



European economies benefit greatly from a higher-skilled workforce

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Simon Wiederhold
Ifo Institute Munich
Germany

Ludger Woessmann
University of Munich
and Ifo Institute
Germany





IMPRESSUM

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Zeppelin University
Am Seemoserhorn 20
88045 Friedrichshafen
Germany

Authors:
Dr Simon Wiederhold
Prof Dr Ludger Woessmann

Graphics, Design and Layout:
Maren Sykora

Multimedia and Website:
Urs Boesswetter, Spooo Design

Video Production:
Sascha Kuriyama

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EUROPEAN ECONOMIES BENEFIT GREATLY FROM A HIGHER-SKILLED WORKFORCE

About the authors

Simon Wiederhold

Since September 2011, Dr Simon Wiederhold is working as an economist at the Ifo Institute for Economic Research, Ifo Center for the Economics of Education. He is also the guest coordinator of CESifo, the world's third largest, Europe-based research network in economics.

Simon Wiederhold received his Ph.D. in Economics from the University of Jena. His main research interests are labor markets, economics of education, and economics of innovation. He has published in leading international journals, such as the European Economic Review and the American Economic Journal: Macroeconomics. From 2014-2015, he spent six months on a research visit at Harvard University.

Ludger Woessmann

Prof Dr Ludger Woessmann is Professor of Economics at the University of Munich and Director of the Ifo Center for the Economics of Education at the Ifo Institute for Economic Research. He received his Ph.D. from the University of Kiel and worked at the Kiel Institute for World Economics before moving to Munich.

His main research interests are in the economics of education, growth, and history. His research has been published in leading international journals like the Quarterly Journal of Economics and the Journal of Economic Literature. He is co-editor of the recent volumes of the Handbook of the Economics of Education (North-Holland).

He held a 2010 National Fellowship at the Hoover Institution at Stanford University and spent extended research visits at Harvard University and the National Bureau of Economic Research. He coordinates the EU-funded European Expert Network on the Economics of Education (EENEE), a forum to promote and dis-seminate research on the Economics of Education in Europe.

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Evidence from the new Programme for the International Assessment of Adult Competencies (PIAAC) suggests that skills are highly valued in modern economies. On average, going up one (out of five) PIAAC proficiency levels is associated with an 18 percent increase in hourly wages. But the labor-market returns to skills differ widely across European countries, from 12 to 24 percent. Further, we observe that returns to skills are systematically lower in countries with higher union density, stricter employment protection, and larger public-sector shares.

Introduction

Why is it interesting to look at the returns to skills?

It has long been reckoned that the cognitive skills of the population are a key ingredient in knowledge-based economies, which is why the European Union emphasizes the development of a skilled workforce. However, unlike the case of the returns to school attainment, obtaining estimates of the value of individual cognitive skills has had to rely on a small number of specialized data sets. While assessments of the achievement of students are common, tested students are seldom followed from school into the labor market where the impact of differential skills can be observed.

PIAAC, the new OECD study of adult skills, for the first time allows us to quantify how different modern economies value cognitive skills. PIAAC was designed to measure key information processing skills that individuals need to advance in their jobs and participate in society. Drawing representative samples of adults in each country, the survey assessed skills in numeracy, literacy, and problem solving in technology-rich environments.

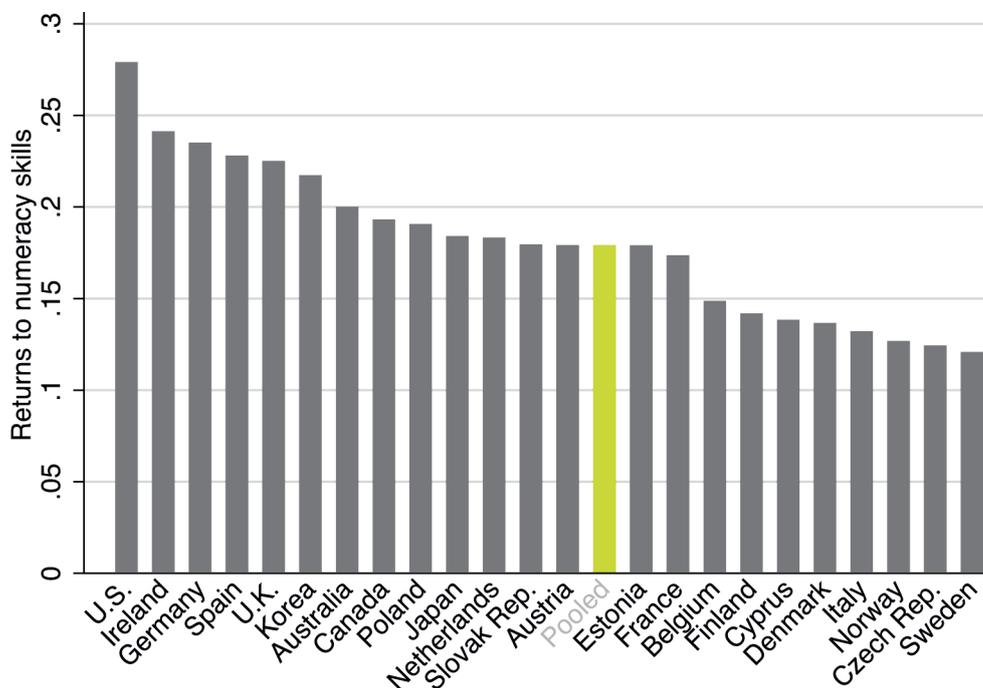
These new data allow us to measure how labor markets reward skills in 18 European and 5 additional countries. We estimate the returns to skills as the increase in hourly wages (before taxes) when skills increase by one out of five proficiency levels in PIAAC. Our analysis focuses on workers aged 35-54 who are full-time employed, because prime-age earnings best approximate lifetime earnings.

Key Observations

Returns to skills around the world

Higher cognitive skills are systematically related to higher wages in all 23 countries (see Figure 1). The effect size of the returns is economically important: On average, an increase in numeracy skills by one out of five proficiency levels in PIAAC is associated with an increase in wages by 18 percent across countries. But perhaps the most striking finding from the international analysis is the substantial variation in returns to skills across countries. Estimated returns to skills in the countries with the highest returns (the United States, Ireland, and Germany) are roughly twice as large as in the countries with the lowest returns (Sweden, the Czech Republic, and Norway). Eight countries, including all Nordic countries, have returns between 12 and 15 percent, whereas six countries are above 21 percent with the largest return being 28 percent in the United States.

Figure 1: Returns to skills in 18 european and 5 additional countries



The graph depicts the percentage by which hourly wages increase on average with each standard deviation in numeracy skills, which is roughly one out of five proficiency levels in PIAAC. Estimates refer to prime-age full-time employees and control for gender and work experience. Returns to skills estimates are statistically significant at the 1 percent level in each country.

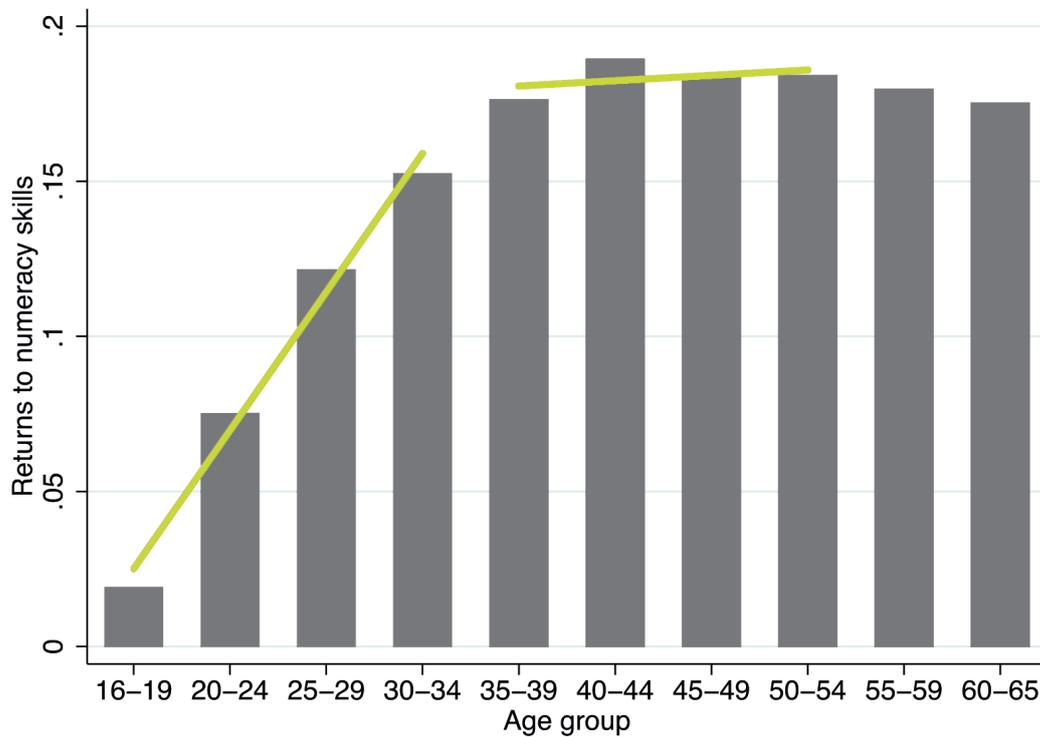
Source: Hanushek, Schwerdt, Wiederhold, and Woessmann (2015).

The age pattern in the returns to skills

Most previous evidence on the returns to skills has relied on U.S. panel data that permit observing the subsequent earnings of youth who can be followed into their initial jobs. However, estimates based on such early-career earnings are likely to suffer from downward lifecycle bias as people with higher lifetime earnings show systematically steeper earnings growth. Furthermore, in the beginning of a career the likelihood of job-skill mismatch is relatively high. Early career observations would tend to understate the full value of skills when observed in imperfect job matches. Observing people across the entire work life, PIAAC allows an investigation of how much returns to skills differ by age group.

Prime-age workers considered in the main analysis have skill returns that are on average 4 percentage points greater than for labor-market entrants aged 25-34. By contrast, returns for workers aged 55-65 are close to the ones of prime-age workers (see Figure 2). This age pattern underscores the problem of previous studies that relied just on the experiences of younger workers in evaluating the economic role of skill differences. Only the participating transition economies in Eastern Europe do not show this age pattern, probably reflecting the loss of human capital to older workers when their economies changed after the fall of the Iron Curtain.

Figure 2: Returns to skills by age group



The graph shows returns to skills (for a one-standard-deviation increase in numeracy skills) for indicated 5-year age groups. Slopes of solid lines reflect average change in returns by age groups (separately estimated for ages 16-34 and 35-54). Estimates refer to full-time employees pooling all countries and control for gender, work experience, and country fixed effects.

Source: Hanushek, Schwerdt, Wiederhold, and Woessmann (2015).

What accounts for the substantial differences across countries?

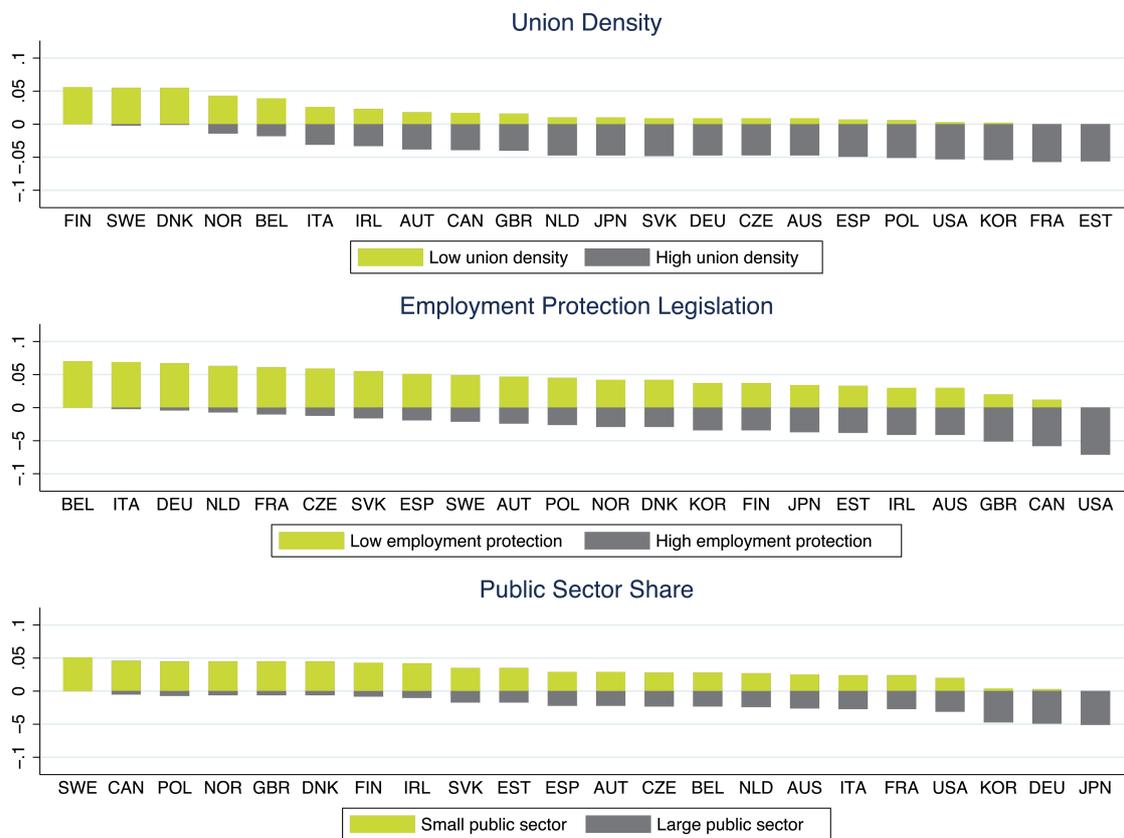
The cross-country dimension of the analysis allows us to provide stylized facts about what accounts for differences in returns to skills across countries. Intriguingly, returns to skills are systematically lower in countries with higher union density, stricter employment protection legislation, and larger public sectors. By contrast, product-market regulations and the existence of a minimum wage are not systematically related to differences in skill returns across countries. Skill returns neither vary systematically with the level or distribution of skills in a country.

How would returns to skills change with other institutions?

To document the size of the effects of these institutions, consider what would happen to the returns to skills in the pooled sample if all countries had the institution of the country with the lowest or highest value of this institution, respectively. These counterfactual simulations show that the return to skills in the pooled sample would range from 14 percent to 20 percent if all countries had the highest or the lowest observed value of union density, respectively; from 15 percent to 22 percent for employment protection legislation; and from 16 percent to 21 percent for the public-sector share.

Figure 3 shows the counterfactual returns for each country individually (upper panel: union density; middle panel: employment protection; lower panel: public-sector share). For example, if employment protection would be as strict in the United States as it is in Belgium (the country with the highest protection), the simulations suggest that the return to skills in the United States would be 21 percent instead of the actual 28 percent. Conversely, if Germany had the low level of employment protection of the United States, its return to skill would be 30 percent instead of the actual 23.5 percent based on this simulation.

Figure 3: Counterfactual Simulation



The graph shows predicted returns to skills assuming counterfactual institutions. Returns are predicted for each country assuming the maximum (grey bar) and the minimum (green bar) level of the respective institution across all countries. Union Density: share of wage and salary earners who are trade union members. Employment Protection Legislation: composite indicator measuring strictness of employment protection for individual and collective dismissals. Public Sector Share: share of workers employed in the public sector. The country with the lowest (highest) value is Estonia (Finland) for union density; the United States (Belgium) for employment protection legislation; and Japan (Sweden) for public sector share.

Source: Hanushek, Schwerdt, Wiederhold, and Woessmann (2015), own calculations.

Returns to skills and earning distributions

Furthermore, we relate a country's returns to skills to its level of income inequality. The distribution of income has been an issue of intense policy discussion in a wide range of countries, but the forces that affect this distribution are not well understood. Efforts to analyze distributional issues within individual countries face serious obstacles, because they are generally forced to rely upon limited variation over time and because much of the underlying structure of a nation's economy is largely unchanging. Additionally, significant portions of the distribution of income within countries at any point in time are deeply intertwined with the life-cycle difference in income, but these facets are not easily identified with the existing panels of young workers or with the limited information in national census data.

PIAAC offers an unprecedented opportunity to investigate the relationship between cognitive skills and the distribution of income across countries. This evidence is consistent with the above finding that higher union density, stricter employment protection, and larger public sectors are negatively related to the returns to skills – all of them lead to a more compressed earnings distribution.

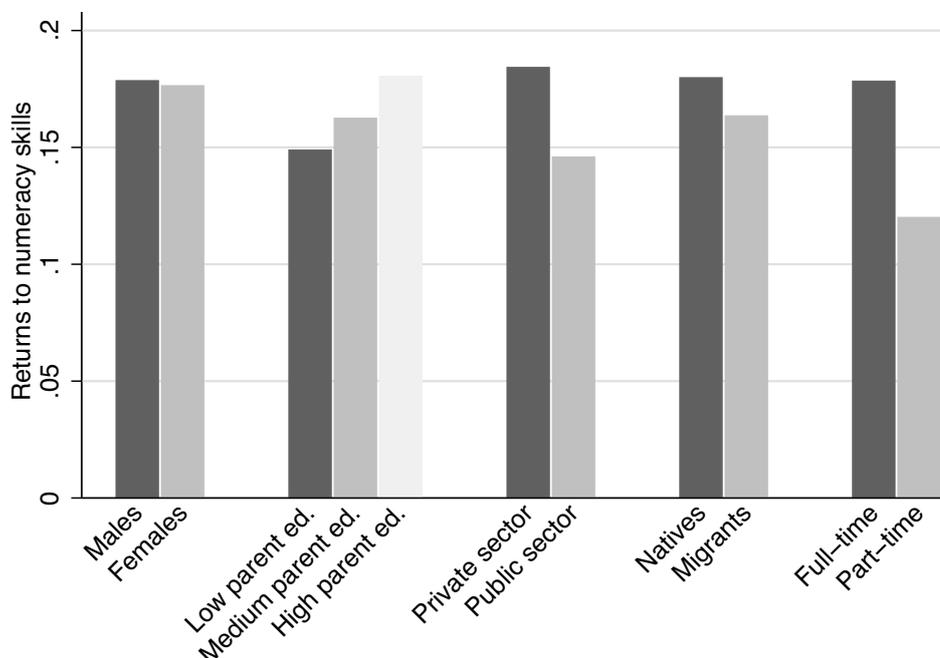
However, this result should not be interpreted as causal evidence that a country's earnings inequality determines the returns to skills. In fact, the reverse channel is also possible; i.e., high returns to skills for a given distribution of skills leads to high dispersion of wages. Returns to skills and earnings inequality appear as two sides of the same coin.

Only small differences across subgroups

Differences in returns to skills across subsets of workers also show interesting patterns (see Figure 4). On average, women and men have identical returns. By contrast, observed skills make somewhat more difference for natives than for immigrants, for full-time than for part-time workers, for private-sector than for public-sector workers, and for workers with high rather than low socioeconomic background. However, any of these differences are limited, and returns are substantial even in the subgroups with lower returns. Still, there are important country differences in these patterns.

The skill-earnings associations also prove immensely robust in a variety of further dimensions. For example, they hardly change when accounting for earnings differences across migration status, parental education, or industries. The same is true when using monthly rather than hourly earnings, adding bonus payments, or including the self-employed.

Figure 4: Returns to skills in alternative subgroups



The graph shows returns to skills (for a one-standard-deviation increase in numeracy skills) for indicated subgroup. Estimates refer to prime-age employees (except for last set of bars only full-time employees are considered) pooling all countries and control for gender, work experience, and country fixed effects. With the exception of gender, all subgroup differences are statistically significant at the 5 percent level.

Source: Hanushek, Schwerdt, Wiederhold, and Woessmann (2015).

Do returns differ for alternative skill measures?

A particular innovation of the PIAAC survey is a richer measurement of various skills, both in the sense that a wider range of competencies is assessed within each skill domain and that a new skill domain was added. Perhaps surprisingly, returns to literacy and particularly numeracy are quite consistently higher than returns to information and communication skills (labeled by the OECD as “problem solving in technology-rich environments”). One interpretation of this result is that labor markets still value the more traditional cognitive skills (that is, numeracy and literacy) more than ICT skills. However, given that most developed economies transit towards information-based economies, this may well change in the future. Another interpretation of the result of lower returns to ICT skills is that there is less experience with measuring skill demands in technologically-based economies, so these skills were probably measured with more noise.

The “full” returns to skill

Skills may not only affect wages but also the probability to be employed in the first place. One reason would be that individuals with higher earnings potential are more likely to choose to participate in the labor market. Another reason would be that low-skilled people are less likely to find a job on labor markets with effective minimum wages.

Indeed, consistently across countries, we find that better skills are significantly related to higher employment probabilities.

One way to take the employment effects of skills into account is to estimate sample selection models, which explicitly model the decision to participate in the labor market. These estimates suggest that the full returns to skills in the total population are about one fifth higher than in the baseline model that ignored selective employment.

In the selection models, Germany has the highest estimated returns to skills at 33 percent, followed by Spain with returns at 30 percent.

Moreover, for a variety of reasons, our estimated returns to skills may not reflect a causal effect of cognitive skills on wages. For instance, different employment patterns could directly affect measured skills over the lifecycle, implying problems of reverse causation. For example, better jobs might use and reinforce skills whereas worse jobs or employment breaks might lead to skill depreciation. Furthermore, unobserved variables like family networks, health, or personality traits could directly influence earnings; if also related to skills, these could lead to standard omitted variable bias in the analysis of skills.

However, instrumental-variable models that use skill variation stemming from school attainment, parental education, or compulsory-schooling laws point to a causal interpretation of the returns to skills shown in Figure 1. Moreover, estimated returns in the instrumental-variable models are consistently larger than those in the main analysis, suggesting that the latter provide a lower bound of the true returns to skills in the labor market.

Policy Recommendations

What can be finally recommended?

Much of the international discussion of educational policy is centered on school quality and student achievement. To understand the full economic implications of these discussions, it is necessary to go beyond labor-market analyses of the mere length of school attainment and directly investigate the role of acquired skills.

Overall, the results show that modern knowledge-based economies highly reward skills. Given the crucial importance of the skills of the population for economic prosperity, it is instructive to look at the skills of the EU population vis-à-vis other countries.

Many EU countries perform close to the average of the OECD participants in PIAAC. But even the EU top performers of Finland and the Netherlands fall short of the international top performer Japan. At a worrying level, Italy and Spain, but also France, fall substantially short of the international performance and constitute the bottom of the international league tables. The rather poor performance of European adults on the PIAAC skill test signals a dire need for reforms if the European Union wants to prosper in the future.

This puts the focus on policies for skill development at all levels – from the education provided before and in school to lifelong learning opportunities on and off the job – and on policies that ensure that skills are effectively retained and used. The new results emphasize that such policies are crucially important to secure the prosperity of European citizens in the future.

Literature

Eric A. Hanushek, Guido Schwerdt, Simon Wiederhold, Ludger Woessmann, Returns to Skills around the World: Evidence from PIAAC. *European Economic Review*, 2015, Vol. 73, pp. 103-130.

Project Identity

LLLight'in'Europe is an FP7 research project supported by the European Union, which has investigated the relevance and impact of lifelong learning and 21st century skills on innovation, productivity and employability. Against the background of increasingly complex tasks and jobs, understanding which skills impact individuals and organizations, and how such skills can be supported, has important policy implications. LLLight'in'Europe pioneered the use of an instrument to test complex problem solving skills of adults in their work environment. This allowed for the first time insights into the development of professional and learning paths of employed individuals and entrepreneurs and the role that problem solving skills play. Additionally, LLLight'in'Europe draws on a series of databases on adult competences from across the world to conduct rich analyses of skills and their impact.

These analyses were conducted in concert with different disciplines. Economists have been analyzing the impact of cognitive skills on wages and growth; sociologists have been investigating how public policies can support the development of such skills and lifelong learning; innovation researchers have been tracking the relationships between problem solving skills, lifelong learning and entrepreneurship at the organizational level; educational scientists have investigated how successful enterprises support their workforce's competences; cognitive psychologists have researched on the development and implications of cognitive skills relevant for modern occupations and tasks; and an analysis from the perspective of business ethics has clarified the role and scope of employers' responsibility in fostering skills acquisition in their workforce. The team has carried out its research and analyses on the value of skills and lifelong learning in EU countries, USA, China, Latin America and Africa.

The result is a multi-disciplinary analysis of the process of adult learning and problem solving in its different nuances, and of the levers which can support the development of these skills for both those who are already in jobs, and for those who are (re)entering the labor market, as well as the development of effective HR strategies and public policy schemes to support them.

Coordinator	Zeppelin University
Project Director	Peer Ederer
EU Project Officer	Monica Menapace
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This policy brief is part of the publication suite of the FP7 Project LLLight'in'Europe. The publication suite consists of 21 policy briefs, 6 thematic reports and 1 synthesis report. The 21 policy briefs discuss findings and policy implications proceeding from the project's research; they are organized along three level of analyses (persons; enterprise; country) and seven topics.

01	Resources of society for learning
02	Institutions of learning
03	Circumstances of learning
04	Role of transversal skills
05	Role of job-specific skills
06	Productivity of skills
07	Outcomes of skills

This policy brief discusses findings related to **Productivity of skills** at the analysis level **country**. For further publications and multimedia material related to the project, please visit www.lllightineurope.com