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# Comment on Krueger and Lindahl: Education for growth in Sweden and the world

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One of the most stable and robust findings in the empirical growth literature is that the initial level of human capital—measured as average years of schooling—has a positive and significant impact on the subsequent growth rate (see, e.g., Barro, 1999). On this background, one would expect that the rate of growth in human capital, and not just the initial *stock* of human capital, should matter for growth. Mainstream economic growth theories suggest that a country that invests a lot in education and, as a result, substantially increases the average human capital of its labour force should grow faster (e.g., Lucas, 1988). This implication is echoed by the empirical literature in labour economics (Krueger and Lindahl, 1999). If more education increases an individual's wage and labour productivity, then an increase in the educational attainment in the entire population should translate into higher total production. But so far, the macro evidence has failed to confirm this prediction of the theory.[1] In particular, Benhabib and Spiegel (1994) analyse how differences in growth rates of GDP per capita can be explained by differences in the *growth rates* (as opposed to the stock) of human capital across countries, and they find no significant effects. This finding is consistent with studies that simultaneously look at differences over time and across countries (Caselli, Esquivel and Lefort, 1996; Islam, 1995).

The purpose of Krueger and Lindahl (1999) is to inquire into the reasons for this apparent inconsistency between theory and data. Krueger and Lindahl suggest that the puzzle reflects problems with the measurement of human capital, rather than a failure of the predictions of economic theory. In particular, they argue that changes in human capital over time are measured less precisely than differences in stocks of human capital across countries. They show that this lack

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[1] One exception would be if education is simply a costly signal that increases wages but which renders productivity unchanged (Spence, 1973). In this case, growth in educational attainment should not be expected to increase the growth rate of GDP.

of precise measurement would tend to bias the econometric results toward finding no effects of changes in human capital on growth. Once Krueger and Lindahl pick the human capital data set guided by minimising the measurement error, they find evidence that countries with a higher growth rate of human capital tend to grow faster. This is an important result, and their findings are robust to several model specifications.

## Some specific comments

This said, I feel that some caution is in order. A standard approach in the empirical growth literature has been to explain the economic growth rate by a set of more or less exogenous variables.

The fact that the coefficients in a regression might be biased if endogenous variables are mistakenly included as exogenous regressors is a standard econometric result. For this reason, one has typically not included the changes in human or physical capital as explanatory variables—an expansion of educational attainment can well be a result of an exceptionally good economic performance. For the case of *physical* capital investment, Krueger and Lindahl discuss the endogeneity problem and even make a point of excluding it from their regressions. Bottom line: to the extent that there are endogeneity problems associated with regressing economic growth on growth rates in human and physical capital, it will be difficult to interpret the coefficients in the regressions.

One striking fact about the results in Krueger and Lindahl (1999) is that the coefficient on the impact of change in schooling on growth varies considerably with the length of the time interval of the changes. For instance, the coefficient on $\Delta S$ increases with a factor of six when moving from 5-year differences to 20-year differences (Table 4). This could be due either to smaller measurement errors with longer intervals and therefore less bias downwards. Or, it could be due to a larger endogeneity problem and hence a larger (upwards) bias, the longer the time interval.

One way to discriminate between these two possible hypotheses for the unstable coefficients is to assess the plausibility of the coefficients in the case of 20-year differences. When the regressions in Table 4 and Table 5 are interpreted as macro-Mincer regressions in differences, one should divide the coefficient on $\Delta S$ by labour's share of output (0.65, say) to compare the results with the coefficient on edu-

cation in standard micro-Mincer regressions. This approach reveals that the estimated coefficients in Table 4 (last two columns) are unreasonably large, implying a return to education of more than 28%, about twice the high end of the micro evidence surveyed in Table 1. This suggests that either the endogeneity problems are large or the externalities from education are enormous. But in defence of Krueger and Lindahl (1999), it should be noted that the coefficients on $\Delta S$ in Table 5 are all *within* the ballpark of the micro evidence.

Lastly, Krueger and Lindahl (1999) explore the robustness of some standard approaches in the empirical growth literature. In particular, they show that when allowing for country-specific return to schooling, the initial level of schooling does not seem to matter for output growth. This is a potentially very important finding, although it contradicts strong priors both from empirical introspection and from predictions of mainstream endogenous growth theory—that recovering from a loss in human capital is slower than recovering from a loss in physical capital. Prominent examples of slow recovery after large exogenous reductions in human capital include, for example, Bangladesh after its independence and Europe after the black plague. The reconstruction of Japan after the World War II is an example of a fast recovery after loss of *physical* capital.

## Implications for Sweden

If we take Krueger and Lindahl's main conclusion seriously—that higher growth rates of human capital increase the rate of economic growth—it is natural to ask what the implications are for educational policy in a country such as Sweden. Before turning to policy implications, it is worth pointing out two facts about education in Sweden:

- Education has little impact on wages in Sweden. One extra year of schooling translates into a 2-5% increase in earnings (Edin, Fredriksson and Holmlund, 1993), compared to 5-18% for other countries (Table 1).
- Average higher educational attainment in the Swedish workforce (19%) is the second highest in Europe, but low relative to that of the US (46%). These are measures of the *stock* of human capital. But the flows into higher education seem to lag behind. For example, Finland, Norway, Austria, Netherlands, France, Belgium, the US, and Canada all have higher education enrolment ratios

than Sweden (see Storesletten and Zilibotti, 1999, for further discussion).[2]

The social return to education is the central issue for educational policy. First suppose that the social return is substantially larger than the private (after tax) return. This could be due to progressive taxation, and, as several authors have argued, to egalitarian wage policies that lead to a compressed wage structure in Sweden (e.g., Edin and Topel, 1997; Flam, 1987; Lindbeck, Molander, Persson, Peterson and Sandmo, 1993). If the impact on aggregate growth of increases in education is as large as what is indicated by the estimates in Table 4, then any sensible social welfare function would imply that the educational attainment in Sweden should increase. This increase could occur in at least three ways by:

- Prolonging the duration of high school from, say, four to five years
- Increasing the enrolment in higher education, or
- Admitting more high-skilled immigrants.

It should be straightforward to influence the enrolment in higher education, because the enrolment in Sweden seems sensitive to the wage premium of education.[3] So to increase enrolment one could lower the marginal tax rates for the top wage earners or implement labour market reforms aimed at increasing the college wage premium.

[2] One standard method of comparing the growth in higher educational attainment across countries involves comparing the national enrolment ratios—the ratio of the number of students enrolled in higher education over the size of the population between ages 20 and 24. As Krueger and Lindahl point out, this measure abstracts from students studying abroad. So in countries such as Sweden, where many students attain their education abroad, the national enrolment ratio will bias downwards the measure of human capital accumulation. Using data from the Swedish Level of Living Survey (LNU), they argue that this bias is large for Sweden. But Swedish students, who take jobs abroad upon graduating from their Swedish education, mitigate the bias.

[3] The after-tax return on education, abstracting from student support, fell from 11.5% in 1968 to 0.5% in 1981, and rose again to 4.5% in 1991 (Edin, Fredriksson and Holmlund, 1993). The development of higher education enrolment ratio in Sweden, *relative* to a set of major OECD countries, has followed a qualitatively similar pattern; it fell continuously from 1970 to 1988 and rose slightly after 1989 (Storesletten and Zilibotti, 1999).

Suppose, alternatively, that the social return on education is low in Sweden, comparable to, say, the private return. The straightforward implication would be that the government should strive to increase the social return of education up to or above the level of other OECD countries. If this is impossible, it would, in fact, be optimal to reduce educational attainment by, for example, shortening the duration of high school!

The government can influence the social return to education in at least two ways:

- Improve the quality of education
- Enhance the allocation of talented individuals to the right education and the allocation of educated individuals to the right jobs.

Note that increasing the social return on education is desirable regardless of whether the current true social return is high or low. While the quality of primary and secondary education in Sweden seems reasonably good compared to other OECD countries (Sohlman, 1999), my subjective feeling is that the quality of higher education in Sweden is inferior to the quality in the US. The most effective tool to improve the quality of education is probably to increase the demands on performance for students and teachers. For students, this could occur through a heavier course load and through steeper student incentives. The current system is characterised by generous student benefits, coupled with a low (private) wage premium on education. So the students are rewarded for being students rather than for acquiring productive skills. One remedy for this could be to let students pay tuition and compensate them upon successful completion of the courses, to reward them for completing their studies and for doing well. The incentives are even weaker for teachers and university faculty to deliver high-quality teaching and research performance. To the extent the performance in teaching and research can be measured (the latter through, for example, publications in peer-reviewed academic journals), the government should construct more explicit wage and career incentives to reward good research and teaching performance.

In addition, for each field of specialisation in every higher educational institution, one should publish completion rates, employment rates, and average wages (after graduation) for respective students, coupled with statistics on the quality of the students when they first entered (to assess the value added of the education). Such published

statistics would aid prospective students in assessing the quality of the educational product offered by the various institutions and put pressure on the institutions to improve quality through healthy, old-fashioned competition.

Lastly, I believe the quality of (all levels of) education could be improved by paying teachers higher wages to attract more high-skilled people to the teaching profession.

When turning to the allocation of students, one obvious challenge is to improve the allocation of students to "needed" branches of studies, i.e., fields where the social return is high. One mechanism is the invisible hand—to let the prospective students get signals through wages. To this end, one could, for example, make detailed wage statistics publicly available to high school students. But note that in the absence of clear signals through wages, it is important that the government intervenes to increase the number of students in socially needed fields on the expense of less-needed fields.

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