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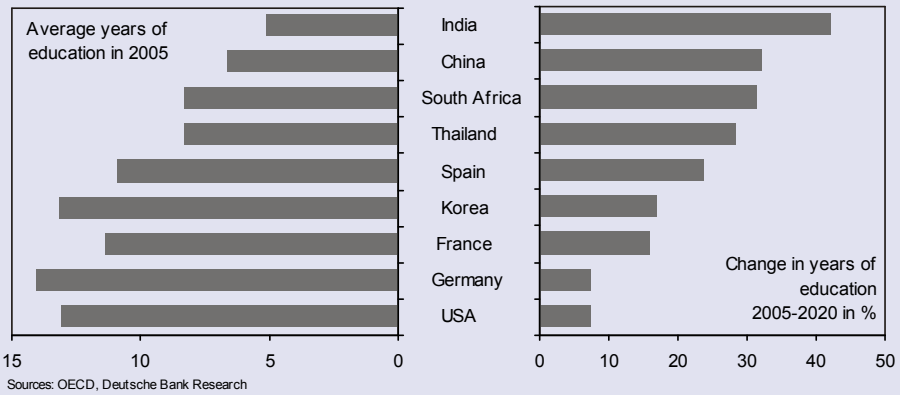
Current Issues

Global growth centres

Human capital is the key to growth
Success stories and policies for 2020

- Many of the growth stars identified in our introductory study "Global Growth Centres 2020" owe their success to solid gains in human capital – especially India, China, Thailand and Spain.
- Our empirical investigation supports the view that human capital is the most important factor of production in today's economies. Increases in human capital are crucial to achieving increases in GDP. The best available proxy for human capital is the average years of education of the population aged 25 to 64.
- Over the next 15 years, Spain is expected to generate the fastest increase in the average years of education among the rich economies. High current enrolment rates and the low level of education during the Franco dictatorship imply that new entrants into the labour market have a much higher human capital than those who exit.
- South Korea has given top priority to education for decades. It spends more than 8% of GDP on education and already ranks among the Top 3 in PISA. The years of education will continue to rise significantly and the level will close in on that of the leading countries.
- These success stories show that policy changes can lead to positive developments. Successful countries share the one-track school system and the goal of bringing as many children as possible into higher education – without jeopardising quality. Private financial resources are an important ingredient in these systems. These countries understand that education is an investment.

Human capital to rise strongly in India and China



Sources: OECD, Deutsche Bank Research

Author: Stefan Bergheim, +49 69 910-31727 (stefan.bergheim@db.com)

www.dbresearch.com

Editor
Stefan Schneider
+49 69 910-31790
stefan-b.schneider@db.com

Technical Assistant
Pia Johnson
+49 69 910-31777
pia.johnson@db.com

Deutsche Bank Research
Frankfurt am Main
Germany
Internet: www.dbresearch.com
E-mail: marketing.dbr@db.com
Fax: +49 69 910-31877

Managing Director
Norbert Walter

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ISO codes of the countries analysed:

AR	Argentina	JP	Japan
AU	Australia	KR	Korea (South)
AT	Austria	MY	Malaysia
BE	Belgium	MX	Mexico
BR	Brazil	NL	Netherlands
CA	Canada	NZ	New Zealand
CL	Chile	NO	Norway
CN	China	PT	Portugal
DK	Denmark	ZA	South Africa
FI	Finland	ES	Spain
FR	France	SE	Sweden
DE	Germany	CH	Switzerland
GR	Greece	TH	Thailand
IN	India	TR	Turkey
ID	Indonesia	GB	Great Britain
IE	Ireland	US	USA
IT	Italy		

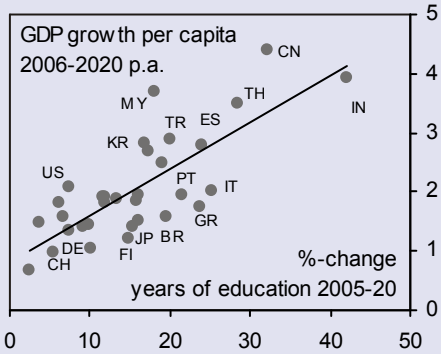
1. Growth centres focus on human capital

2020 growth stars base their success on gains in human capital

Many of the growth stars identified in our introductory study "Global Growth Centres 2020" owe their success to solid gains in human capital – especially India, China, Thailand and Spain.[1] On the other hand, many of the slow-growth countries also are likely to post small gains in human capital. Our empirical investigation reveals that human capital is the most important factor of production in modern economies. By explicitly including human capital in our innovative long-run forecasting model *Formel-G*, we achieve one of the main goals of our "Global growth centres" project: to explain and forecast technological progress.

Human capital is the sum of the abilities and knowledge of individuals. It measures the quality of the labour supply and can be accumulated through education, further education and experience. Education is an investment in human capital, while learning is the process of acquiring knowledge or skills through study, experience or teaching. Knowledge is the awareness and understanding of interconnected facts, truths or information gained in the form of experience, learning or introspection.[2]

More human capital = strong GDP growth per capita



Source: Deutsche Bank Research

In our introductory study we only briefly explained why human capital is so important for GDP growth, how it is measured and what drives our forecasts until 2020. This follow-up study will explain the importance of human capital in more detail, evaluate the different measures, highlight some success stories and derive education-related policy recommendations. Investors, corporate strategists and policy-makers will therefore gain access to the most important know-how on human capital in a single publication.

Human capital facilitates structural change

Structural changes increase pressure on low-skilled workers

The rapid structural change caused by globalisation and technological change has increased the importance of human capital over the past years.[3] In the rich economies, this structural change increased the pressure on the suppliers of less qualified labour (i.e. people with low human capital). Physical work is substituted by machines at home and by cheaper labour input from abroad. As a reaction, rich countries can either shield themselves from globalisation (negative for prosperity), cut the wages of less qualified workers (rather unpopular), accept higher unemployment (ditto; but effectively what happened in many countries in Europe) or they can raise the skill level of their workers. Some countries have already realised that human capital is increasingly important and have acted accordingly. They are better equipped to deal with the structural changes.

Education does not end with the last degree

These countries realise that education starts in the first year of life and does not end with a university degree: modern brain science shows that most of the synapses in human brains form within the first three years. And research on ageing shows that, although people live longer and longer, they may suffer from age-related disabilities for shorter periods.[4] This implies that the number of years

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1 Bergheim, Stefan (2005). Global Growth Centres 2020. Deutsche Bank Research, Current Issues. March 23, 2005.

2 We need to distinguish between information (can be codified) and knowledge (initially not codified), which allows one to recognise, process and evaluate this information.

3 Specifically, it seems that technological process has reduced the role of skill-specific education (apprenticeship) relative to general education, see Krüger and Kumar (2004).

4 The German Max Planck Institut for Demographic Research sees a decline in the likelihood of suffering from disability in old-age, see Doblhammer and Ziegler (2005).

people can spend productively rises at least as quickly as life expectancy.

Education reform for more growth

Long lags between education reform and GDP growth

It tends to take a long time for a nation to boost its human capital – unless it opts for immigration of educated workers or for the relatively quick path of further education. If a larger proportion of each cohort is to eventually graduate from university, the foundations have to be laid in kindergarten. Decades can pass before these additional highly skilled workers enter the labour market – or before past mistakes in educational policy become visible via a shortage of qualified labour. While we can derive valuable information for our growth forecasts from this inertia, these long lags may prevent the implementation of effective economic policy given the short time horizons in the political arena.[5] The currently low rates of German GDP growth partly stem from the stagnation of the educational system since the 1980s. Therefore, higher growth thanks to gains in human capital requires significant reforms as quickly as possible – although they will only bear fruit ten or more years down the road.

Success stories: Spain and South Korea

One of the goals of our "global growth centres" project is to provide input into the decision-making process of investors, corporate strategists and policy-makers. Therefore, this publication will also highlight the recent success stories of Spain and South Korea. The different measures of human capital show a very dynamic development there – but what caused it? We will show how the institutional framework has been improved over the past decades to allow a rapid accumulation of human capital. In addition, better education of the relatively poor is one of the most important ways to fight poverty – both in rich and in poor countries. After all, differences in educational attainment explain the major part of differences in income, both among individuals in one country and across countries.

[5] See Bergheim, Stefan, Marco Neuhaus and Stefan Schneider (2003). *Reformstau* – causes and remedies. Deutsche Bank Research. Current Issues, September 18, 2003.

2. The most important factor of production

Human capital facilitates innovation and higher productivity

Human capital and income are closely linked. This is true both for individuals and for whole economies. Higher human capital acquired through better and longer education allows an individual to perform higher value-added tasks more efficiently and more quickly. This individual can also apply more new ideas and be more innovative. In short, higher human capital leads to more output per hour worked – productivity is higher.[6] Similar to additional physical capital (machines), additional human capital also raises the productivity of labour. This relationship is often ignored in empirical growth models and in economic policy-making.[7]

Interaction between human and physical capital

A rise in human capital boosts the return on physical capital

At this point the linkages between the different drivers in our econometric model already become evident. Equipping unskilled workers with ever more complicated and more expensive machines does not necessarily boost output. In fact, output might rise more significantly if the additional money were spent on more human capital instead of more physical capital. However, this could lead to conflicts of interest: the additional human capital leaves the company every evening and may decide to move on to a competitor some day. Many foreign companies in China went through this unfortunate experience over the past years. Therefore, the first preference for many companies might be an investment in physical capital – and they might therefore prefer tax breaks for physical investment over breaks for the possibly more sensible (from an economy-wide perspective) investment in human capital. This highlights the responsibility of the individual and of the state for the accumulation of an economy's human capital.

A lopsided focus on physical capital can be inefficient from a macroeconomic perspective, especially if globalisation opens up more options in other countries for the owners of physical capital. Furthermore, there is an important interaction between trade openness and human capital in an economy: countries with higher human capital can learn more easily from abroad and therefore take greater advantage of the beneficial effects of trade opening.[8]

Education explains income of individuals

One additional year of education boosts an individual's income by around 10%

Quantitative analyses at the micro-level can explain a large part of an individual's annual or monthly income by his/her level of education and work experience.[9] Econometric estimates consistently show a statistically significant positive impact of an individual's average years of education – even after controlling for other factors like the parent's level of income or education. Only the magnitude of the effect is somewhat controversial: estimates of the gain in income from an additional year of education range from 5% to 15%. In the USA, for example, a college graduate earns about two-thirds more than a high school graduate. In addition to the effect on income, better educated individuals are also less likely to be unemployed – even though their employment need not be

6 Of course, students cannot contribute to production while they are receiving education. The growth potential declines temporarily (opportunity costs).

7 Even today most long-run forecasting models use only labour and physical capital as inputs.

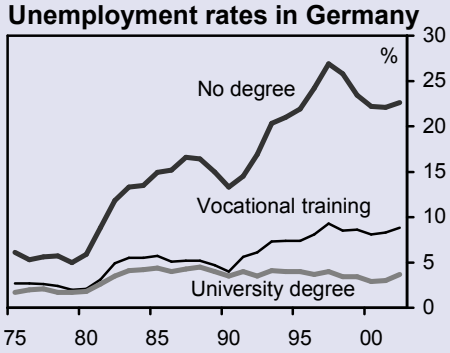
8 More details in: Neuhaus, Marco (2005). Progress through openness. Deutsche Bank Research, Current Issues (forthcoming, available in German).

9 Mincer (1974) was particularly influential in this context.

commensurate with their education. Measures of income inequality in a society largely reflect inequalities in educational attainment.

The high positive private returns are an incentive to invest in education. Social, economy-wide returns may even be higher than returns to the investing individuals, if their colleagues are inspired by the new knowledge. These external effects (spillovers) can lead to total returns exceeding the sum of the returns to those individuals who spent more time studying. Of course, if the individual shoulders the investment costs, but the returns also accrue to others, there will be too little investment in education from the point of view of the society. In that case, government action would be justified: tax those who do not invest and subsidise those who do. However, it is highly controversial as to whether social returns indeed exceed individual returns – especially when taking the current levels of government subsidies for education into account. In sum, it appears that education may partly be a public good, but the bulk of the returns remain with the individual. Consequently, the individual should also bear the bulk of the costs.

Unemployment rates in Germany



Source: IAB

More sophisticated theory

The most valuable capital is that invested in human beings

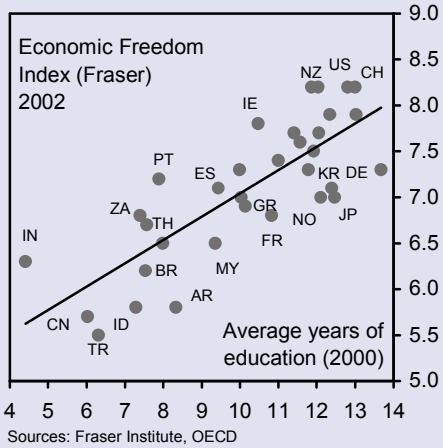
The theoretical models of the impact of human capital on economic activity have become increasingly sophisticated over the past centuries, especially during the last twenty years. As early as 1890, Alfred Marshall noted that “the most valuable of all capital is that invested in human beings.” And Benjamin Franklin was aware that "investment in education pays the best interest." Gary Becker refined and deepened these insights and coined the term “human capital” with the title of a book published in 1964: education is an investment.

Decisive for GDP growth: a change in human capital

In 1998, Robert Lucas modelled the link between human capital and economic activity by splitting the economy into two sectors: the education sector produces new human capital with the help of existing human capital (teachers), while the final goods sector uses both human and physical capital as inputs. In this model, a rise in human capital leads to a rise in national income, while a high level of human capital explains a high level of income. This is the relationship we are using in our empirical model and which is well supported in academic research. Economic policy that raises the rate of growth of human capital will lead to higher growth rates of GDP.

An alternative view is that a high level of human capital allows for a high growth rate of GDP. Paul Romer stirred up a lot of attention in the late 1980s with his model of knowledge spillovers, where the stock of knowledge determines the growth rate of GDP. However, there is no clear-cut empirical evidence for his thesis. Germany, unless it gets a lot wrong in other areas, should, for example, post the highest rates of income growth given its high level of human capital. Furthermore, some researchers claim that individuals only go to school to signal their potential future employers how motivated and smart they are. In this view, they do not really learn much in school that would increase their productivity and innovative capacity. This thesis is highly controversial on theoretical and empirical grounds – and we do not use it in our growth model.

Human capital vs Fraser Freedom Index



Sources: Fraser Institute, OECD

Freedom, health and a long life expectancy

In addition to the direct effects of human capital on growth, there are several indirect effects both on growth and on measures of a nation’s well-being. For example, human capital correlates strongly with other factors that are often seen as explaining the level of GDP: Countries with a high level of education or human capital tend to

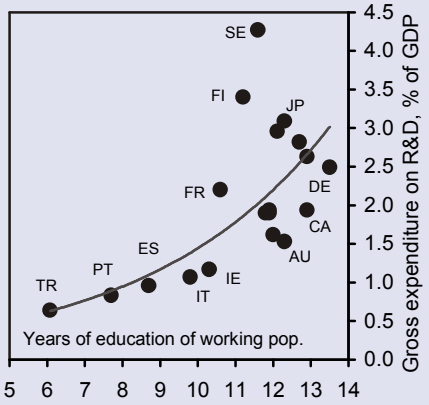
also score highly in economic freedom indices such as the Fraser Institute's Economic Freedom Index (see chart on previous page) or the Heritage Foundation's Index of Economic Freedom. Given this high correlation we do not deem it necessary to add a freedom index to our growth model.

Expenditures on research and development also tend to be higher in countries with a lot of human capital: there can be no research without human capital and not much innovation without research (see chart). This strong link is one of the reasons why we did not include research and development spending in our *Formel-G* model.

On top of the direct productivity-enhancing effects of higher human capital, it also leads to additional positive consequences such as improved health, higher life expectancy, social peace, less crime, etc. These benefits are probably quite large, but they are extremely difficult to quantify.

So, GDP growth hinges on the accumulation of human capital. But what determines the growth rate of human capital? Compulsory school attendance and other legal conditions, return expectations, government subsidies and social attitudes all are important determinants. Our trend analysis takes many of these determinants into account, directly or indirectly. Urbanisation, for example, boosts the returns on education because knowledge can spread more easily if people live more closely together. The question as to how the DBR trend clusters affect human capital and which countries are set to show the most significant growth-positive trend developments will be discussed in section 5 of this study. We do not explicitly model education reforms in *Formel-G*, but see them as a consequence of developments in the trend clusters.

Education & research correlate



Source: Deutsche Bank Research

Return expectations determine accumulation of human capital

3. The right measure of human capital

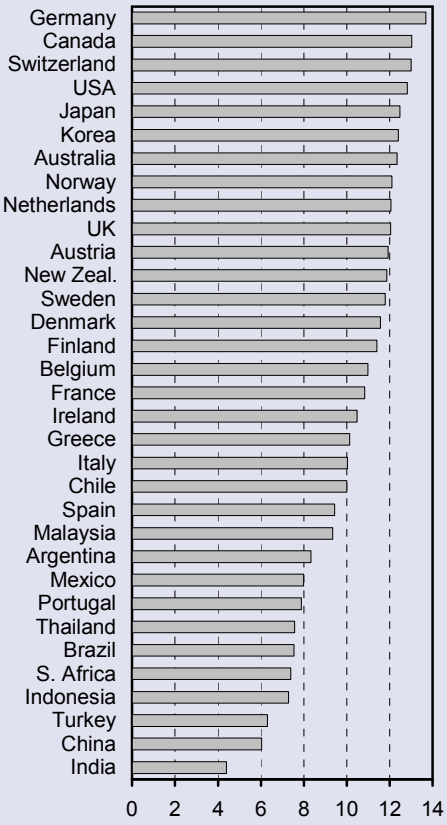
As shown above, the positive impact of human capital on the level of income is rather uncontroversial, although the transmission mechanisms and the feedback loops are complex and intransparent. But how can we measure human capital and use it in a growth model? Which indicators should be observed by investors and corporate strategists who want to track and forecast the trajectory of a country's human capital? As indicated earlier, our preferred measure is the average years of education of the population aged 25 to 64 years, even if it can only be an approximation. This measure has more advantages and fewer disadvantages than all the other available measures, which we will now discuss in more detail.

Average years of education is the best measure available

Years of education: the best measure

Our preferred measure for human capital in an economy is the average years of education of people aged between 25 and 64 years. Although experience and further education certainly also raise human capital, they cannot be included in this measure.[10] For the years of education to correctly represent human capital across countries, the assumption is that a year of education has the same quality in all countries, which may not always be the case as we will show below. In addition, this measure treats a degree in physics in the same way as a degree in medieval literature, although the latter may not produce the same macroeconomic return. Likewise, four years in primary school are treated in the same way as four years in a Ph.D. program.

Average years of education of the working-age population in 2000



Source: OECD

The current discussion in Germany centres around reducing the length of schooling, and many states are cutting the number of years until high-school graduation (Abitur) from 13 to 12. While this may help international comparability by bringing the length of schooling in line with that in other countries and may boost productivity (if the same subject matter is taught in less time), these changes are unlikely to generate any lasting gains in GDP growth. On the other hand, boosting high-school and university graduation rates significantly would certainly bring about a sustained increase in GDP growth. Only one-third of each cohort finishes high school in Germany, while the OECD average stands at 60%.

It is not quite clear either theoretically or empirically whether there are decreasing marginal returns to education, i.e. does a year of primary education lead to a bigger gain in income than a year in a Ph.D. program? Also, it is not clear whether the growth rate of GDP depends on the relative or the absolute change in human capital. Microeconomic studies like that of Mincer (1974) point to the absolute change as the most relevant factor. According to these studies, an additional year of education boosts income by the same percentage regardless of whether the starting level was 4 years or 12 years. We are not sure that this accurately reflects reality and see a 10% rise in years (human capital) as having the same impact on GDP growth – regardless of the starting level. In other words, an additional year of education leads to a larger percentage change in GDP if the initial level is comparatively low.

Reliable data sets from the OECD

Limited data availability initially only allowed for the use of other measures (e.g. enrolment rates) in empirical studies, but the average years of schooling are increasingly gaining ground, especially since Barro and Lee presented their first data set in 1994.

[10] However, the correlation between formal education and further education is very high, see the section on life-long learning below.

We use the more up-to-date numbers published by the OECD because there are some qualitative and systematic difficulties with the Barro-Lee data set.[11] According to the OECD data, Germany, Switzerland and Canada had particularly high levels of human capital in 1998, while China and India were among the bottom countries in our group. Italy, Spain and South Africa boasted the strongest gains between 1988 and 1998, while the USA, Denmark and Germany barely raised their average years of education.

10% more human capital = 9 % more income

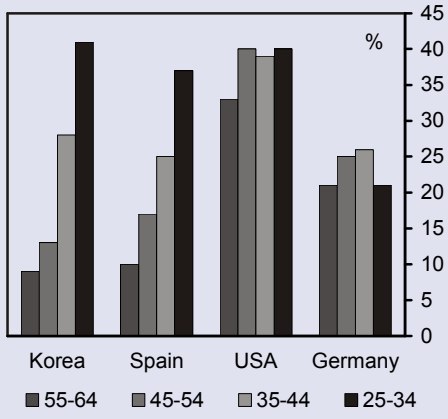
Our empirical analysis shows close link with GDP

Our panel estimates indicate that a 10% rise in human capital leads to a 9% rise in GDP per capita over the long run.[12] A 10% gain would be 1.4 years in Germany, but just 0.4 years in India. Bassanini and Scarpetta (2001) arrive at a similar conclusion. Again, we are not saying that a higher level of human capital permanently increases the growth rate of GDP. Changes in GDP require changes in human capital (all things being equal). One of the difficulties of any growth analysis is the assumption of exogeneity of human capital. It may well be that rich countries can afford better education; the level of human capital would then depend on the level of income. We believe that the causality runs mainly from human capital to income, a view that is supported by the study of the successful countries investigated later in this publication.

Attainment rates – guides for the future

The average years of education are basically an aggregation of the average graduation levels that individuals have attained. They are a vehicle to add up the education of high school drop-outs and university graduates. The different attainment rates (e.g. secondary, tertiary) and their development over cohorts can provide important information about the likely future path of the average years of education. If the new entrants into the labour market have spent more time in school than those retiring, the average human capital of the working-age population will rise.

Population that has attained tertiary education by age groups



Source: OECD

Today, nearly 40% of 25 to 34-year old Spaniards have completed tertiary education, compared with just 10% of the 55 to 64-year olds. As a consequence, the average years of education will continue to rise quickly over the coming years, simply because more Spaniards complete tertiary education today than 30 years ago. In Germany, on the other hand, just about the same share of people in the 25 to 34-year old cohort has completed tertiary education as in the 55 to 64-year cohort. In addition, the ratio of school drop-outs among young people rose from 8.1% in 1990 to 8.9% in 2003. All in all, this indicates that Germany's human capital per person is set to barely grow over the coming years. As a result, GDP growth is likely to remain modest.

Attainment rates not useful in regression analysis

Attainment rates and their development over cohorts can therefore provide important information about the future trajectory of human capital. But they are not useful for econometric analysis: a tertiary attainment rate of 40% of the young cohort can signal either a rise in human capital or a decline, depending on the starting level of the average human capital of the overall population.[13] As shown earlier,

[11] Details on the quality of the different data are in Cohen and Soto (2001). There is no consensus on which is the better data set. Some studies use averages of the two sets.

[12] See page 11 of the introductory study Global Growth Centres 2020.

[13] Using the change in the attainment rates also does not help. A rise of 10 percentage points can be consistent with a rise or a fall in human capital depending on the starting levels of human capital and the attainment rate.

we need the change in human capital as input to project GDP growth. Using the tertiary attainment rate of the working-age population also does not solve the problem because education can be spread very unevenly across the population: a tertiary rate of 30% can coincide with 70% high school graduates in one country and 70% illiterates in another.

Enrolment rates – future human capital

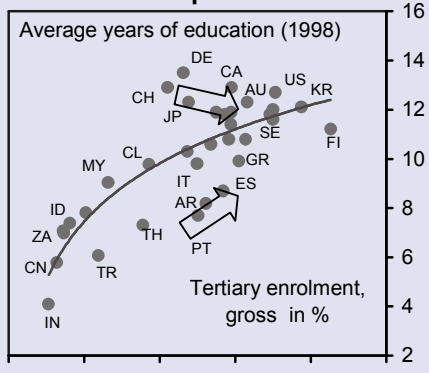
Enrolment rates also provide valuable information about the future development of human capital. They measure the share of people of the typical age who attend secondary or tertiary programs. Since, for example, people can still graduate from high school when they are 30 (i.e. past the typical age), some countries report secondary enrolment rates exceeding 100%. Sweden posted secondary enrolment of 150% in 2000. In the same year, tertiary enrolment rates ranged from 10% in India to 85% in Finland.

Of course, these enrolment rates are not a measure of the human capital of today's working population. At the most, they can give an indication about the future – when compared with today's level of human capital. Countries with a high number of average years of education need relatively high enrolment rates to keep their human capital constant by replacing exiting workers with new workers who have the same skill levels. In a country with a low starting level of average years of education, on the other hand, modest enrolment rates would suffice to yield a significant rise in human capital.

As the chart shows, Spain, Portugal and Greece had relatively high tertiary enrolment rates in 2000, which indicates that the average years of education are set to rise significantly in the future – in line with our forecasts. Enrolment rates in Germany, Switzerland and Japan, however, are not high enough to allow a significant rise in average human capital in the coming years. For the emerging markets with their low average human capital, secondary enrolment rates are more useful guides. They point to relatively dynamic schooling activity in Brazil, Turkey, China and India.

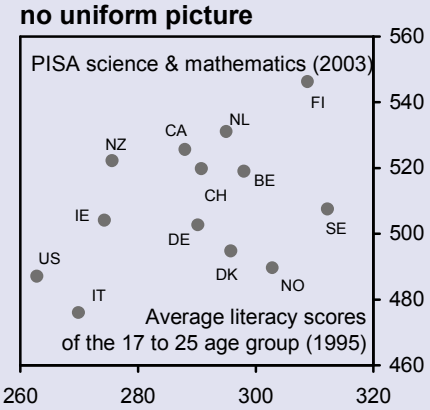
In the past, many empirical studies used enrolment rates as a measure of human capital, especially in cross-section models.[14] However, as we indicated above, a tertiary enrolment rate of 40% can be consistent with stagnant human capital in one country and rapid gains in another. If the change in human capital is relevant for economic growth, these models are almost certain to deliver misleading results.[15] Therefore, enrolment rates enter our *Formel-G* framework as indicators for cross-checking the human capital forecasts.

Relatively high tertiary enrolment in Spain and Greece



Sources: World Bank, OECD

Literacy and PISA: no uniform picture



Sources: OECD, IALS

Quality of human capital difficult to measure

Ideally, measures of human capital should reflect the quality of labour input. Unfortunately, the average years of education only measure how much time someone has spent in school – and not how much he has actually learned during that time. Our favourite measure thus does not take the quality of education into account, although quality is likely to affect a person's productivity and income. The OECD's PISA (Program for International Student Assessment) tests for the young and the literacy survey of the IALS (International Adult Literacy Survey) for the adults fill this gap. According to the 2003 PISA test, the education systems of Finland, Japan and Korea

Combine data on quantity and quality

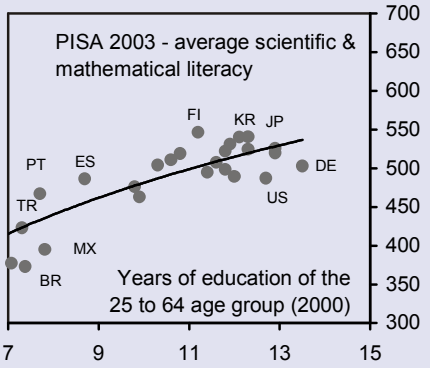
[14] For example: Mankiw, Romer and Weil (1992) and Levine and Renelt (1992).
[15] Again, using the difference in enrolment does not solve the problem.

produced the best scores and the highest quality, while the USA and Spain had only average scores and poor countries like Indonesia and Brazil came in at the end of the ranking. Of the 14 countries covered in the IALS in 1995, the Scandinavian countries performed best, while Italy and the USA did relatively poorly. The chart shows the most recent test results for the countries that participated in both PISA and IALS.

Data on quality provide little additional information

For a long-run growth forecasting model by means of a panel analysis like that used in our global growth centres project, quality measures have several disadvantages but few major advantages. The main and crucial disadvantage is the lack of time series in many countries. In addition, as the chart illustrates, there is a high correlation between the level of education of the parent generation (years of education) and the PISA results of the young generation. Germany and the USA are negative outliers in this respect. This shows that the PISA results hold little additional information for our model. Also, if the quality differences are constant over time, the country-specific constant in our regression model picks up these cross-country differences completely. However, Coulombe at al. (2004) claim that literacy scores better explain economic growth in panel models of 14 OECD economies than the years of education. Hanushek and Kimko (2000) had earlier come to a similar conclusion that the quality of education (test scores) better explains growth than the quantity of education (years of education). These important results will be refined in future academic research, and they have rightly received a considerable amount of attention in education policy. However, as outlined above, we cannot explicitly factor them into our *Formel-G* framework given current data availability.

Smart parents = smart children



Sources: OECD, Deutsche Bank Research

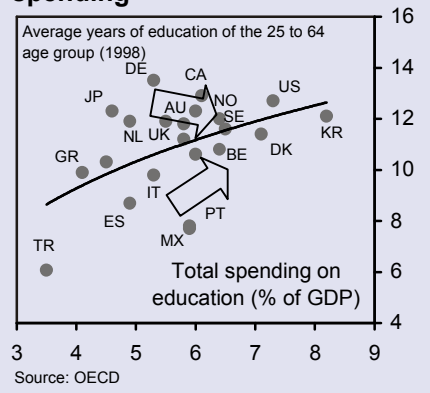
Spending a lot of money wisely

Of course, high-quality education at high enrolment rates requires significant financial resources. In 2000, public spending on education ranged from 1.5% of GDP in Indonesia to 8 ¼% in Denmark. On top of this public money, many countries add significant private resources, accounting for as much as 40% in South Korea in 2001. Therefore, any spending comparison should ideally look at overall (public & private) resources.

High spending is not necessarily a sign of either a high level or a significant rise in human capital. Countries with a high level of human capital have to invest a lot of money just to maintain the average education level of the population. Germany's 5.3% total spending on education in 2001 probably will not suffice to boost the average years of education significantly above the current high level. By contrast, countries with a low level of human capital can induce a large rise in human capital by investing just 5% of GDP. As the chart shows, Portugal and Mexico currently spend relatively large amounts of money on education. If that money is spent wisely, human capital will rise significantly over the coming years.

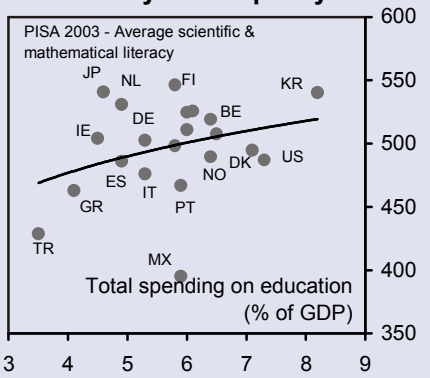
Therefore, we use spending data only in combination with the current level of human capital, in order to assess the likely future path of the average years of education. In addition, it is obvious that different education systems use the money in more or less efficient ways. Spending of 5.8% of GDP leads Finland to top scores in PISA (see chart), while Mexican pupils' scores were very low despite similar spending.

More human capital = more spending



Source: OECD

More spending does not necessarily boost quality



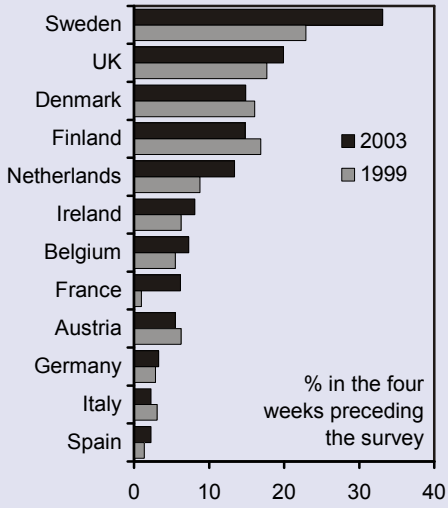
Sources: OECD, Deutsche Bank Research

Life-long learning ever more important

Education does not end with a formal degree. Further education and training on the job, in courses and seminars allows people to keep their human capital up to date and replace depreciated knowledge with new knowledge. Jacob Mincer calculated that US companies spend around 2% of GDP each year on training.

Given the rise in life expectancy and the rapid technological progress, keeping one's human capital up to date is getting increasingly important. This part of learning does not enter into our favourite proxy for human capital. However, it is well-documented that people with high formal education also expend a lot more effort on maintaining their human capital than people with little formal education. In 2003, 44% of Germans aged 19 to 64 with a higher education participated in further education, compared with just 16% of those with lower education. Further education varies considerably across the EU: Scandinavia and the UK showed the highest rates of people aged 45 to 54 participating in further education in the four weeks prior to the survey, while Germany, Italy and Spain only mustered participation rates of 3% (see chart).[16]

Participation in education and training (45 to 54 age group)



Source: European Commission

The value of human capital

The Center for the Study of Living Standards has calculated cost-based dollar values of human capital by adding up the costs of education, albeit without taking quality differences and further education into account.[17] Between 1991 and 2001 the average real human capital per person rose by just 3% in Germany to USD 28,682, while it surged by 20% in Spain to USD 27,533. The IW Institute for Economics did similar calculations for Germany and draws the same conclusion: while Germany's physical capital stock rose by 20% between 1992 and 1999, its human capital stagnated.[18] This led to a rise in the ratio of physical capital per unit of GDP and depressed the returns on physical capital, thus increasing the incentives to move physical capital elsewhere in the global economy.[19]

Data to improve in the future

There are many different measures of human capital which all have some value. The best measure available at the moment is the average years of education of the population aged 25 to 64. As the importance of human capital is likely to increase further going forward, new time series will become available that combine the quantity and quality of human capital, include experience as well as further education, but also take depreciation into account. What is relevant for economic growth is a strong rise in the years of education of a high quality. To this end, high enrolment rates and the efficient use of financial resources are necessary.

[16] See: European Commission (2005). Indicators for monitoring the Employment Guidelines.

[17] www.csls.ca/iwb/oecd.asp. This is a cost-based approach. Income-based approaches are likely to lead to higher values, but they require assumptions about GDP growth.

[18] IW Informationsdienst. „Milliarden in den Köpfen". January 20, 2005.

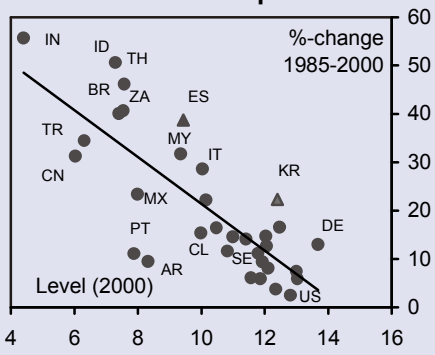
[19] See Bergheim, Stefan and Marco Neuhaus (2002). Bottleneck labour – an empirical growth analysis. Deutsche Bank Research. Current Issues, December 4, 2002.

4. Success is possible – with political action

Having established that human capital – measured by the average years of education – is a major driver of economic growth, the question now is how societies can generate a significant rise in human capital. Which institutional frameworks and incentives are most conducive to education? What are the characteristics of successful education systems? Which countries were success stories in the past and could serve as role models today?

South Korea and Spain witnessed the most impressive combination of change in and level of human capital over the past 20 years (see chart). The average years of education in South Korea rose by more than 20% between 1985 and 2000 to 13 years. The 40% rise in Spain was even more impressive, but the level of human capital is still significantly lower than in Korea.[20] Both countries gave a clear political priority to boosting human capital and followed a long-term strategy. Their success stories will be described in the following sections.

The strongest changes in years of education in the past



Sources: OECD, Deutsche Bank Research

Spain – long-term political strategy

Single-track school system …

The educational success of Spaniards begins at an early age. Almost all children between 3 and 5 years go to pre-school and many children below the age of 3 to a nursery. Enrolment is voluntary, but free of charge. A single-track school system until 10th grade follows. The PISA results roughly match those of the USA but trail those of Germany – not surprising given the still relatively low education level of the Spanish parent generation. The school system splits only after the 10th grade: those seeking vocational training leave high school, while those seeking a university degree attend another two years of upper secondary education. Access to a university requires passing an entry exam. Tuition fees range from EUR 700 to EUR 1000 per year at public universities – and can be many times higher at private schools. The number of universities rose from 18 in 1965 to 86 in 2000, with the number of students up from 170,000 to 1.6 million. This rise implies that around 40% of the young Spaniards now finish tertiary education – a major increase from the 17% attainment rate of 45 to 55-year olds. As a result, the average years of education of those aged 25 to 64 will continue to rise significantly for many years to come: less-educated retirees will be replaced by well-educated new entrants into the labour force.

… and tuition fees

Systematic education reform

Spanish politicians laid the groundstone for this rapid rise in human capital before the end of the Franco dictatorship in 1975.[21] The general education law of 1970 was aimed at providing a general education for all Spaniards between the age of 6 and 14. The new constitution of 1978 even included the right to education. The 1983 reform of universities introduced economic and academic autonomy for universities, while the 1990 general law on the education system raised the age limit for compulsory education from 14 to 16 years. The university law of 2001 continued this process with a focus on improving the quality in education and research. So far, Spain does not spend unusually large amounts of money on education: in 2001 public and private education spending added up to 4.9% of GDP, which is one of the lowest ratios among the OECD economies. Although that money appears to be used efficiently, more spending

Milestones of the Spanish education system

1970	General Education Act
1975	End of Franco regime
1978	Right to education is guaranteed by the Constitution
1983	University Reform Act (LRU)
1990	Act on the General Organisation of the Education System (LOGSE)
2001	University Act (LOU)

Source: Ministerio de Educacion

[20] Average labour productivity still barely grew over the past 10 years because more low-skilled workers were integrated into the formal labour market: employment grew by 40% and the unemployment rate came down by half to 10% in 2004.

[21] See Ministerio de Educación y Ciencia http://www.mec.es/mecd/jsp/plantillaAncho.jsp?id=1&area=legislacion

appears necessary in the future to finance quality improvements in secondary education (PISA) and expensive research institutes. The balanced government budget puts Spain into a relatively favourable position to make these funds available over the coming years.

Korea – the way to the top

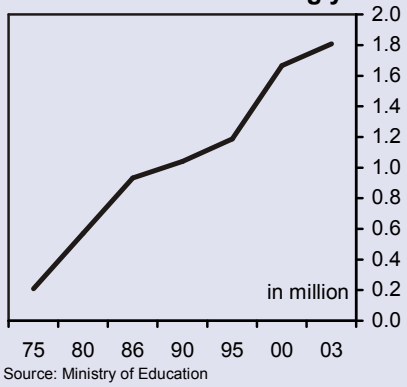
Rapid rise in human capital in Korea

One of the most important elements contributing to the economic success of Korea over the past decades has been the rapid rise in human capital, from seven years of education in the early 1970s to around 13 years today. As a result, Korean per-capita GDP will soon catch up with that of Portugal and Greece. Korea also has a single-track school system. 6 years of primary school are followed by 3 years of middle school and 3 years of high school. Compulsory education ends at the age of 14, but 95% of the young Koreans complete high school – the highest ratio among the OECD economies. Tests regularly show the high quality of the education system: Koreans trail only the Finns and the Japanese in PISA. However, there are complaints that the students lack creativity and innovative drive.

Top scores in PISA 2003

Higher/tertiary education witnessed the most impressive success during the last two decades. The number of higher education institutions shot up from 290 in 1975 to 1,400 in 2003. The number of students surged from 240,000 to 3.6 million. Currently, more than 40% of Koreans aged 25 to 34 have completed tertiary/higher education, compared with an OECD average of 28%.

Korea: Number of university students has risen strongly



Source: Ministry of Education

The Korean education system is controlled from the centre, with the Ministry of Education & Human Resources Development setting the course. Some 20% of central government spending goes to education, highlighting the overarching importance of education for the government. On top of this, private financing plays a major role at the kindergarten and university level. More than 80% of spending on the tertiary sector came from private sources in 2001 – the highest share among OECD economies. Tuition fees range from EUR 4,000 to EUR 8,000 per year. Overall, Korea spends more than 8% of its GDP on education out of public and private funds and is top among the OECD economies regarding this type of investment.

New program: “Brain Korea 21”

A long series of reforms and a general appreciation of education facilitated these successes in human capital accumulation.[22] Initially, in the 1960s and 70s, the goal was to increase the number of students in primary and middle schools. A focus on raising enrolment in high school followed. Since the early 80s the emphasis has been shifting from the quantity to the quality of education. The government clearly laid out the priorities for the coming years: to support the transition to a service economy and foster the creativity of students. An example is the “Brain Korea 21” programme, which the education ministry initiated to promote the seven most important technologies of the 21st century. The goal is to produce the next generation of world class leaders in these fields by upgrading the research infrastructure and graduate-level training.

Learning from Spain and Korea: education is an investment

Goal: high attainment rates and high quality

The examples of Spain and Korea reveal that determined political efforts can lead to success if the importance of education for economic success is recognised. Both countries have a single-track school system; both want to provide access to high education levels

[22] See Ministry of Education & Human Resources Development. Education in Korea 2003-2004.

to as many children as possible without compromising the quality of education.[23] Private financial involvement in the form of tuition fees is a crucial part of the system, in line with the theoretical arguments outlined in the second section of this study. There appears to be a general understanding that education is an investment in the future. In general, more money also leads to better quantitative and qualitative results.

[23] The recommendations of the German Council of Economic Experts in their annual report 2004/05 are consistent with theses insights.

5. Development in selected countries from 2006-20

According to our forecast, India, South Africa, China, Thailand, Italy and Spain will be the countries recording the largest percentage rise in the average years of education over the next 15 years. For the rich economies, the first step to this forecast is a simple extrapolation of past developments to take advantage of the series' inertia. To avoid extreme projections we dampened the exponential development that is indicated by the historic developments in Italy and Spain. For the emerging markets the baseline forecasts are interpolated values from the OECD's Development Centre. The indicators described above tend to support these baseline forecasts: the countries with relatively high attainment rates of the young cohort, relatively high enrolment rates and relatively high education spending levels today are expected to post the strongest rises in the average years of education. The third step applied to all countries is the analysis of our six trend clusters and their link to human capital.[24] The sections to follow explain in greater detail the forecasts for some of the star performers of the human capital ranking 2005-20 (and for Germany).

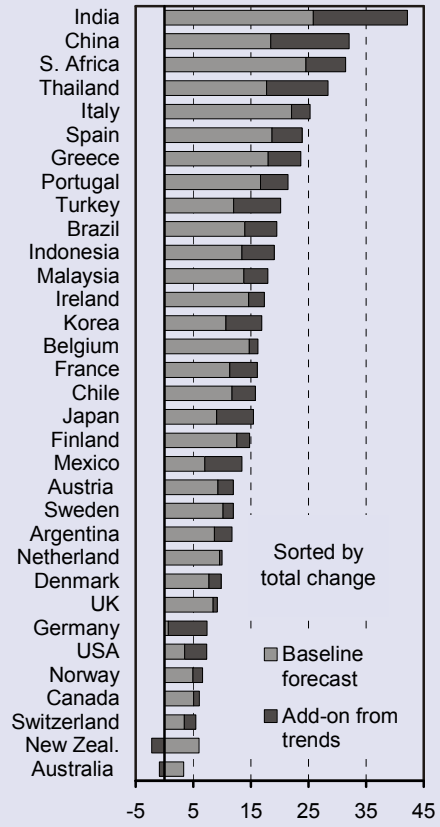
India – most dynamic development

Between 2005 and 2020 we expect a 40% rise in the average years of education in India, to just above 7 years. Although this will still be the lowest level among our 33 countries (which helps explain why per-capita income in 2020 will still be very low), it is the strongest percentage gain (which helps explain why per-capita GDP is expected to rise so quickly going forward). India's secondary enrolment rate of 50% today significantly exceeds the 30% rate of the early 1980s. Public education spending has risen to 4% of GDP, and the government plans further increases. In addition, our trend analysis points to several developments that favour the accumulation of human capital. The trend cluster "opening of work and society" is set to accelerate and more members of the lower castes should gain excess to higher education. Likewise, the more intensive "global networking in business and politics" will boost returns to human capital and therefore the incentives to get more education.

South Africa – education for equality

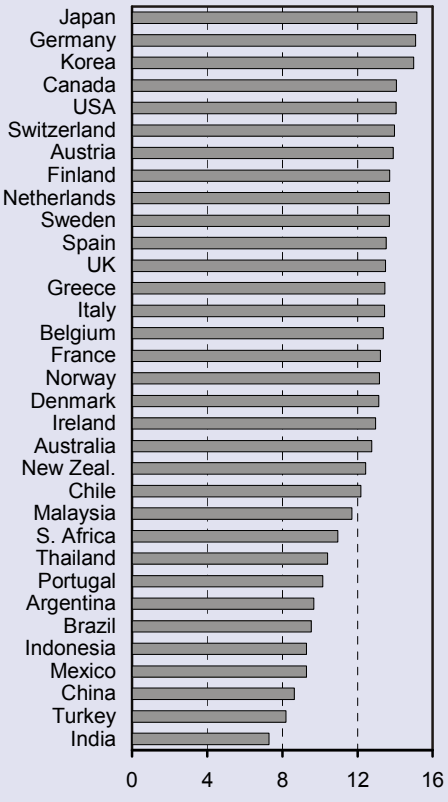
After the end of apartheid, South Africa realised that education for all is an important driver of economic growth and can reduce inequality between the population's different ethnic groups. We expect the average years of education to rise sharply by 30% from 2005 to 2020, up to almost 11 years. At 5.7% of GDP in 2000, public spending on education was about as high as in France – but the starting level of human capital is much lower in South Africa. The secondary enrolment rate of 85% also points to rapid future gains in human capital. However, AIDS is hampering this gain at the moment. Our trend analysis points to an acceleration in some of the trends that are relevant for human capital, especially if a growing health sector lowers mortality rates. In addition, the rising flexibility of a more open society is set to raise the return on to education for more and more people.

Percentage change in years of education 2005-2020



Source: Deutsche Bank Research

Average years of education of the working-age population in 2020



Source Deutsche Bank Research

[24] See the trend map and the description on pages 20ff. of the introductory study Global Growth Centres 2020. Our six trend clusters are called: opening of work and society, enlarging scope of life, conquest of smallest structures, global networking in business and politics, process virtualisation in networks, and restriction of growth.

Spain – a new generation of knowledge

New entrants have above-average human capital

Spain is the star among the rich economies in terms of human capital accumulation. The improvement in its institutional framework has been outlined above. Over the next 15 years we expect a 20% rise in human capital to an average of 13 ½ years of education. The high enrolment rates and the poor education standards during the Franco period highlight that the new entrants into the labour force have attained a much higher level of education than those retiring. The average human capital of the working-age population will rise sharply. Our trend analysis sees an additional positive effect coming particularly from the rapid acceleration of the trend cluster "process virtualisation in networks" from a low starting level. This assumption points to one of the main challenges for Spain: since its per-capita income level is now close to the EU average, it has to mature towards higher value-added, technology-intensive products. Rising human capital is a good basis, but it has to be supplemented by higher expenditure on research and development. The government plans a rise in total R&D spending, from 1.2% in 2005 to 1.4% in 2007.

Korea – leaders within reach

Korea is closing in on Japan and Germany

As described in detail above, Korea has emphasised education for decades and acted accordingly. The average years of education rose by more than 20% between 1985 and 2000, moving Korea to 6th place in the ranking of human capital levels. Another significant increase by 15% should let Korea catch up with Japan and Germany over the coming years. The high growth rates and levels of tertiary attainment rates as well as education spending of more than 8% of GDP point to such a rapid rise. The quality of education is convincing, too: Korea took 3rd place in PISA 2003.

Germany – major efforts needed

German human capital to rise more substantially only after significant reforms

The meagre rise in years of education over the past years, relatively low tertiary enrolment rates and relatively low spending on education all suggest that the gain in human capital will be marginal over the next 15 years. However, we expect several significant structural changes in Germany, which should be positive for human capital. Germany is beginning to understand that it has neglected its human capital and how important it is for Germany's growth potential. However, institutional and ideological hurdles restrain the speed of change for now.

But our trend analysis points to significant changes that will boost incentives to acquire more education. In particular, work and society are set to open up more quickly as career paths are becoming more flexible, women gain in importance in employment and urbanisation rises further. This should be positive for the accumulation of human capital, partly through more incentives for life-long learning. In addition, an acceleration in the trend cluster "process virtualisation" should promote new web-based education services and more efficient education, while raising the returns to investment. However, despite all these education-positive changes, Germany is unlikely to see more than a modest gain in human capital over the next 15 years.

6. Policies for enhancing human capital

Providing education is a genuine task for the government

This study highlighted the important role that faster growth of human capital plays in boosting GDP growth. Spain and South Korea are impressive success stories, showing that faster growth of human capital will indeed materialise if the appropriate political steps are taken. Adam Smith saw two genuine roles for the government (beyond defence): to support institutions "facilitating the commerce of the society" and institutions providing education. He thought that the state should provide access to general education for the broad population – and that attendance should possibly be mandatory. This was also Smith's answer to the basic problem in economics: the social question. Equal educational opportunity is a more sustainable vehicle towards social peace than transfer payments from rich to poor.

Boost the returns on education

The analysis in this study leads to some general goals for education policy. Returns on education should be raised and not curtailed through an excessively progressive tax system. Government spending ought to focus on kindergarten, pre-school and primary education, where the educational paths are set. By contrast, higher education should require a significant contribution (tuition fees) from the student who reaps most of the benefits. A system of student loans and stipends for the highly-talented would be part of a successful system. Autonomy and competition among educational institutions tend to boost efficiency and quality as long as parents and students are free to choose the school.

Many countries around the globe keep expanding their human capital at significant rates. They will be able to produce ever more sophisticated products. This increases the pressure on countries like Germany to raise their own human capital or accept a decline in relative income levels.

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