Investment in Education: A Global Update. *World Development* 22 (9): 1325–1343.

- (1996). Economics of Education: A Research Agenda. *Economics of Education Review* 15: 339–344.
- PWT (Penn World Table) (1994). Version 5.6. Read-only file maintained by the NBER, Cambridge, Mass., available at: <http://www.nber.org/pwt56.html>
- Stevenson, H.W., and J.W. Stigler (1992). *The Learning Gap: Why Our Schools Are Failing and What We Can Learn from Japanese and Chinese Education*. New York: Summit Books.
- Temple, J. (1998). Where All the Education Went: A Positive Effect of Human Capital on Growth. Hertford College, mimeo, available at: <http://www.nuff.ox.ac.uk/Users/Temple/abstracts/educnote.htm>
- TIMSS International Study Center (1996). Highlights of Results from TIMSS. Third International Mathematics and Science Study. Boston College, available at: <http://wwwwcsteep.bc.edu/TIMSS1/Achievement.html>
- UNESCO (1997). *Statistical Yearbook*. Paris.
- World Bank (1998). *World Development Indicators*. CD-ROM.