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HUMAN CAPITAL FORMATION IN GERMANY: AN UNTAPPED POTENTIAL

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In the last decade or so, Germany has been losing ground in terms of educational proficiency as well as of human capital formation. IALS, TIMSS, PISA, PIRLS and IGLU are acronyms for a wide-scale underperformance of schooling and education in Germany. Additionally, a recent OECD study (2003) delivered alarming evidence of a huge underinvestment in human capital formation, making Germany the only major OECD country not drawing on human capital formation to increase economic growth.

This is why it is time to shed some light on what the German education “production function” looks like. The approach followed in this article rests on a much broader concept which attempts to meet at least the following criteria¹: 1) It should be based on empirical evidence. 2) It should be comprehensive in the sense that education is path-dependent and covers a long time span, from early childhood to the training of an ageing workforce. 3) It should

be based on an international comparison, using a benchmarking approach to identify the strengths and weaknesses of a country-specific educational system, while bearing in mind the limits of international comparability. 4) Education is looked at from an explicitly economic viewpoint, understanding education rather in terms of investment and returns on investment than as a mere societal issue.

This article addresses some of the major questions relating to human capital formation from a specific German perspective: What is the relation between investment in human capital and economic growth? What are the driving factors of educational achievement? What is the relative position of higher education in Germany? What role does vocational training play in Germany? And what are the main lessons to be learned from international educational benchmarking?

The role of skills and internal rates of investment in human capital

There is a lot of cross-country evidence showing a positive relation between investment in human capital and economic growth (Barro and Sala-i-Martin 1995). Countries with a higher number of years of schooling on average tend to grow faster and have a higher productivity. Germany has a weak growth performance caused by decreasing working hours and no growth of human capital. The average investment of individuals in their own education did not increase in the last decade (Table 1).

Instead, hourly GDP per efficient unit of labour grew rapidly, showing that Germany increased productivity through more work per hour of work-

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¹ This article draws heavily on “Bildungsbenchmarking Deutschland”, a broad comparative survey of the IW Cologne for 20 OECD countries, covering pre-school, elementary and primary schools, secondary and tertiary education and vocational as well as on the job-training (cf. Klös and Weiß 2003).

Table 1

Sources of GDP per capita growth, 1990–2000

	Growth of GDP per capita	Average annual percentage change of				
		Working-age population / total population	Employment/ working-age population	Hours worked	Hourly GDP per efficient unit of labour	Human capital
USA	2.26	0.06	0.38	0.27	1.20	0.35
United Kingdom	2.05	0.01	0.22	– 0.21	1.18	0.85
Finland	2.12	– 0.04	– 0.71	– 0.06	2.47	0.46
Canada	1.73	0.16	0.18	0.00	1.09	0.30
France	1.54	– 0.10	0.28	– 0.36	1.22	0.50
Italy	1.50	– 0.13	– 0.10	– 0.15	1.30	0.58
Sweden	1.49	0.00	– 0.91	0.58	1.51	0.31
Germany	1.20	– 0.11	– 0.10	– 0.43	1.83	0.01

Source: OECD (2003).

Table 2
Human capital accumulation of young versus older individuals, 2001

	Ratio of shares of young people (25–34) to older (55–64) with higher education	
	persons in	
	Tertiary A-programmes	Tertiary B-programmes
Portugal	3.67	1.50
Spain	3.00	6.00
Denmark	2.75	1.13
Ireland	2.50	2.15
New Zealand	2.43	0.71
Japan	2.40	4.60
France	2.25	2.83
Belgium	2.13	2.11
Australia	2.00	1.11
Austria	1.75	1.60
United Kingdom	1.75	1.29
Norway	1.68	1.50
Canada	1.67	1.67
Finland	1.64	1.67
Netherlands	1.60	1.00
Germany	1.40	0.80
Sweden	1.33	1.70
USA	1.30	1.29
Switzerland	1.23	1.25

Source: OECD (2002).

force with unchanged average schooling levels and less worktime. In contrast countries like United Kingdom, USA, Italy and Sweden had higher labour productivity growth, although their hourly GDP growth per efficient unit of labour is much lower. In these countries average schooling levels of the working-age population grew much faster and the worktime has decreased at a lower rate.²

The story behind these data is that growth in Germany could be fuelled by intensifying human capital formation. But the outlook is bleak, since due to future demographic trends a lack of highly educated persons

² The OECD study presents evidence that growth in output per person is attributable to increases in the ratio of persons of working age (15–64 years) to the total population, increases in the ratio of employed persons to the working-age population, and labour productivity growth. The labour productivity growth itself is based on an increase in human capital, increase in hours worked, and an increase in hourly GDP per efficient unit of labor. Human capital is measured by summing up workers with different levels of formal education, each weighted by their relative wage as a proxy for their relative productivity.

in the workforce is to be expected in Germany. Plünnecke and Seyda (2004) calculate the effects of demographic change which project current stagnation in tertiary school attainment of men and only slow increases in women's attainment. Taking together both effects, the share of highly educated persons of working age in the total population will increase from 13 percent to nearly 14 percent until 2020, but then decrease again to less than 13 percent in 2050. Seen from that perspective, it seems that Germany will make no progress in terms of tertiary education over the next half century.

Moreover, international comparisons reveal unfavourable cohort effects for Germany not only in the years to come, but already at present. At the turn of the century in Germany there were just 1.4 young persons between 25 and 34 years of age with a university degree for every person between 55 and 64 years with the same education, compared to three or more persons in Southern Europe (Table 2). Looking at so called tertiary B-programmes (less academic, more practical higher degrees), the picture is even more uncomfortable since the ratio in Germany is just 0.8. In contrast, other countries have many more young academics who can replace the older ones, thereby easing the demographic challenges of greying and shrinking populations in most of the advanced OECD countries.

Consequently, more accumulation of human capital is needed to handle demographic change and to stimulate economic growth. There are mainly two factors which account for poor investment in human capital: the low skills of German students

Figure 1

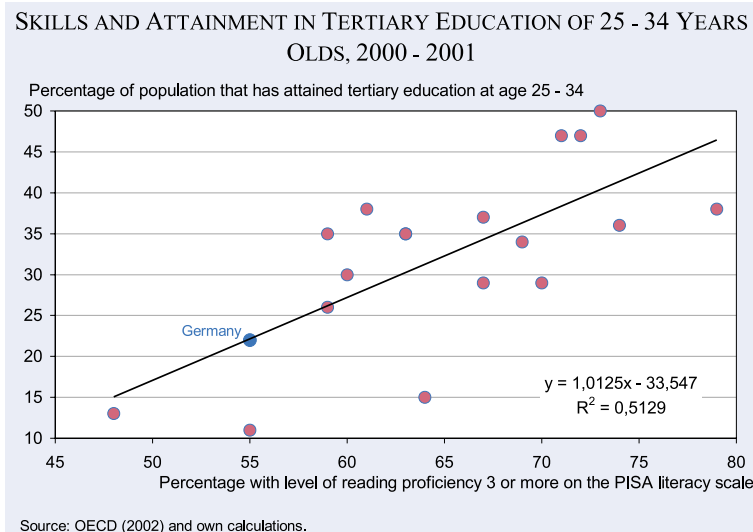
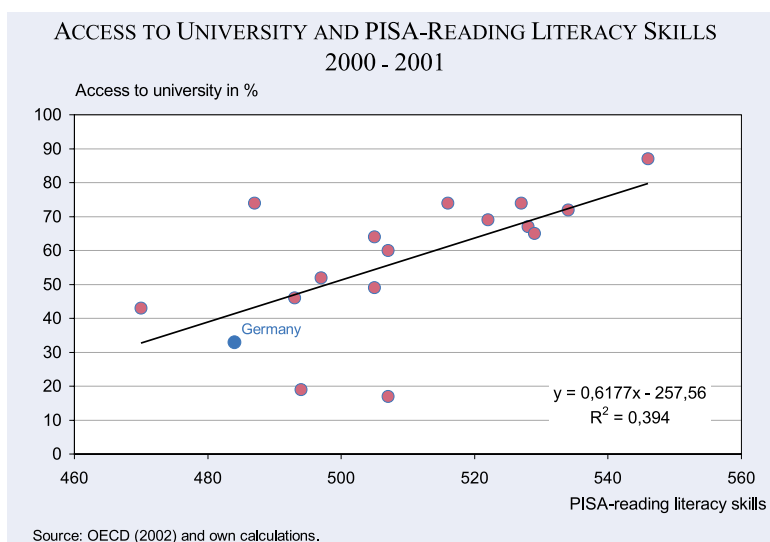


Figure 2

and low private rates of investment in education. If market forces played a more dominant role, private rates of investment would converge. In this case international differences in skills play an important role and cause differences in investment in higher education. The impact of skills on investment in schooling has been subject to many academic articles (Grawe and Mulligan 2002). Figure 1 illustrates this argument by showing the correlation between investment in higher education and reading literacy skills in OECD countries. A similar relation between skills and further investment can be found if the mean of skills in the PISA countries and the share of students who have access to tertiary university education is compared (Figure 2).

Following the regression profile in Figure 2, access to university in Germany could increase to round about 40 percent. To have sustainable higher access, the skills in Germany should also be improved. To foster economic growth the German education system has to improve the skills of pupils and to increase the private rates of investment in education by more efficiency in universities and apprenticeship training.

Skills and competences

The determinants of educational attainment are widely discussed in the literature. The theoretical

link to educational achievement comes through private investment at home and through public investment. Haveman and Wolfe (1995) show that there is a statistically significant positive relation between human capital of parents and educational achievement, with the education of mothers relatively more important. The family income has a relatively small impact on education. The link from human capital to the education of children is via family genes (Plug and Vijverberg 2003) and family input of time and education quality.

The effects of public investments are controversial. Hanushek (2003) finds no consistent relationship between school input and student performance when reviewing regression studies in literature. However, Krueger (2003) argues that there are social returns with reduced class size and criticizes the equal weight of the cited studies in Hanushek (1997). Additionally, there is a problem in regression analysis if the variables are not unrelated. Lazear (2001) shows in a model that from a school's point of view the optimal class size is larger for groups of students who are well behaved, so that empirically observed regression coefficients of class size could be downward biased.

The right question to obtain the non-ceteris-paribus-effect is: What would be the total effect of an exogenous change in class size on students

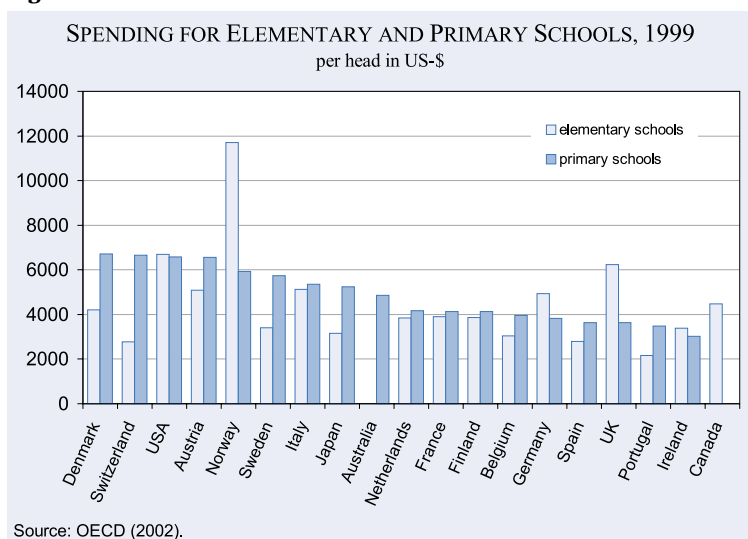
Figure 3

Table 3
IGLU results and teacher resources, 2001

	IGLU reading	IGLU science	IGLU maths	Pupil- teacher ratio	Teacher's salary
Sweden	561			13	26,000
Netherlands	554	557	577	17	29,000
United Kingdom	553	551	513	21	–
Canada	544	549	532	18	–
USA	542	565	545	16	40,000
Italy	541			11	25,000
Germany	539	560	545	20	38,000
France	525			20	27,000
Norway	499	530	502	12	27,000

Source: IEA (2003).

skills? This can be more readily discerned from experiments than from regressions (Todd and Wolpin 2003). For example, in the STAR experiment there is a reduction of class size in primary schools from about 22 to about 15 students per teacher which causes an increase in mathematics and reading test scores of about 0.2 standard deviations (Krueger 2003, p. 57).

Taken both effects together, cognitive achievement of children is based on cumulative process depending on innate ability, the education of family and school input (Todd and Wolpin 2003). In the US, test scores did not improve between 1960 and 1990, although the input of schooling was increased. One controversial explanation brought forward for this stagnation is that there is less parental input due to rising female labour force participation. On the other hand, there are rising parental education levels which could compensate this effect.

In Germany there is no increase in parental education levels. In the last few decades the fertility rate of highly educated women has decreased to a very low level of 115 children per 100 women. Poorly educated women have more children with 175 per 100 women. In the last decade fertility rates of women with high levels of education have decreased even further by more than 20 percent, while fertility rates of other women have not changed (Grünheid 2003). To deal with this problem either family policy has to be changed in a pronatalistic direction or more and better infrastructure in pre-schools and schools is needed in order to reconcile family and work.

The investment in schools has disproportionately positive effects in early stages. In Germany there is

a strong relationship between kindergarten attendance and educational outcome if parents have low education or are immigrants (Spiess, Büchel and Wagner 2003). Nevertheless, there is comparatively little aggregate spending in early childhood programmes and primary schools in Germany. Figure 3 shows spending per head for elementary schools and primary schools in US\$, indicating that spending for primary schools in Germany is remarkably low.

According to IGLU, there is no international relationship between resources, like class size or teacher wages, and reading literacy skills, since German pupils exhibit average performance, their teachers receive high wages and the class size is a bit larger than average (Table 3). However, even if there are no strong direct effects of teacher's wages on international test scores, Vignoles et al. (2000) find that teacher-salary incentive schemes like bonus payments and teacher's experience as well as class size have a significantly positive effect. Reliable methods to control quality and autonomy of schools might be other important key factors for increasing quality in classroom teaching.

According to PISA, educational achievement in reading and mathematics is very low in Germany at the age of 15. Pupils' skills have an important impact on further schooling. Standard economic textbooks suggest that students choose to continue schooling in order to maximize the present value of lifetime earnings. If they have low skills at the age of 15, they have lower returns from further schooling and they invest less in formal education. For secondary schools Plünnecke (2003) shows that better-educated parents, longer schooldays, a better equipped infrastructure as well as greater autonomy for schools and more competition can increase children's skills.

Higher education

To teach more students, universities in Germany will probably need more money. The expenditure on tertiary education from public and private sources increased by around 4 percent in real terms between 1995 and 1999. Nevertheless, entire ter-

Table 4
Private rates of return on investment in human capital, 1999–2000

	Return based on net earnings and lengths of studies	Impact of unemployment risk	Public support / fees	Total
United Kingdom	15.1	1.4	0.8	17.3
USA	16.7	1.2	– 3.0	14.9
France	11.1	3.6	0.2	14.9
Sweden	7.3	1.4	2.4	11.1
Canada	8.7	1.2	– 0.5	9.4
Japan	7.7	0.7	– 0.9	7.5
Italy	8.0	0.3	– 0.8	7.5
Germany	5.5	0.9	2.4	8.8

Source: Blöndal et. al (2002).

tiary spending accounts for only 1.1 percent of GDP compared to about 2.3 percent of GDP in the US. The gap is mainly due to differences in private spending, which accounts for only 0.1 percent of GDP in Germany compared to 1.2 percent in USA (OECD 2002), a direct consequence of free-riding in German tertiary education.

The introduction of tuition fees would have positive effects in terms of educational efficiency. On the one hand, fees would increase the money spent by universities on teaching staff and material, so the quality of teaching could be improved. On the other hand, students would have a better position in the allocation process in universities. Third, fees would provide an incentive to increase the speed of studying, which has a strong effect on internal rates of investment in higher education.

In Germany the rate of return on investment in university education is low compared with other countries. This is caused by a flat income distribution and a high number of years spent at university, which in turn increases the opportunity costs of education. The private internal rate in Germany is increased by a huge public student support, crowding out the market driven internal rate due to disincentives for the student to work harder. Taken together, the private internal rate of returns on education is markedly different in OECD countries (Table 4).

In countries like the United Kingdom, United States and France students need much less time to finish their university degree. One important reason behind this is the introduction of master and bachelor degrees. With bachelor and master degrees the investor faces important options (Brealy and Myers 1996, p. 589): 1) the option to proceed with follow-up

investments (master's degree) if the immediate investment project (bachelor's degree) succeeds, 2) the option to abandon the investment process after achieving a bachelor's degree, 3) the option to wait and learn (after the bachelor's and practical experience) before investing in a master's degree, and 4) the option to vary the specific human capital accumulation after achieving a bachelor's degree.

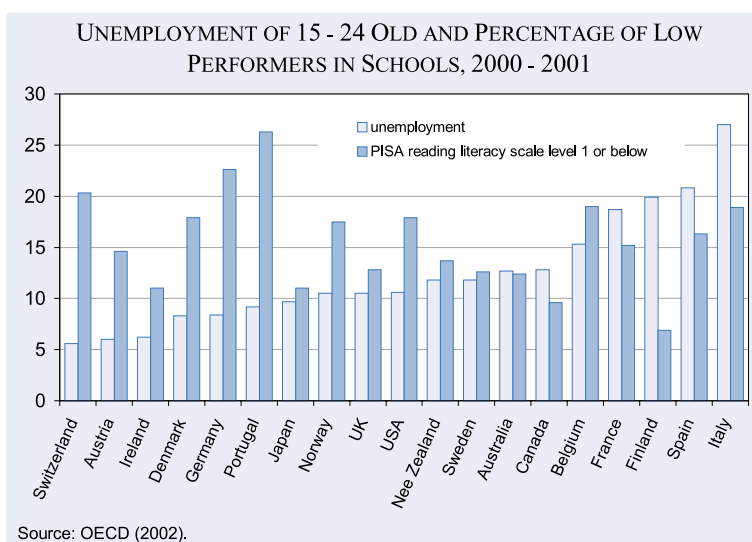
With these options the investor has 1) a positive option value even if he invests in negative net present-value projects (bachelor), 2) a partial insurance against failure, 3) an attractive possibility to invest efficiently in specific human capital needed for work and 4) an effective possibility to react to new labour market signals. With these real options the investor can add value to his investment in human capital. With the introduction of bachelor's and master's degrees it is possible to increase average internal rates of return in human capital and lower the risk for the investor, resulting in better incentives to invest in higher education.

Apprenticeship training

Like Austria, Switzerland and Denmark, the German vocational training system values the apprenticeship system ("duales System"). Public opinion holds that this system is the best way to integrate young people into the labour market and to improve the school to work transition, thus keeping youth unemployment under control. With the apprenticeship model, the employer has a flexible way of finding out about the productivity of the young worker and to teach practical knowledge and foster the accumulation of implicit knowledge and experience so that the transition from school to work might be easier.

However, there is a high percentage of young people with low skills in Germany. Roughly a quarter of 15-year-olds are not capable of basic reading tasks, which is defined as a level 1 of PISA proficiency or below. They cannot locate straightforward information or make low-level inferences of various types. This group "may not acquire the necessary literacy skills to sufficiently benefit from edu-

Figure 4



cational opportunities" (OECD 2002, p. 67). Germany has one of the highest percentages of young persons with low reading skills, which is in marked contrast to a very low unemployment rate similar to other countries with apprenticeship systems (Figure 4).

The German apprenticeship system is thus obviously successful in reducing youth unemployment. Nevertheless, this system is having increasing difficulties in generating enough vocational training opportunities. One important reason for this is structural change. Jobs with high percentages of apprenticeship training in comparison to total employment have experienced reduced employment in the last decade while jobs with low percentages have increased. As a result of structural change, levels of required skills are more polarized (Gross 1998). This means that the German apprenticeship system has to become more flexible with short programmes in stages and better possibilities for up-skilling, thereby facilitating the transition from school to work for young people with low-level skills and the investment in more human capital for those with better skills.

What can be done?

International educational benchmarking should focus on the accumulation process of educational achievement in different stages of educational production. The main lesson on an aggregate level is that reforms to improve young people's skills must start in primary school or in early childhood pro-

grammes. One main reform would involve concentrating on the output of educational processes rather than input. Quality can be improved by encouraging more competition between schools and other educational institutions as a result of increased autonomy and reliable quality standards.

There is evidence that family backgrounds and incentives for quality in schools play an important role in the accumulation process of skills. Salary incentive schemes for teachers, longer schooldays for children

and family policies to increase the number of children of better educated mothers are options that policymakers can choose to increase skills in early childhood. To facilitate better access to private schools, which have more autonomy and could improve mean skills of all pupils as a result of peer effects and competition pressure, a voucher system for low income students should be implemented. With higher skills the investment in higher education might increase and promote economic growth in Germany.

The financing of educational processes should be increased through private money and the allocation linked more to demand. The introduction of fees and bachelor's and master's degrees at universities are important means for improving efficiency in the educational system and for increasing the internal rate of investment in higher education. In this way, economic growth may be improved by increased investing in human capital and by better utilization of the current stock of human capital through longer working hours.

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