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The Economic Case for Education

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Content

List of Figures	ii
Executive Summary (English)	iii
Executive Summary (German)	v
Executive Summary (French)	viii
1. Introduction	1
2. Theory: Why Education Affects Prosperity	2
2.1 Education and Individual Productivity	2
2.2 Education and Macroeconomic Development.....	4
3. Growth: Educational Achievement and Societal Prosperity	6
3.1 The Crucial Role of Educational Achievement for Long-Run Economic Growth.....	6
3.2 The Costs of Low Educational Achievement: Simulations of Future Growth.....	9
4. Employment: Low-Educated at Highest Risk of Unemployment	12
4.1 Unemployment and Employment by Educational Attainment.....	13
4.2 General vs. Vocational Education and Life-Cycle Employment.....	16
5. Earnings: Education and Individual Prosperity	18
5.1 Rates of Return to Education.....	18
5.2 Returns to Skills.....	21
6. Implications for Policy-Making	23
6.1 The Need for Further Reform	23
6.2 Policy Measures for the EU Agenda	26
7. Conclusions	29
References	31

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List of Figures

Figure 1: Educational Achievement and Economic Growth Rates	7
Figure 2: The Cost of Low Educational Achievement in the European Union	10
Figure 3: Unemployment Rates by Educational Attainment	13
Figure 4: Employment Rates by Educational Attainment	15
Figure 5: Education Type and Life-Cycle Employment.....	17
Figure 6: Earnings Returns to one Year of Education	19
Figure 7: Earnings Returns to Skills	22
Figure 8: Literacy Proficiency of the Adult Population.....	23
Figure 9: Development of Student Achievement, 2000-2012	25

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Executive Summary (English)

The case for education can be made from many perspectives. This report makes the **economic case for education**. Based on the most recent empirical evidence, it shows the crucial role of education for individual and societal prosperity. Education is a leading determinant of economic growth, employment, and earnings in modern knowledge-based economies such as the European Union. Ignoring the economic dimension of education would therefore endanger the prosperity of future generations, with widespread repercussions for poverty, social exclusion, and the financial sustainability of social security systems. The available evidence warrants a strong focus of the EU policy agenda on the importance of education, knowledge, and skills.

From a **theoretical** perspective, education can be viewed as an investment into the knowledge and skills of people. It equips people with the skills that make them more productive in performing their work tasks and it conveys the knowledge and competencies that enable people to generate and adopt the new ideas that spur innovation and technological progress. To the extent that this increases individual productivity, educated *individuals* will be able to earn higher wages and – in societies with effective minimum wages – less likely to be unemployed. At the *macroeconomic* level, education can spur long-run economic growth by increasing aggregate productivity through accumulated human capital and by helping to generate and diffuse innovations which bring technological progress. Beyond the economic benefits in the narrow sense, education also offers nonproduction benefits such as increased work satisfaction, improved health decisions, reduced crime, improved citizenship, and better parenting.

Empirical evidence strongly supports these theoretical considerations. At the country level, education is indeed one – if not the most – important determinant of economic **growth**. If measured by the skills actually learned, the education of its population is very closely linked to a nation's long-run growth rate. An increase in *educational achievement* by 50 PISA points translates into 1 percentage point higher rates of economic growth in the long run. This means that if the European Union was successful in improving average student achievement by the equivalent of 25 PISA points, the economic gain would amount to an astounding €35 trillion. Put differently, this amount is the *cost* to the EU of not improving the quality of its school systems.

At the individual level, **employment** rates are very closely related to education levels. In the modern economy, widespread *unemployment* is predominantly a phenomenon among low-educated people. Across European countries, unemployment rates are at 6% for those with a

higher education, 9% for those with upper secondary education, and 18% for those who did not manage to finish an upper secondary degree. Over the entire employment *life-cycle*, there is a trade-off between vocational (occupation-specific) and general types of education programs, with early advantages of vocational programs in facilitating the school-to-work transition and later advantages of general programs in facilitating adaptability when economies change their structures and technologies over time.

Higher levels of educational attainment and skills also go along with substantial returns in the form of higher individual **earnings** on the labor market. Among those who have a job, earnings increase on average by 7.4% for each additional *year of education*. A substantial literature suggests that this association indeed reflects a causal effect of getting more education. When education is measured directly as *skills* in the new PIAAC adult-skill data, individual earnings increase on average by 17.4% for each step on the five-step PIAAC competency scale.

The report closes with some cautious **implications for policy-making**. The rather lackluster 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. While some EU countries have seen important improvements in their young generations' achievement levels on PISA over the past decade, achievement trends paint a picture of complacency in some other EU countries. Such complacency endangers future prosperity in the European Union. At the same time, the diverging trends in PISA show that achievement levels are not destiny, but can be improved – or let slip.

Given the crucial importance of knowledge and skills for future prosperity, the *EU policy agenda* should particularly focus on educational outcomes, rather than inputs or attainment. Not least in a context of tight public budgets, successful education reform calls for the need to improve efficiency. Given that most of the skill foundation is laid during youth, policy-makers should place a particular focus on schools and – as a pre-requisite – high-quality early childhood education. Available research highlights that accountability, autonomy, and choice are three dimensions of good governance that are important for increased efficiency and high levels of achievement in the school system. Similar measures appear promising for the European system of higher education. To find out the best ways to nurture the skills of adults, more research is needed to evaluate the outcomes and effectiveness of different adult education and training programs. Throughout the education system, additional research could help in closing gaps in our current knowledge about what works best to improve educational outcomes.

Executive Summary (German)

Das wirtschaftliche Argument für Bildung

Argumente, die für Bildung sprechen, können aus vielen Perspektiven aufgezeigt werden. Dieser Bericht liefert das **wirtschaftliche Argument für Bildung**. Auf der Basis aktueller empirischer Evidenz legt er die entscheidende Rolle von Bildung für individuellen und gesellschaftlichen Wohlstand dar. Bildung ist eine zentrale Ursache von Wachstum, Beschäftigung und Einkommen in einer modernen wissensbasierten Wirtschaft wie der Europäischen Union. Die wirtschaftliche Dimension von Bildung zu ignorieren würde deshalb den Wohlstand zukünftiger Generationen gefährden, mit weitreichenden Folgen für Armut, soziale Ausgrenzung und finanzielle Nachhaltigkeit der sozialen Sicherungssysteme. Die verfügbare Evidenz rechtfertigt einen starken Fokus der politischen Agenda der EU auf die Bedeutung von Bildung, Wissen und Fähigkeiten.

Aus **theoretischer** Sicht kann Bildung als Investition in Wissen und Fähigkeiten der Bevölkerung angesehen werden. Sie stattet die Menschen mit den Fähigkeiten aus, die sie beim Ausführen ihrer Arbeitsaufgaben produktiver machen. Zudem vermittelt Bildung das Wissen und die Kompetenzen, die es den Menschen ermöglichen neue Ideen zu generieren und anzuwenden, die wiederum Innovation und technologischen Fortschritt hervorbringen. In dem Ausmaß, wie dies die individuelle Produktivität erhöht, werden besser gebildete *Individuen* höhere Einkommen erzielen können und – in Gesellschaften mit effektivem Mindestlohn – weniger von Arbeitslosigkeit bedroht sein. Auf *makroökonomischer* Ebene kann Bildung das langfristige Wirtschaftswachstum beflügeln, indem sie die gesamtwirtschaftliche Produktivität durch angereichertes Humankapital erhöht und indem sie hilft, Innovationen hervorzubringen und zu verbreiten, die technologischen Fortschritt mit sich bringen. Über die wirtschaftlichen Erträge im engeren Sinne hinaus bietet Bildung auch Erträge jenseits der Produktion wie erhöhte Arbeitszufriedenheit, bessere Gesundheitsentscheidungen, weniger Kriminalität, mehr bürgerliches Engagement und bessere Erziehung.

Empirische Evidenz untermauert diese theoretischen Überlegungen deutlich. Auf gesamtwirtschaftlicher Ebene ist Bildung in der Tat eine wichtige – wenn nicht die wichtigste – Ursache wirtschaftlichen **Wachstums**. Wenn sie mit den tatsächlich erlernten Fähigkeiten gemessen wird, ist die Bildung der Bevölkerung sehr eng mit den langfristigen Wachstumsraten der Länder verbunden. Ein Anstieg der *Bildungsleistungen* um 50 PISA-Punkte überträgt sich in der langen

Frist in eine um einen Prozentpunkt höhere wirtschaftliche Wachstumsrate. Das bedeutet, dass der wirtschaftliche Nutzen davon, wenn die Europäische Union erfolgreich ihre durchschnittlichen Schülerleistungen um das Äquivalent von 25 PISA-Punkten verbessern würde, erstaunliche 35 Milliarden Euro betragen würde. Anders ausgedrückt entspricht dieser Beitrag den *Kosten* für die EU, die Qualität ihrer Schulsysteme nicht zu verbessern.

Auf individueller Ebene hängen **Beschäftigungsquoten** sehr eng mit Bildungsniveaus zusammen. In der modernen Wirtschaft ist weitverbreitete *Arbeitslosigkeit* vor allem ein Phänomen unter den Geringqualifizierten. In der Europäischen Union beträgt die Arbeitslosenquote 6% unter denjenigen mit höherer Bildung, 9% unter denjenigen mit höherer Sekundarbildung und 18% unter denjenigen, die keinen höheren Sekundarabschluss erreicht haben. Des Weiteren gibt es über den *Lebenszyklus* der Beschäftigung einen Zielkonflikt zwischen berufsspezifischen und allgemeinen Bildungsprogrammen mit frühen Vorteilen der beruflichen Programme beim Übergang von der Schule ins Berufsleben und späteren Vorteilen von allgemeinen Programmen bei der Anpassungsfähigkeit, wenn sich die Strukturen und Technologien der Wirtschaft über die Zeit verändern.

Höhere Niveaus von Bildungsabschlüssen und Fähigkeiten gehen auch mit substantiellen Erträgen in Form höherer individueller **Einkommen** am Arbeitsmarkt einher. Unter denen, die eine Beschäftigung gefunden haben, steigen die Einkommen mit jedem zusätzlichen *Bildungsjahr* um durchschnittlich 7,4%. Umfangreiche Literatur legt nahe, dass dieser Zusammenhang in der Tat einen kausalen Effekt zusätzlicher Bildung widerspiegelt. Wenn Bildung direkt als *Kompetenzen* in der neuen PIAAC-Studie der erwachsenen Bevölkerung gemessen wird, steigen die individuellen Einkommen mit jedem Schritt auf der fünfstufigen PIAAC-Kompetenzskala um durchschnittlich 17,4%.

Der Bericht schließt mit einigen vorsichtigen **Politikimplikationen**. Das eher glanzlose Abschneiden europäischer Erwachsener im PIAAC-Kompetenztest signalisiert eine deutliche *Reformnotwendigkeit*, wenn die Europäische Union in Zukunft prosperieren möchte. Während einige EU-Länder im letzten Jahrzehnt deutliche Verbesserungen in den Leistungsniveaus ihrer jungen Generation in PISA gesehen haben, zeichnet die Leistungsentwicklung in einigen anderen EU-Ländern ein Bild der Nachlässigkeit. Solche Selbstgefälligkeit gefährdet den zukünftigen Wohlstand in der Europäischen Union. Gleichzeitig zeigen die unterschiedlichen Entwicklungen

in PISA, dass Leistungsniveaus kein Schicksal sind, sondern verbessert – oder vernachlässigt – werden können.

Vor dem Hintergrund der entscheidenden Bedeutung von Wissen und Fähigkeiten für zukünftigen Wohlstand sollte die *politische Agenda der EU* sich besonders auf Bildungsergebnisse statt auf Bildungsinputs und Bildungsdauer konzentrieren. Nicht zuletzt in Zeiten knapper öffentlicher Budgets sind für erfolgreiche Bildungsreformen Effizienzverbesserungen notwendig. Da ein großer Teil der Kompetenzgrundlagen während der Jugend gelegt wird, sollten politische Entscheidungsträger einen besonderen Schwerpunkt auf die Schulen und – als Voraussetzung – auf qualitativ hochwertige frühkindliche Bildung legen. Die Forschung belegt, dass Verantwortungssysteme, Selbständigkeit und Wahlmöglichkeiten drei Dimensionen guter Steuerung sind, die von großer Bedeutung für verbesserte Effizienz und hohe Leistungsniveaus im Schulsystem sind. Ähnliche Maßnahmen erscheinen im europäischen System der höheren Bildung vielversprechend. Um die besten Wege zur Förderung der Fähigkeiten Erwachsener zu finden, ist weitere Forschung notwendig, die die Ergebnisse und Effektivität verschiedener Programme der Erwachsenenbildung evaluiert. Im gesamten Bildungssystem könnte zusätzliche Forschung dabei helfen, Lücken in unserem derzeitigen Wissensstand darüber zu schließen, was am besten funktioniert, um Bildungsergebnisse zu verbessern.

Executive Summary (French)

Une vision économique des bénéfices de l'éducation – Synthèse

Les bénéfices de l'éducation peuvent être regardés sous bien des angles, en particulier l'angle économique auquel ce rapport s'intéresse plus particulièrement. En s'appuyant sur les études les plus récentes, il montre le rôle crucial de l'éducation pour la prospérité à la fois de l'individu et de la société dans son ensemble. L'éducation est un des facteurs les plus importants de croissance économique, d'emploi et de revenu dans des économies modernes basées sur la connaissance telles que l'Union Européenne. Ignorer la dimension économique de l'éducation pourrait par conséquent menacer la prospérité des générations futures, avec de grandes implications pour la pauvreté, l'exclusion sociale et la viabilité financière des systèmes de sécurité sociale. Les études disponibles préconisent ainsi une concentration accrue de l'agenda politique européen autour des questions d'éducation, de connaissances et de compétences.

D'un point de vue théorique, l'éducation peut être vue comme un investissement dans les connaissances et les compétences de l'individu. L'éducation permet de donner aux travailleurs des compétences qui les rendront plus productifs dans l'accomplissement de leurs tâches professionnelles. Elle favorise également la création et l'assimilation d'idées nouvelles par lesquelles se diffusent l'innovation et le progrès technologique. Dans la mesure où cela améliore effectivement la productivité individuelle, les personnes ayant fait des études devraient ainsi avoir des salaires plus élevés et – dans les pays avec un salaire minimum effectif – connaître moins de périodes de chômage que les autres. Au niveau macroéconomique, l'éducation peut favoriser la croissance économique de long terme grâce à l'accroissement de la productivité agrégée au travers de l'accumulation du capital humain. Elle peut également aider à la création et à la diffusion d'idées novatrices indispensables au progrès technologique. Au-delà des bénéfices économiques stricto sensu, l'éducation peut également avoir d'autres vertus comme une plus grande satisfaction au travail, des décisions de santé mieux avisées, une moindre propension au crime, un exercice de la citoyenneté plus éclairé ou encore une meilleure éducation des enfants.

Les résultats empiriques confirment ces considérations théoriques. Au niveau national, l'éducation est en effet un des facteurs les plus importants – sinon le plus important – pour la croissance économique. Quand on l'approxime par les compétences effectivement acquises, l'éducation de la population est très étroitement liée au taux de croissance de long terme d'un pays. Une augmentation des acquis scolaires de 50 points PISA se traduit par 1 point de

pourcentage sur la croissance de long terme pour un pays donné. Cela signifie que si les pays européens parvenaient à accroître les acquis scolaire de l'équivalent de 25 point PISA, cela représenterait un gain économique considérable d'environ 35 milliard d'euros. Dit autrement, cette somme représente le coût pour l'Union Européenne de ne pas améliorer son système éducatif.

Au niveau individuel, le niveau d'éducation est également très lié au taux d'emploi. Dans les économies modernes, le chômage de masse est un phénomène qui affecte principalement les personnes peu qualifiées. Dans les pays européens, le taux de chômage est de 6% pour les diplômés du supérieur, de 9% pour les personnes ayant obtenu leur baccalauréat et de 18% pour ceux qui ne sont pas parvenus jusque-là. Il existe par ailleurs un arbitrage temporel entre les formations professionnelles (spécialisées) et les formations généralistes. Les premières offrent un avantage à court terme en facilitant la transition entre le système éducatif et le monde professionnel, tandis que les secondes permettent une meilleure adaptation sur le long terme aux changements structurels de l'économie et au progrès technologique.

De plus hauts niveaux d'études et de compétences vont aussi de pair avec de plus hauts revenus individuels sur le marché du travail. Si l'on considère seulement les actifs, les revenus individuels augmentent en moyenne de 7,4% pour chaque année d'études supplémentaire. De nombreuses analyses concluent que cette corrélation reflète l'effet causal de l'augmentation du niveau d'études. Lorsque l'éducation est directement mesurée par les compétences acquises, comme dans la récente étude du PIACC sur les compétences des adultes, les revenus individuels augmentent en moyenne de 17,4% lors du passage d'un échelon dans la classification en cinq catégories du PIACC.

Le rapport s'achève par quelques prudentes recommandations pour les politiques publiques. Les performances mitigées des adultes européens lors des tests de compétences du PIACC mettent en lumière le besoin de réforme si l'Union Européenne veut continuer à prospérer dans le futur. Bien que certains pays Européens aient vu les résultats aux tests PISA de la jeune génération progresser ces dix dernières années, l'évolution des résultats dans d'autres pays dénote d'une forme de laisser-aller. Un tel relâchement met en danger la prospérité de l'Union Européenne. Dans le même temps, l'évolution différenciée des résultats aux tests PISA prouve que les performances scolaires ne sont pas une fatalité, mais que l'on peut les améliorer – ou les laisser se dégrader.

Etant donnée l'importance cruciale de la connaissance et des compétences pour la prospérité future, l'agenda politique européen devrait prêter davantage attention aux acquis scolaires, plutôt qu'aux moyens dédiés à l'école ou au niveau d'études. De plus, chose non-négligeable dans ces temps de déficits budgétaires élevés, des réformes éducatives réussies se doivent de viser à l'efficacité. Sachant que la plus grosse partie du socle de compétences est constituée pendant la jeunesse, les politiques publiques devraient se concentrer en particulier sur les écoles avec comme prérequis un enseignement de qualité lors de la petite enfance. Les études disponibles montrent que la responsabilisation, l'autonomie et le choix sont trois dimensions d'une bonne gouvernance qui sont essentiels pour un système efficace et de bonnes performances scolaires. Des études similaires semblent prometteuses pour le système d'enseignement supérieur de l'Union Européenne. Quant à savoir comment renforcer les compétences des adultes, plus de recherche semble requise pour évaluer les résultats et l'efficacité de plusieurs programmes de formation pour adultes. Effectuer davantage d'analyses sur le système éducatif dans son ensemble pourrait permettre de combler les lacunes dans notre connaissance des moyens efficaces pour améliorer les performances scolaires.

1. Introduction

Education can serve many goals. It can empower people to be independent citizens and participate in society. It can promote civic awareness and foster a shared system of values and social cohesion. It can increase health consciousness and prevent criminal behavior. It can also serve mere “consumption” purposes: the pure joy of increasing our understanding of the world. The case for education can thus be made from many perspectives.

This report makes the case for education from an **economic** perspective. It is a highly compelling case. Based on the most recent empirical evidence, education plays a crucial role for individual and societal prosperity. The knowledge and skills of the population are a leading determinant of economic growth, employment, and earnings. It would thus be irresponsible to ignore the economic role of education. This would be just as misguided as viewing education exclusively from an economic perspective. Those who ignore the economic case for education should be aware of the dire consequences of this ignorance for future unemployment, poverty, sustainability of social security systems, and many other economic problems of future generations.

The economic role of education is particularly relevant in modern knowledge-based economies such as the **European Union**. This report thus focuses on the situation of advanced economies with a particular focus on the EU Member States. According to the available evidence, to be able to prosper in the global economy, Europe as a region depends on the knowledge and skills of its population.¹

In the next section, this report starts with the theoretical background of why education is expected to affect economic prosperity from a micro and macro perspective. Sections 3-5 present the empirical evidence on the role of education for macroeconomic growth, employment, and individual earnings, respectively. Section 6 draws implications for the EU policy agenda. Section 7 concludes.

¹ For a discussion of some of these issues in the context of the United States, see Hanushek, Peterson, and Woessmann (2013). The fact that education also plays a crucial role for the future prospects of developing countries is highlighted in chapter 5 of Hanushek and Woessmann (2015).

2. Theory: Why Education Affects Prosperity

Ever since the ground-breaking work on the role of education as human capital by Theodore Schultz (1961), Gary Becker (1964), and Jacob Mincer (1974), it is hard to imagine fundamental theories to understand individual success on the labor market and the macro development of economies that do not assign a leading role to education.²

2.1 Education and Individual Productivity

The fundamental insight of human capital theory is that education can be viewed as an **investment** into the knowledge and skills of people. Similar to investments in machinery, those who invest in their education incur an initial cost in the hope to reap benefits in the future. The costs in this investment decision include both direct costs such as educational material and tuition fees and the opportunity cost that the people could use their time for other activities such as working for income. As pointed out in the introduction, the benefits can take many forms, but in a pure economic perspective, the main expected return is the increased **productivity** that comes along with higher knowledge and skills: Education equips people with the skills that make them more productive in performing their work tasks and it conveys the knowledge and competencies that enable people to generate and adopt the new ideas that spur innovation and technological progress.

If a more educated person contributes a larger marginal product to the production process of a firm, in a market economy the firm will pay the person higher **earnings** accordingly. To the extent that the increases in future income streams are valued higher than the initial costs, the investment in education will be viewed as worthwhile from an economic perspective. This basic insight goes as far back as to Adam Smith (1776[1979]) who wrote in his *Wealth of Nations* (p. 118),

“A man educated at the expence of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to [an] expensive machin[e]. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole

² For general introductions into the economic role of education, see, e.g., Brewer and McEwan (2010), Checchi (2006), Hanushek and Woessmann (2008), Hanushek, Machin, and Woessmann (2011), and Machin and Vignoles (2005).

expenditure of his education, with at least the ordinary profits of an equally valuable capital.”

In general, these benefits will take the form of higher earnings streams at the individual level. However, if the marginal product of a low-skilled worker lies below the effective minimum wage in a society (set, for example, by the alternative income that one may obtain from the welfare state), this worker may remain unemployed. In this case, the increase in individual productivity through better education may also materialize as an effect on **employment**: Education may enable people to escape unemployment and find a job in the first place.³ In addition, education may increase individuals’ ability to deal with changing conditions, thereby enhancing employability in times of rapid technological changes.⁴ By reducing unemployment and increasing earnings, investing in people’s education and skills can thus ultimately help to avoid poverty, reduce social exclusion, and reduce inequality in society.⁵

The productivity-enhancing features of education almost certainly contain increased **cognitive skills**, both at a general and at an occupation-specific level, that enable people to better understand, perform, and improve economic processes.⁶ In addition, education may also affect **non-cognitive skills** and personality traits that have an economic payoff.⁷ In empirical work, it is often hard to disentangle the different types of skills, not least because many so-called non-cognitive skills such as perseverance, patience, locus of control, self-esteem, or grit, contain an important cognitive component. Most importantly, available evidence suggests that in reality educational processes will tend to further several productivity-relevant skills at the same time, rather than enhancing one skill dimension at the detriment of another.

Beyond the benefits in terms of increased productivity that is remunerated on the labor market, education may also offer a range of **nonproduction benefits**.⁸ These may include such

³ For a richer discussion of how recent changes in technologies and globalization affect the earnings and employment returns to different levels and types of skills, see the review in Acemoglu and Autor (2011). Goldin and Katz (2008) document the continuing race between education and technology over the long run.

⁴ See Schultz (1975).

⁵ For a detailed analysis of inequality in education and training, see the companion EENEE report by Sandra McNally and Jo Blanden.

⁶ See Hanushek and Woessmann (2015) for the crucial role of cognitive skills.

⁷ The economic effects of non-cognitive skills have been stressed, among others, by Bowles, Gintis, and Osborne (2001), Heckman, Stixrud, and Urzua (2006), Cunha et al. (2006), Borghans et al. (2008), Almlund et al. (2011), and Lindqvist and Vestman (2011).

⁸ Lochner (2011) and Oreopoulos and Salvanes (2011) provide reviews of nonproduction benefits of education.

aspects as increased work satisfaction, improved decision-making on health issues, reduced crime, improved citizenship, and better parenting. Some of these nonproduction benefits may accrue at the individual level, whereas others may accrue to society at large.

2.2 Education and Macroeconomic Development

Apart from its impact at the individual level, education has also entered theories of economic **growth** at the macroeconomic level.⁹ There are two broad classes of theoretical models on the specific mechanisms by which education may affect the long-run development of the economy.

The first class of models builds directly on the microeconomic theory of human capital described above. The output of the macro economy is simply a function of capital and labor as factors of production. If education works as an investment that increases individual productivity, human capital is a factor of production also in the macro economy that can be accumulated. The increased individual productivity simply aggregates at the economy level. On the transition path from the old steady state of economic output to the new higher steady state, the growth rate of the economy will increase. In such so-called augmented neoclassical growth models, education simply lifts **macroeconomic productivity** by accumulating human capital.¹⁰

The second class of models highlights the role of education in generating and diffusing new technologies. Ultimately, an economy's rate of growth depends on technological progress, or improvements in the technology that transforms factors of production into output. Such improvements in total factor productivity emerge from **innovation** of products and processes. In so-called endogenous growth models, innovation arises from intentional investments in research and development. This process is fundamentally guided by the underlying invention of people, which flows from the knowledge and skills of the population. Here, education plays the crucial role of increasing the innovative capacity of the economy by producing a continuing stream of new ideas and technologies. By inventing and marketizing these new ideas and new technologies, highly educated people give rise to sustained growth dynamics in these models.¹¹

⁹ For textbook introductions into the theory of economic growth, see, e.g., Acemoglu (2009), Aghion and Howitt (1998, 2009), Barro and Sala-i-Martin (2004), and Jones and Vollrath (2013).

¹⁰ Mankiw, Romer, and Weil (1992) augmented the neoclassical growth model by Solow (1956) by human capital in this way.

¹¹ See the contributions by Lucas (1988), Romer (1990), and Aghion and Howitt (1998).

Relatedly, in technological **diffusion** models, the rate at which economies can absorb the technological developments that happen outside depends again on the knowledge and skills of its population.¹²

These macroeconomic effects of education stem from increased productivity and income within a country. In the public debate, the case for education is sometimes also made on the basis of the necessity to be competitive in the global marketplace. However, in contrast to firms, national economies do not readily lend themselves to the concept of **competitiveness**.¹³ In particular, it is not obvious why the increased productivity of one region should come at the detriment of prosperity in another region. Global income is not a fixed cake. Rather, by increasing productivity and innovation, better education will increase the cake that is to be distributed. Higher levels of education in a country allow it to innovate, to improve its production, and to import and employ new technologies without decreasing the growth prospects for other countries. What is more, a country's education may generate positive spillovers if, by pushing out the world technological frontier, it allows other countries to profit by imitation and reaching a higher productivity level.

Theoretically, the macroeconomic (social) returns to education may be higher or lower than the individual (private) returns discussed above. On the one hand, the macro returns may exceed the individual returns if there are **externalities**. For example, in the spirit of the innovation effects emphasized in endogenous growth models, high-skilled inventors may produce innovations that also raise the productivity of other workers and ultimately of whole economies without all these benefits accruing to the innovator.¹⁴ On the other hand, the social returns to education may also be lower than the private returns if part of the private returns comes in the form of unproductive **signaling** or screening.¹⁵ Individuals may get more education simply to signal high ability to the labor market, so that educational institutions simply act as devices to select more able students as opposed to providing them with new knowledge and skills.

¹² See the contributions by Nelson and Phelps (1966), Welch (1970), and Benhabib and Spiegel (2005).

¹³ See Krugman (1994).

¹⁴ At our current state of knowledge, the empirical bearing of the size of such externalities is open to debate, with the existing empirical literature being inconclusive; see, e.g., Acemoglu and Angrist (2000), Moretti (2004), Ciccone and Peri (2006), Iranzo and Peri (2009), as well as the literature on nonproduction benefits in the form of reduced crime, good citizenship, and better parenting referred to above.

¹⁵ See, e.g., Spence (1973), Stiglitz (1975), Weiss (1995), Riley (2001), and Arcidiacono, Bayer, and Hizmo (2010).

However, the available evidence surveyed below strongly speaks towards an interpretation that the micro returns to education are by no means limited to private payoffs.

3. Growth: Educational Achievement and Societal Prosperity

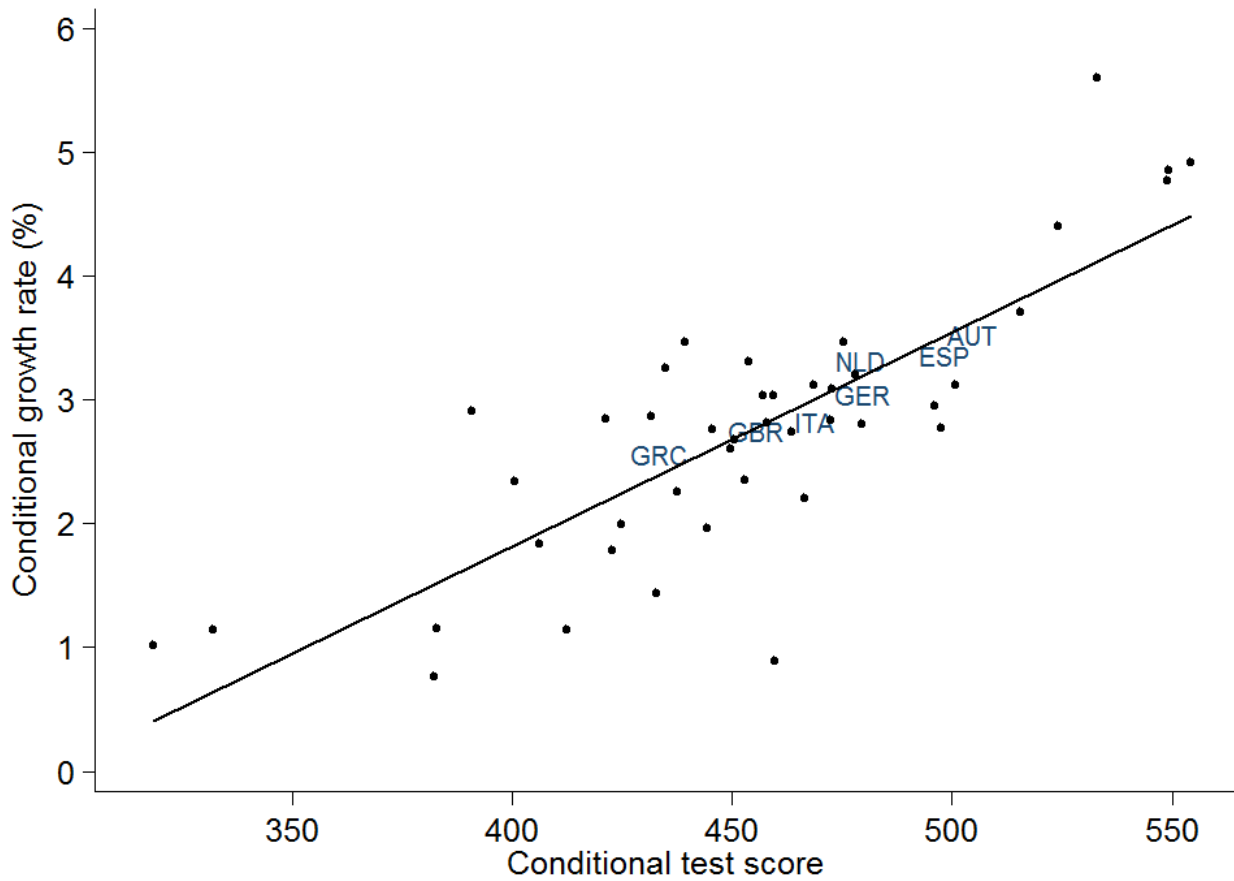
Against the theoretical background, this section covers the existing empirical evidence on the effect of education on macroeconomic growth. We start with evidence on the role of educational achievement for long-run growth and then simulate the costs of low educational achievement in the form of lost economic growth. The subsequent two sections will then cover the effects of education on employment and individual earnings, respectively.

3.1 The Crucial Role of Educational Achievement for Long-Run Economic Growth

Over the recent past, empirical research has shown that education is indeed one – if not the most – important determinant of economic growth in the long run (i.e., of long-term growth trends beyond business-cycle fluctuations and temporary crises). If measured by the skills actually learned – particularly, the performance of the population on achievement tests in math and science – the education of its population is very closely linked to a nation’s long-run growth rate. This is depicted in Figure 1, which plots countries’ average annual rate of growth of real GDP per capita in 1960-2009 against the **educational achievement** scores of their populations (both after taking out effects of the initial level of economic development).¹⁶ It is directly visible that there is a very close relationship between the two, with countries that do well on the achievement tests systematically having higher long-run growth rates than countries with poor educational achievement. In fact, such a simple model can account for about three quarters of the total cross-country variation in economic growth over the past half century. Moreover, the figure suggests a very strong effect: For every half standard deviation in test scores – equivalent to 50 points on the PISA scale – a country’s long-run growth rate is 1 percentage point higher.

¹⁶ See Hanushek and Woessmann (2008, 2012a, 2015) for details on the effect of educational achievement on economic growth.

FIGURE 1: EDUCATIONAL ACHIEVEMENT AND ECONOMIC GROWTH RATES



Added-variable plot of a regression of the average annual rate of growth (in percent) of real GDP per capita in 1960-2009 on average test scores on international student achievement tests, initial average years of schooling, and initial level of real GDP per capita (mean of unconditional variables added to each axis). “Conditional” refers to variation in growth rates and test scores, respectively, purged for variation in these other variables. Selected EU countries highlighted for expositional purposes. Source: Hanushek and Woessmann (2015), own calculations.

In this analysis, education is crucially measured as actual achievement, namely the average test scores on all international student achievement tests in math and science performed between 1964 and 2003. When the education of the population is instead measured by its average **years of education**, the association with economic growth is much weaker, and the model accounts for only one quarter of the cross-country variation in long-run growth (rather than three quarters with achievement). In fact, once differences in achievement are taken into account, there is no separate relation whatsoever between years of education and economic growth. This means that the quantity of education matters for growth only insofar as it in fact leads to better knowledge and skills of the population. It is what people know and can do that matters for economic growth,

not how long it took them to reach that achievement. This evidence strongly calls for a focus on educational outcomes, not just attainment.

Several detailed analyses indicate that the achievement-growth picture indeed depicts a **causal** effect of better educational achievement on economic growth.¹⁷ Among others, the effect is even larger if early achievement is separated out from subsequent growth by relating achievement on the tests performed through the mid-1980s to economic growth since the mid-1980s. This rules out that the association reflects simple reverse causation from growth to achievement, a concern that is anyways dampened by the ubiquitous result that higher education spending is not systematically related to better outcomes across countries. The concern that the association may capture additional unobserved factors such as economic institutions, the structure of the economy, or particular cultures that relate to both achievement and growth is mitigated by several additional detailed analyses.

A first analysis restricts the achievement variation to only that part that stems from observed differences in school systems such as exam systems, decentralization, or private competition. A second analysis shows that immigrants from countries with higher educational achievement reap substantial earnings returns on the same U.S. labor market, but only if they were indeed schooled in their home country, not if they were schooled in the United States. A third analysis disregards any level differences across countries and shows that countries that have improved their test scores over time have witnessed systematic upward trends in their economic growth rates. A fourth analysis takes the parameters of how education affects economic outcomes from well-identified microeconomic estimates to show that differences in education can account for substantial parts of the cross-country variation in levels of economic development. Finally, an analysis that relies solely on variation within countries and within industries shows that countries with a more skilled populations experienced faster growth in skill-intensive industries.¹⁸ Together, these analyses suggest that the educational achievement of the population indeed has a strong positive effect on a nation's economic growth.

A vast literature investigates the role of education in economic growth further, employing different measures of education and different methods such as growth regressions, growth accounting, and development accounting. Several pieces of additional work underscore the

¹⁷ See Hanushek and Woessmann (2012a, 2015) for details.

¹⁸ See Ciccone and Papaioannou (2009).

importance of measured skills for long-run growth.¹⁹ An extensive empirical growth literature has focused on quantitative measures of schooling.²⁰ In general, this literature has tended to find a positive association between quantitative schooling measures and economic growth. In fact, an encompassing robustness analysis has found primary schooling to be the most robust substantial influence factor on long-run growth among a long list of analyzed factors.²¹ Still, the evidence presented above indicates that actual acquired skills play a dominant role when considered in cross-country growth regressions. A recent study has focused on the regional level and found that years of schooling are of paramount importance for differences in regional development across more than 1,500 subnational regions in 110 countries.²² Another important line of research turns the focus from rates of growth to levels of development and analyses to what extent education can account for cross-country differences in the level of development.²³ Again, education plays a very important role once measured by actual achievement. Recently, research has also uncovered an important role of education in historical economic development, showing the strong empirical relevance of education and literacy for catch-up during the Industrial Revolution and for Jewish and Protestant economic history.²⁴

3.2 The Costs of Low Educational Achievement: Simulations of Future Growth

Taking the estimates of how educational achievement relates to economic growth over the past half century, one can also simulate the economic value in terms of future economic growth of reforms that improve student achievement – or, as the other side of the same coin, the economic costs caused by low educational achievement in terms of lost future growth. These

¹⁹ The research started with the seminal contribution by Hanushek and Kimko (2000). Additional contributions include, among others, Barro (2001), Woessmann (2003), Bosworth and Collins (2003), and Kaarsen (2014). See Hanushek and Woessmann (2011a) for a review.

²⁰ Important contributions include, among others, Barro (1991, 1997), Mankiw, Romer, and Weil (1992), Bils and Klenow (2000), Bosworth and Collins (2003), de la Fuente and Doménech (2006), Vandenbussche, Aghion, and Meghir (2006), Cohen and Soto (2007), Aghion et al. (2009), and Barro and Lee (2013). For extensive reviews of the literature, see, e.g., Topel (1999), Temple (2001), Krueger and Lindahl (2001), Sianesi and Van Reenen (2003), and Pritchett (2006). See Delgado, Henderson, and Parmeter (2014) for a list of recent research.

²¹ See the analysis of 67 explanatory variables in growth regressions on a sample of 88 countries by Sala-i-Martin, Doppelhofer, and Miller (2004), where primary schooling comes out as the most robust variable after an East Asian dummy.

²² See Gennaioli et al. (2013).

²³ See, among others, Hendricks (2002), Woessmann (2003), Caselli (2005), Hsieh and Klenow (2010), Hanushek and Woessmann (2012c, 2015), Schoellman (2012), and Caselli and Ciccone (2013).

²⁴ See, in particular, Becker, Hornung, and Woessmann (2011), Botticini and Eckstein (2007), and Becker and Woessmann (2009).

simulations compare the projected paths of future economic growth of a country with and without improved achievement of its labor force and discount the cumulated future gains back to present values.²⁵ In doing so, they assume that skills play the same role in the future as they have in the past and that the experiences of other countries with higher skills provide insight into how the improved skills will be absorbed into an economy. Importantly, the simulations take into account that a school reform does not take full effect instantaneously and that the impacts of better achievement come only after students have become integrated into the work force. Still, when viewed over a sufficiently long-term perspective such as the expected lifetime of a child born today (i.e., over 80 years), the magnitude of economic impacts from improved skills that are consistent with the historical achievement-growth relationship described above is truly enormous.

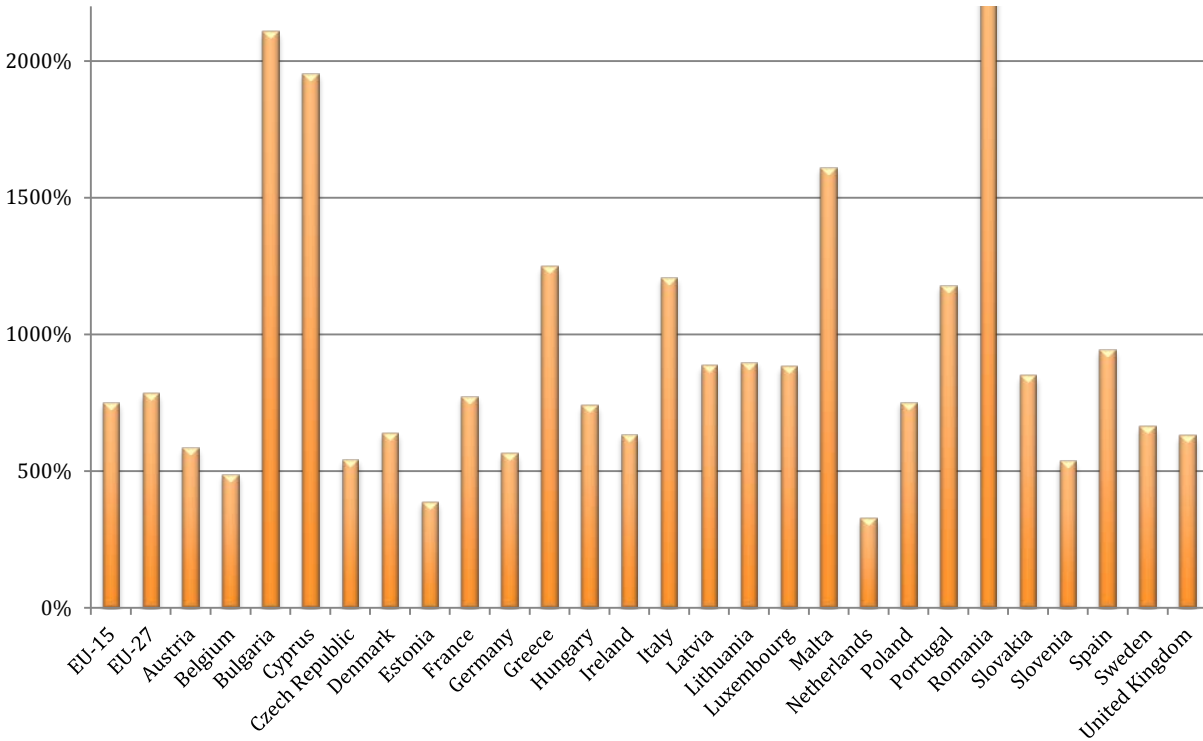
For example, we can simulate the future benefits of a reform that would improve student achievement by 25 PISA points. Such improvement is quite plausible and has, for example, been observed in Germany, Poland, and Turkey during the past decade and in Canada and Finland over the two to three decades before.²⁶ According to the projections, the future gains from improving student achievement by 25 PISA points amount to €35 trillion for the entire European Union until 2090. This is equivalent to 288 percent of the EU's total current GDP. Relative to the value of discounted future GDPs of the EU countries over the same time span, the effect amounts to a 6.2 percent increase in discounted future GDPs. Such an increase would be roughly equivalent to an average wage increase of 12 percent for all workers over this entire period.

Similar projections can be made for alternative school reforms. For instance, if each EU Member States' achievement were brought up to level of the EU top performer on PISA, Finland, the future gains in terms of EU prosperity until 2090 would sum to an astounding €95 trillion. Figure 2 shows what these gains mean separately for each EU Member State, expressed in terms of percent of each country's current GDP. And even just reaching the EU's Education and Training 2020 benchmark of having less than 15% low achievers in basic skills in each country would be projected to bring future gains worth €25 trillion until 2090. Put differently, the costs caused by low educational achievement in terms of lost future economic growth are simply huge.

²⁵ For details on the projection models for OECD and EU Member States, see Hanushek and Woessmann (2011b, 2012b).

²⁶ See Hanushek and Woessmann (2015) for details.

FIGURE 2: THE COSTS OF LOW EDUCATIONAL ACHIEVEMENT IN THE EUROPEAN UNION



Discounted value of future increases in GDP until 2090 of improving student performance in each country so as to reach the level of EU top performer on PISA, Finland, as percentage of the country's current GDP. Source: Hanushek and Woessmann (2012b).

These growth projections enclose all effects of improved educational achievement on societal economic prosperity, as far as they are measured by a country's gross domestic product. Directly or indirectly, these will include both the private labor-market returns (see below) – in terms of both employment and earnings – and any additional returns accruing to society at large. In that sense, the projected costs of low educational achievement also contain the costs from the perspective of **public finances** such as lost tax revenues and social security contributions as well as additional required welfare outlays.²⁷

Empirically, it is hard to distinguish between the two types of growth models introduced above – the augmented **neoclassical** growth models of accumulated production factors and the **endogenous growth** models of faster innovation and technological diffusion. The projections so far take the framework of an endogenous growth model where improved education leads to

²⁷ See de la Fuente and Jimeno (2009) for estimates of the fiscal returns to education for 14 EU countries.

higher growth paths also in the very long run. It seems highly intuitive that the development of general skills captured by the measure of educational achievement is a key element in how individuals adapt to new situations and how new ideas and approaches are developed. As such, countries with more knowledge and skills can be envisioned to keep improving their economic performance over time through new technologies, improved production processes, and enhanced economic operations. Indeed, the finding that countries with a more skilled labor force experienced faster growth in skill-intensive industries is particularly indicative of the relevance of growth models that stress ideas, innovation, and technological diffusion.

But effectively, both types of mechanisms are likely to be at work in the real world. If the growth models above are estimated by separating out the extent to which a country reaches a sound basic achievement level for the population at large – something particularly relevant in the neoclassical framework – from the extent to which a country reaches outstanding performance at the very top – something particularly relevant for future “rocket scientists” in the endogenous growth framework – both dimensions separately exert a positive effect on economic growth.

Ultimately, though, the relevance of the differences between the two types of models for real-world considerations may be fairly limited, after all. In fact, if we perform the long-term projection of a 25 PISA-point improvement in achievement above in the framework of a neoclassical rather than endogenous growth model, the gains would amount to €28 trillion rather than €35 trillion for the European Union. That is, no matter whether the dominant mechanism is that better education lifts the growth rate of an economy forever (as in endogenous growth models) or that it only lifts the growth rate transitionally until the economy has reached a new higher steady state (as in neoclassical growth models), the importance of educational achievement for future prosperity is enormous.

4. Employment: Low-Educated at Highest Risk of Unemployment

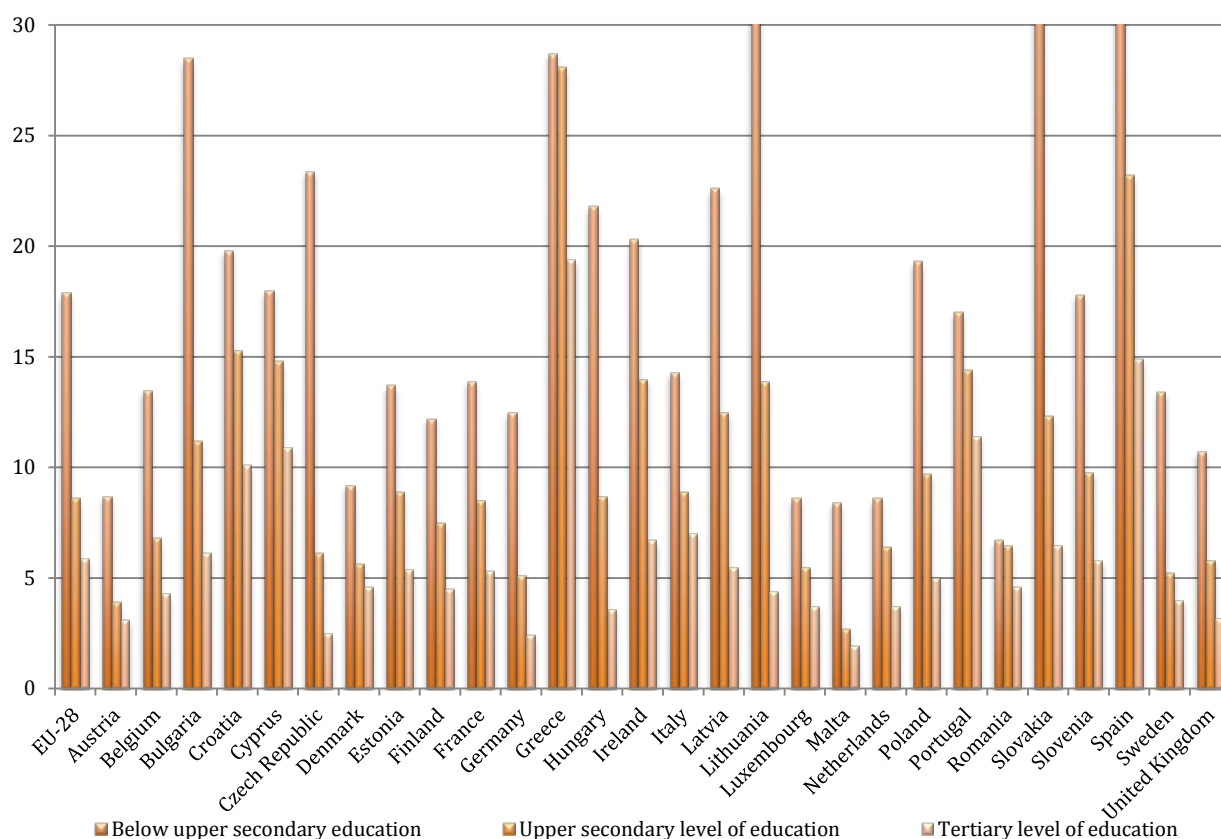
In this section, we turn to the relation between education and (un)employment. We first show that modern unemployment is predominantly a phenomenon of the low-educated and then look at employment patterns over the life-cycle by whether the type of education was general or vocational.²⁸

²⁸ For greater details on how education and training may help to prevent or combat youth unemployment and increase employment, see the companion EENEE report by Francis Kramarz and Martina Viarengo.

4.1 Unemployment and Employment by Educational Attainment

As a start, Figure 3 shows **unemployment** rates by educational attainment for all 28 EU Member States. The unemployment rates refer to the share of unemployed in the labor force. The three categories of educational attainment considered in each country are below upper secondary education, at most upper secondary education, and tertiary education.²⁹

FIGURE 3: UNEMPLOYMENT RATES BY EDUCATIONAL ATTAINMENT



Number of unemployed 25-64 year-olds as a percentage of all 25-64 year-olds in the labor force, by educational attainment, 2013. Unemployment rates are cut at 30% for expositional reasons. In three countries, unemployment rates in the low-educated category exceed 30% (Slovakia: 40.0%, Lithuania: 32.9%, Spain: 32.7%). Source: Eurostat (2014).

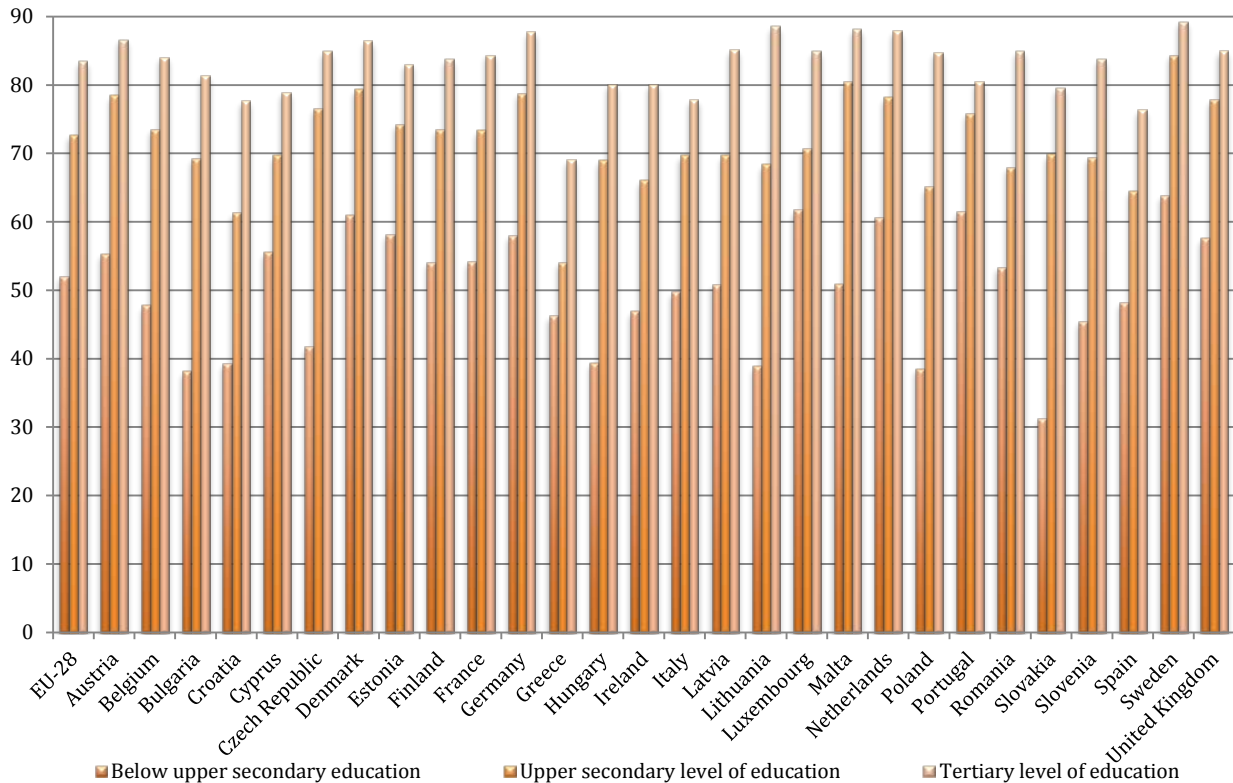
²⁹ In these breakdowns, the category “below upper secondary education” includes less than primary, primary, and lower secondary education (ISCED 0-2), “upper secondary level of education” includes upper secondary and post-secondary non-tertiary education (ISCED 3-4), and “tertiary level of education” includes short-cycle tertiary, bachelor or equivalent, master or equivalent, and doctoral or equivalent degrees (ISCED 5-8).

As is directly visible, there is a strong relation of unemployment rates with educational attainment in the EU countries. On average across all countries, unemployment among those with a low level of education is 17.9%, compared to 8.6% among those with a medium level of education and 5.9% among those with a high level of education. That is, unemployment among the low educated is 9.3 percentage points higher than among the medium educated, which again is 2.7 percentage points higher than among the high educated. In every single country, unemployment among the high educated is lower than among the medium educated, and unemployment among the medium educated is lower than among the low educated.

Eleven countries have differences in the unemployment rate between the low and the high educated that are larger than 10 percentage points: Slovakia (33.5), Lithuania (28.5), Bulgaria (22.4), the Czech Republic (20.9), Hungary (18.2), Spain (17.8), Latvia (17.1), Poland (14.3), Ireland (13.6), Slovenia (12.0), and Germany (10.1). At the other end, Romania (2.1) is the country with the lowest difference in the unemployment rate between the low and the high educated by far, followed by Denmark (4.6), the Netherlands (4.9), and Luxembourg (4.9). The differences are particularly pronounced between the lowest levels of education. In six countries, the difference in the unemployment rate between the low and the medium educated is larger than 10 percentage points: Slovakia (27.7), Lithuania (19.0), Bulgaria (17.3), the Czech Republic (17.3), Hungary (13.1), and Latvia (10.1). In five countries, the difference in the unemployment rate between the medium and the high educated is at least 7 percentage points: Lithuania (9.5), Greece (8.7), Spain (8.3), Ireland (7.3), and Latvia (7.0).

Similarly, when looking at **employment** rates – i.e., the employed as a share of the population – there is a strong gradient by educational attainment. As is evident from Figure 4, on average across the 28 EU countries, those with a low level of education have an employment rate of 52.1%, those with a medium level of education of 72.7%, and those with a high level of education of 83.4%. That is, employment among the high educated is 10.7 percentage points higher than among the medium educated, which again is 20.6 percentage points higher than among the low educated – a full 31.3 percentage point difference in the employment rate among the low and the high educated. This difference is largest in Lithuania (49.7), Slovakia (48.1), Poland (46.3), the Czech Republic (43.1), and Hungary (43.1) and lowest in Portugal (18.9), Greece (22.8), Luxembourg (23.1), Cyprus (23.5), and Estonia (24.9).

FIGURE 4: EMPLOYMENT RATES BY EDUCATIONAL ATTAINMENT



Number of employed 25-64 year-olds as a percentage of all 25-64 year-olds, by educational attainment, 2013. Source: Eurostat (2014).

The bottom line from these figures is that in the European Union today, employment rates are very closely related to education levels and low-educated people are at the highest risk of unemployment. Among all those active in the labor force in the EU-28, 20.1% have a low, 47.5% a medium, and 32.3% a high level of education. From the above-mentioned unemployment rates by education level, it follows that of all the people unemployed in the EU-28, 37.6% have a low, 42.6% a medium, and 19.9% a high level of education. That is, low-educated and medium-educated people make up the major share of European unemployment.

While detailed research on the relationship between education and unemployment is rather limited, available studies – mostly from the United States but also from Norway – suggest that education indeed likely has a causal effect on reducing unemployment and on increasing re-employment rates among those who are currently unemployed.³⁰

³⁰ See Li (2006), Riddell and Song (2011), and Oreopoulos and Salvanes (2011).

In the growth analysis above, measured skills rather than formal attainment levels proved decisive for countries' long-run growth. Similarly, while much less analyzed, skill levels are strongly associated with higher employment probabilities at the individual level in the Programme for the International Assessment of Adult Competencies (PIAAC).³¹

4.2 General vs. Vocational Education and Life-Cycle Employment

A particular aspect about the employment effects of education over the entire life-cycle relates to the question whether the skills generated by the particular education type are specific to a particular occupation (“vocational”) or more general in their applicability. Some countries, particularly in Europe, stress **vocational** education types which develop job-related skills to prepare students to work in specific occupations. Other countries, most notably the United States, instead emphasize **general** education types which provide students with broad knowledge and basic skills in math and communication and serve as the foundation for further learning on the job.

The advantage of vocational education programs is generally seen in that they help young people master the transition from school to work.³² However, in a **life-cycle** perspective, economies are likely to change over time, and the lower adaptability of job-specific skills to technological and structural change may render these skills obsolete at a faster rate. In changing economies, workers at older ages may find it harder to stay employed or get re-employed if their acquired skills are focused on occupations for which there is not much demand anymore in the labor market. Although regular adult education and training may help update to more highly demanded skills, these workers may also find it harder to re-skill at a later stage because they are lacking some basic general skills that facilitate subsequent lifelong learning. The advantage of vocational programs at early age may thus come at the risk that at old age they face the disadvantage of reduced employment opportunities.

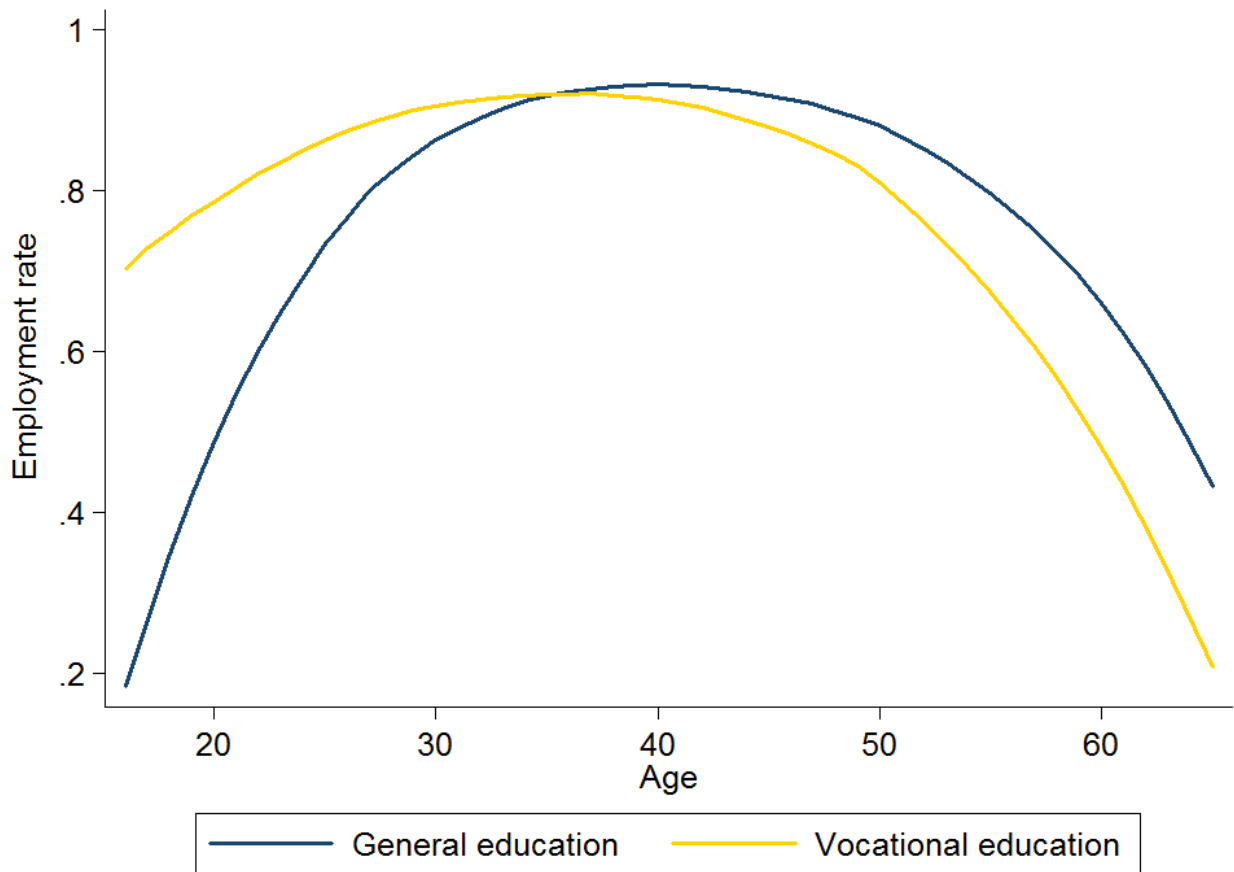
As shown in Figure 5, this **trade-off** between early advantages and later disadvantages of vocational programs in terms of employment is indeed visible in the data, in particular in

³¹ See Hanushek et al. (2014a), section 4.7 for the employment analysis and below for more on PIAAC.

³² Existing evidence on this mechanism is mixed, however; see Arum and Shavit (1995), Malamud and Pop-Eleches (2010), and the reviews and discussions in Ryan (2001), Müller (2009), Wolter and Ryan (2011), and Biavaschi et al. (2012).

countries that have strong apprenticeship programs.³³ At early ages, employment rates are higher for people who have obtained a vocational degree. However, this turns around at older ages, when people with a general education degree have substantially higher employment rates. It is important to be aware of this life-cycle pattern in assessing the relative merits of general and vocational education programs.

FIGURE 5: EDUCATION TYPE AND LIFE-CYCLE EMPLOYMENT



Male employment rate by age and education type. Sample: “apprenticeship countries” (Denmark, Germany, and Switzerland). Smoothed scatterplots using locally weighted regressions, based on International Adult Literacy Survey (IALS) data. Source: Hanushek et al. (2014b).

³³ See Hanushek et al. (2014b) for details. The restriction to (prime-age) males with their historically stable aggregate labor-force participation patterns aims to circumvent concerns in the comparison of younger and older workers about cohort-specific selection into work by females induced by their historically changing labor-force participation in many countries. Additional recent examples of labor-market analyses beyond the entry phase that are in line with this pattern include Cörvers et al. (2011), Weber (2014), and Golsteyn and Stenberg (2014).

This aspect of individual employability is in fact related to a macroeconomic perspective. It has been argued that the propensity to use vocational rather than general education may be an underlying cause of growth-rate differentials between the United States and Europe. The argument is simply that vocational, occupation-based as opposed to general, concept-based education may lead to slower adoption of new technologies in times of rapid technological and structural change.³⁴

5. Earnings: Education and Individual Prosperity

This section turns to the economic effects of education on individual earnings, where education is measured either by educational attainment or by acquired skills.

5.1 Rates of Return to Education

As argued above, to the extent that education increases individuals' productivity on the labor market, individuals with higher education should be able to obtain accordingly higher **earnings**. A very large empirical literature estimates the earnings returns to differing levels of school attainment.³⁵ The easiest way to express this relationship is to estimate by which percentage earnings increase with each additional **year of education**.³⁶ That is, each individual's educational attainment is simply expressed in terms of the years of education required to finish the respective degree. In this sense, the estimated earnings effect captures the average of the returns to a year of education at different (secondary and tertiary) levels of education. Of course, there may be differences between the returns to a year of compulsory schooling and to a year of education at the Master's level, and returns will depend on the specifics of each country and degree. But evidence showing that the return for each additional year of schooling in terms of a percentage increase in earnings appears remarkably stable across different education levels

³⁴ See Krueger and Kumar (2004a, 2004b). The pattern is also in line with the model by Gould, Moav, and Weinberg (2001) where technological progress leads to a higher depreciation of technology-specific skills as opposed to general skills.

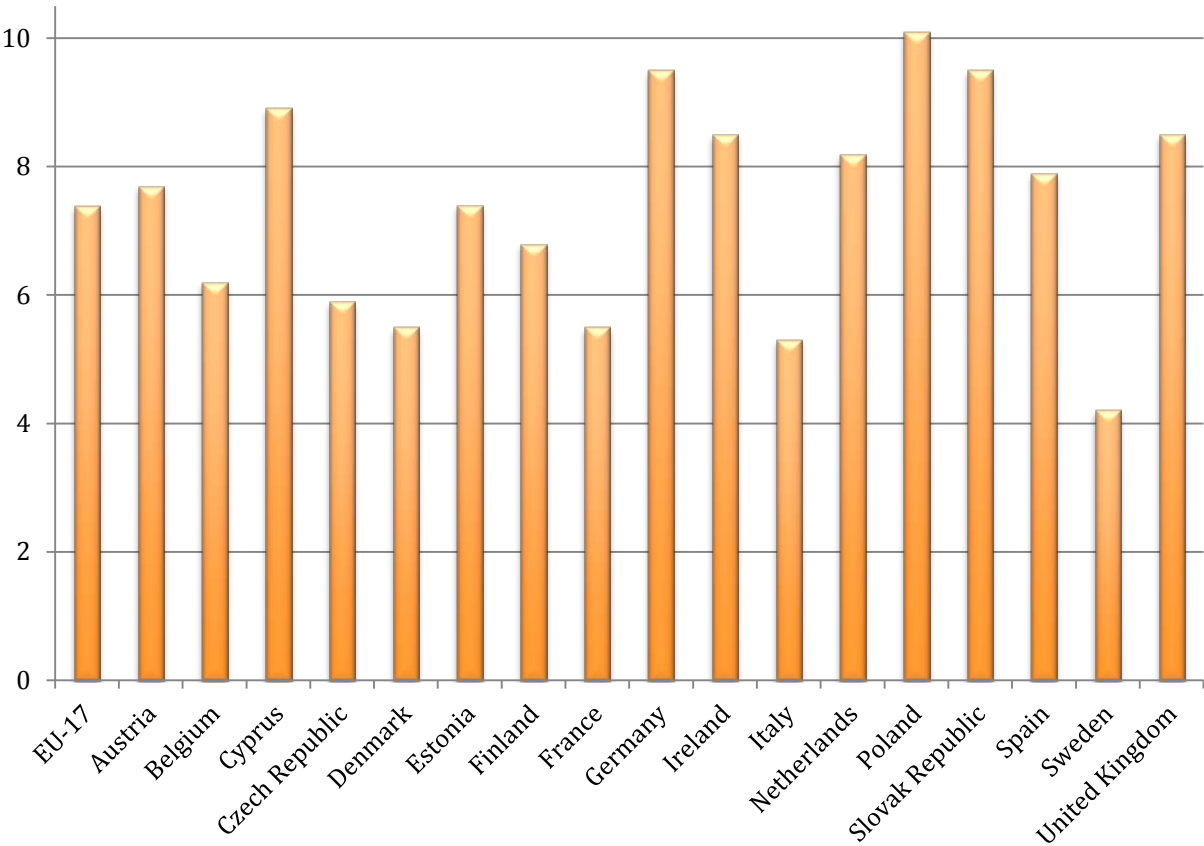
³⁵ The large literature on the effects of educational attainment on individual earnings has been reviewed and interpreted by a variety of studies such as Psacharopoulos (1994), Card (1999), Harmon, Oosterbeek, and Walker (2003), Psacharopoulos and Patrinos (2004), and Heckman, Lochner, and Todd (2006). For a specific focus on EU Member States, see Harmon, Walker, and Westergaard-Nielsen (2001) and de la Fuente and Jimeno (2009).

³⁶ Under specific assumptions, this wage effect of a year of schooling can be interpreted as the rate of return to education in the sense of an investment return that can be compared to the rates of return of alternative investments; see Chiswick (1998) and Heckman, Lochner, and Todd (2006).

suggests that such a proceeding may provide a reasonable first glance of the overall return to education.

Figure 6 shows such estimates of the return to education for the 17 EU Member States that participated in the Programme for the International Assessment of Adult Competencies (PIAAC). Across all countries, gross hourly wages increase on average by 7.4 percent with each additional year of education. Put differently, a five-year educational degree will be related to 37 percent higher earnings on average. This figure refers to the prime-aged population, which makes it a good approximation for the returns in terms of entire lifetime earnings. Differences in earnings due to gender and work experience are accounted for in these estimates.

FIGURE 6: EARNINGS RETURNS TO ONE YEAR OF EDUCATION



Coefficient estimates on years of education in a regression of log gross hourly wage on years of education, gender, and a quadratic polynomial in actual work experience, sample of full-time employees aged 35-54. Belgium refers to Flanders only; United Kingdom refers to England and Northern Ireland. Source: Hanushek et al. (2014a), Table A-2, based on PIAAC data.

While education is significantly related to higher earnings in every country, the magnitude of the association differs: The highest returns to years of education in this sample of countries are observed in Poland (10.1%), Germany (9.5%), Slovakia (9.5%), and Cyprus, Ireland, the United Kingdom, and the Netherlands (8%-9%). The lowest returns are given in Sweden (4.2%), Italy (5.3%), Denmark (5.5%), France (5.5%), and the Czech Republic (5.9%).

Much research has gone into the question of whether such associations between education and earnings indeed depict a **causal** effect of education on earnings.³⁷ A prime concern has been that more able people may be more likely to get additional education and may independently receive higher earnings because of their higher ability. Methods to get around such biases have included the use of variation in education stemming from changes in compulsory schooling laws and in restrictions on child labor, variation in education stemming from differences in the distance to the nearest educational institution, and variation in education occurring between siblings and twins. The exact interpretation of these can sometimes be quite complicated and is often limited to specific subgroups of the population. But overall, this literature suggests that, while returns can clearly differ across subgroups, the causal effect of years of education may be at least as high as the associations depicted above.³⁸

In recent public debates, specific stories of individuals with a higher education who find it hard to get a suitable job, as well as indications of accumulating debt partly from student loans and high tuition fees in particular in the United States, have raised considerable concern. Such discussions have sometimes placed doubts on whether higher education continues to promise economic benefits and raised questions on whether the rapid expansion of higher education systems in some countries might be going too far. However, the facts clearly show that in most cases, higher education continues to have substantial returns on the labor market: While returns to education obviously differ across individuals and fields of study, available evidence indicates that a higher education is still a worthwhile investment in the United States both for the average

³⁷ See, in particular, Card (1999) and Heckman, Lochner, and Todd (2006) for reviews and Oreopoulos (2006) and Carneiro, Heckman, and Vytlačil (2011) for recent contributions.

³⁸ Recent evidence suggests, however, that estimates based on changes in compulsory schooling laws may in fact be smaller, after all; see Pischke and von Wachter (2008), Devereux and Hart (2010), Grenet (2013), and Stephens and Yang (2014).

and for the marginal student.³⁹ Indeed, the wage premium going along with a college education has continued to rise for several decades now.

5.2 Returns to Skills

With the emergence of internationally comparative tests of **skills** in representative samples of the adult population, we are now in a position to also estimate the returns to skills directly. The new PIAAC data allow us to directly observe the skills that people currently have, not just the formal qualifications that they once obtained. Thus, with the new survey of adult skills, estimating earnings returns to education is not restricted to educational attainment, but can take into account the level of skills acquired by an individual – separately for a large number of countries.

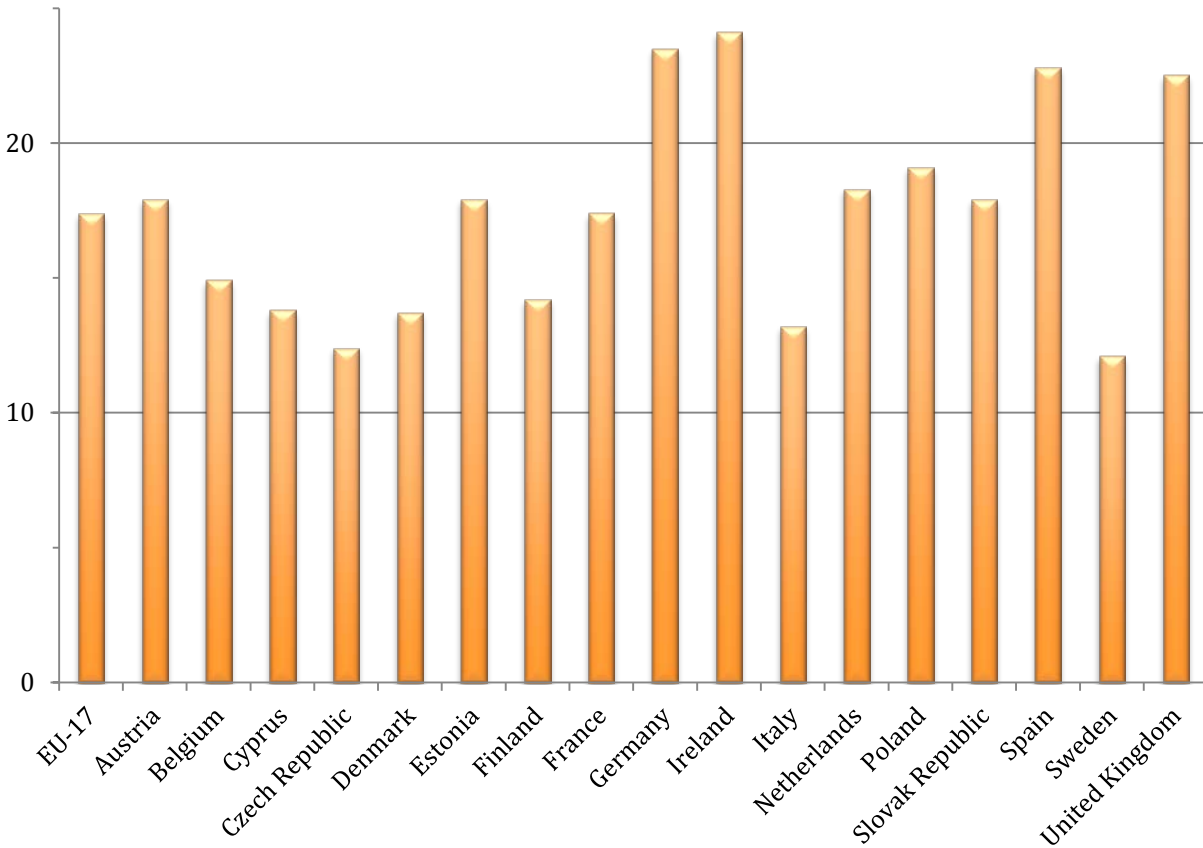
PIAAC is designed to measure key cognitive and workplace skills needed for individuals to advance in their jobs and participate in society. The survey includes an assessment of skills in three domains: literacy, numeracy, and problem solving in technology-rich environments. It thus substantially extends the depth and range of measured skills compared to our previous knowledge. Given the clear importance of direct achievement measures compared to mere attainment measures in the macroeconomic growth analysis above, it is of particular interest to see whether skills also pay off individually. Thus, the new PIAAC data dramatically changes our ability to understand how economies value skills.

And indeed, the results shown in Figure 7 indicate that higher numeracy skills are systematically and strongly related to higher earnings in all countries.⁴⁰ PIAAC measures numeracy in five competency levels (each of which roughly corresponds to one standard deviation). Across the 17 observed EU countries, going up one step on this five-step scale goes hand in hand with 17.4 percent higher gross hourly wages on average. Similar returns are also estimated for literacy.

³⁹ See Oreopoulos and Petronijevic (2013) for a recent review of returns to higher education in the United States.

⁴⁰ See Hanushek et al. (2014a) for details. Additional studies on the earnings returns to cognitive skills include, among others, Murnane, Willett, and Levy (1995), Neal and Johnson (1996), Mulligan (1999), Murnane et al. (2000), Lazear (2003), Leuven, Oosterbeek, and Ophem (2004), Hanushek and Zhang (2009), and Chetty et al. (2011). See Hanushek and Woessmann (2008, 2011a) and Hanushek and Rivkin (2012) for surveys of the evidence.

FIGURE 7: EARNINGS RETURNS TO SKILLS



Coefficient estimates on numeracy score (standardized to std. dev. 1 within each country) in a regression of log gross hourly wage on numeracy, gender, and a quadratic polynomial in actual work experience, sample of full-time employees aged 35-54. Belgium refers to Flanders only; United Kingdom refers to England and Northern Ireland. Source: Hanushek et al. (2014a), Table 2, based on PIAAC data.

There are, however, considerable differences in the returns to skills across countries. The EU countries with the highest estimated returns to skills are Ireland (24.1%), Germany (23.5%), Spain (22.8%), and the United Kingdom (22.5%). At the lower end are Sweden (12.1%), the Czech Republic (12.4%), Italy (13.2%), Denmark (13.7%), and Cyprus (13.8%). Using these cross-country differences, additional analysis suggests that returns to skills are systematically lower in countries with higher union density, stricter employment protection, and larger public-sector shares.

While Figure 7 shows returns to numeracy skills, the data also reveal substantial returns to literacy and problem-solving skills. However, estimated returns tend to be largest for numeracy and literacy and smaller for problem-solving skills. Rich information provided in the PIAAC

data reveals that the skill-earnings associations are highly robust to different earnings measures and additional controls. Differences in returns to skills across subsets of workers also present interesting patterns. Prime-age workers quite consistently show greater returns to skills than labor-market entrants. On average, women and men have identical returns in the sample of prime-age workers, while observed skills make somewhat less difference to immigrants, part-time workers, and public-sector workers.

6. Implications for Policy-Making

We close with a brief discussion of what the results of this report imply for policy-making. We first point out that the skill levels currently achieved in many EU countries call for the need for further reform and then go on to cautiously highlight a number of policy measures that appear important for the policy agenda in the EU.

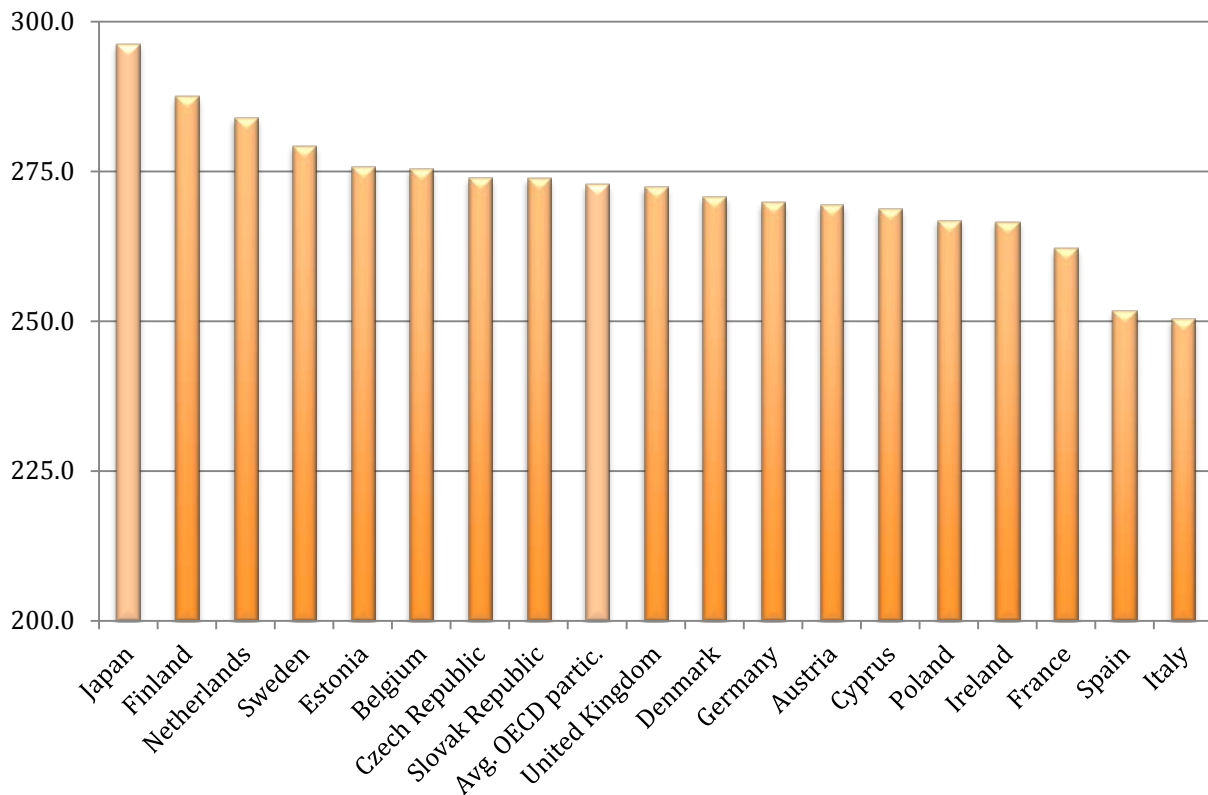
6.1 The Need for Further Reform

Given the crucial importance of the knowledge and skills of the population for economic prosperity, it is instructive to look at where the knowledge and skills of the EU population currently stands. Recently, PIAAC provided a revealing window on the skills of the adult population in many countries, including 17 EU Member States. Figure 8 shows the current levels of **adult skills**, measured as the average PIAAC literacy scores, for the participating EU countries (compared to top-performing Japan). Many EU countries perform close to the average of the OECD participants (of 273 PIAAC points). But even the EU top performers of Finland (288) and the Netherlands (284) fall short of the international top performer Japan (296). At a worrying level, Italy (250) and Spain (252), but also France (262), fall substantially short of the international performance and constitute the bottom of the international league tables.

When moving from the adult population to the young generation, the PISA **student achievement** tests allow us not only to observe current achievement levels of 15-year-olds, but also to analyze how reading achievement has developed between 2000 and 2012. The picture that emerges in Figure 9 is very heterogeneous across different EU countries. All European countries fall short of such OECD countries as Japan (538) and Korea (536) which, although already at a high level in 2000, have even improved their achievement since. Finland is still the European top performer at 524 points, followed by Ireland (523), Poland (518), and Estonia

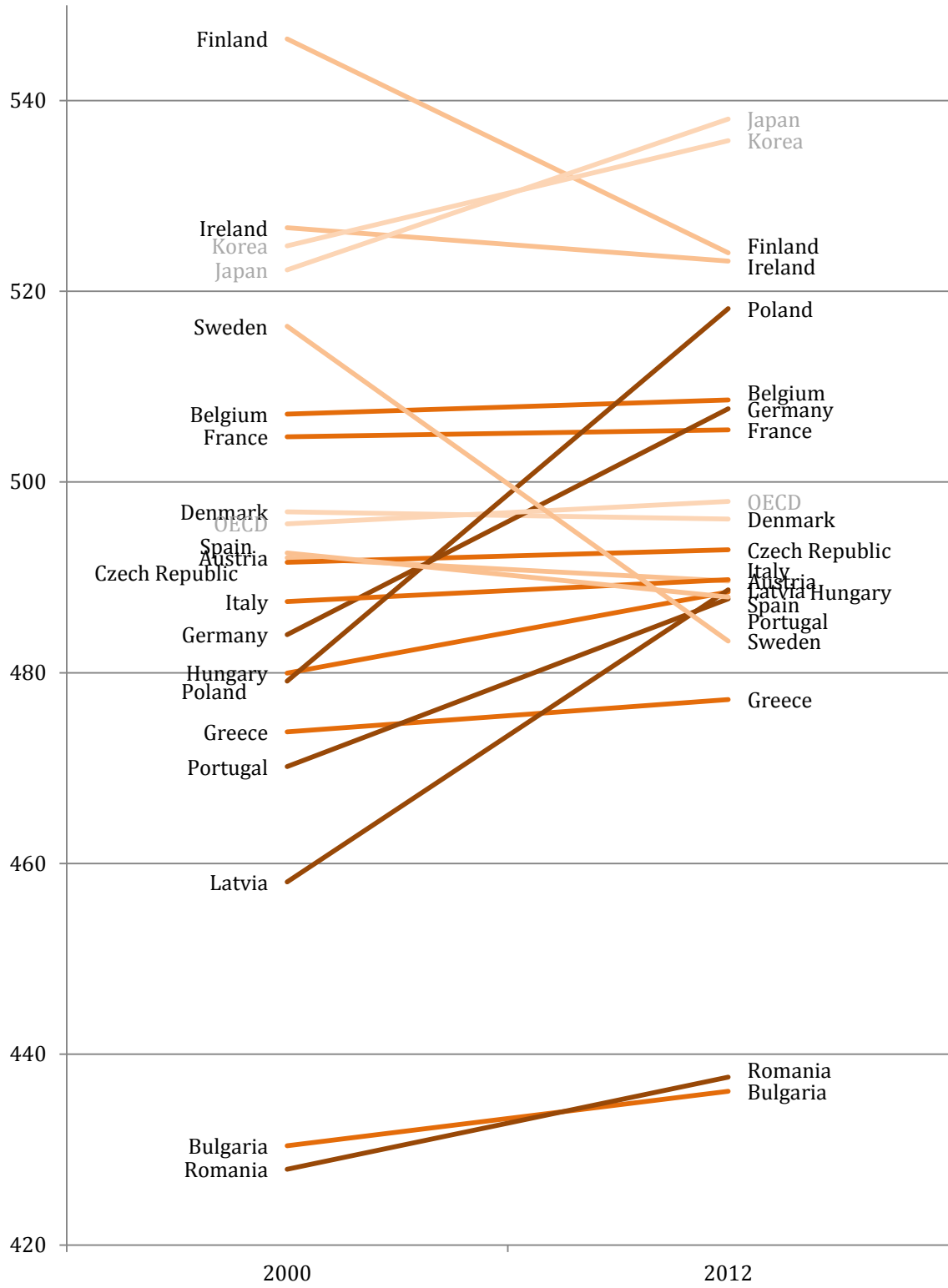
(516). But Finland has in fact lost 22 points since 2000. This immense loss is only surpassed by Sweden which has lost a stunning 33 points on the PISA reading scale since 2000. Other losses, including Spain (5), Ireland (3), and Austria (2), are of a much lower magnitude. At the other end, Poland (39), Latvia (31), Germany (24), and Portugal (18) have all experienced quite sizable gains in achievement levels. Bulgaria and Romania have also improved, albeit at a very low level of 436 and 438 points, respectively.

FIGURE 8: LITERACY PROFICIENCY OF THE ADULT POPULATION



PIAAC literacy proficiency, 2011/12. Belgium refers to Flanders only; United Kingdom refers to England and Northern Ireland. Source: OECD (2013a); own depiction.

FIGURE 9: DEVELOPMENT OF STUDENT ACHIEVEMENT, 2000-2012



PISA reading score, 2000 and 2012. All EU Member States that participated in both tests, plus Japan, Korea, and the OECD average. Source: OECD (2013b); own depiction.

The rather lackluster 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. While some EU countries have seen important improvements in their young generations' achievement levels over the past decade, the available achievement data paint a picture of complacency in some other EU countries. Such complacency endangers future prosperity in the European Union. At the same time, the diverging trends in PISA show that achievement levels are not destiny, but can be improved – or let slip.

6.2 Policy Measures for the EU Agenda

Given the crucial importance of knowledge and skills for economic prosperity, policy-makers interested in advancing future prosperity should particularly focus on **educational outcomes**, rather than inputs or attainment. And given that most of the skill foundation is laid during youth, such policy should have a particular focus on **schools** and – as a pre-requisite – high-quality early childhood education.⁴¹

However, improving knowledge and skills is not a straightforward task. In fact, available evidence on the most straightforward policy – additional educational **spending** to increase resources or reduce class sizes – shows very mixed results at best. While resources may be required in specific contexts, the vast majority of studies finds little to no effect of simple resource policies.⁴² In particular, there is no indication that those countries that spend more on education perform systematically different on international achievement tests from countries with lower spending levels. As a consequence, not least in a context of **tight public budgets**, successful education reform calls for the need to improve **efficiency**.

This brief overview cannot do full justice to our knowledge of how to best increase efficiency and educational outcomes in particular contexts. But while being cautious not to generalize too far, it seems fair to say that increasing evidence suggests that the institutional setup of school systems is a crucial aspect for their efficiency. Institutions are the rules and regulations that explicitly or implicitly set rewards or penalties for the people involved in the

⁴¹ See Blau and Currie (2006), Cunha et al. (2006), and Heckman (2008).

⁴² See Hanushek (2003), Woessmann (2007), and Hanushek and Woessmann (2011a) for reviews. While there are studies that show resource effects in certain situations – e.g., Woessmann (2005), Woessmann and West (2006), and Fredriksson, Öckert, and Oosterbeek (2013) – these generally appear to be exceptions rather than the rule. For a slightly more positive view about the role that resources can play in school improvement, see Gibbons and McNally (2013).

education process. They generate incentives for principals, teachers, and students to promote learning. Available research highlights that accountability, autonomy, and choice are three dimensions of good **governance** that are important for increased efficiency and high levels of educational achievement. While it is beyond the scope of this report to go into details of such governance reforms, we briefly sketch out important general aspects here.⁴³

Accountability systems use standardized testing to identify and reward good achievement. For example, external exit exams provide performance information that can hold students and schools accountable. International evidence shows that students in school systems with external exit exams consistently reach higher achievement than students in systems without them.⁴⁴ In addition, skill outcomes are positively associated with other school-level accountability mechanisms such as internal and external monitoring of lessons and use of assessments to compare schools to the district or nation.

Schools with decision-making **autonomy** can make better use of local knowledge. But this may be counteracted by local opportunism and lack of local decision-making capacity, in particular in contexts of limited accountability and standardization. Recent cross-country evidence suggests that giving decision rights to schools – particularly on academic content but also on personnel – is indeed beneficial in well-developed systems. By contrast, less-developed countries benefit from centralized standardization.⁴⁵ Introducing autonomy is also more beneficial to student learning when external exit exams hold agents accountable for outcomes. Accountability thus seems a pre-requisite for successful autonomy reforms. To be fruitfully used to improve outcomes, local autonomy requires accountability and oversight, not least to ensure that all schools stay within the borders of fundamental values of society.

Parents generally have the strongest interest in their children’s learning. Providing them with **choice** among different schools will create incentives for schools to offer best quality. Even if choice among public schools is limited, privately managed schools can provide alternatives when accessible to all students. The resulting **competition** among schools can lead to improved outcomes. Even if poor families were less likely to exert their freedom of choice, they could benefit from higher achievement due to increased competition. Student outcomes are indeed

⁴³ The exposition here follows Link and Woessmann (2012). See Link (2012) for additional references, greater detail, and various national approaches in the context of the European Union.

⁴⁴ See Hanushek and Woessmann (2011a) for a review.

⁴⁵ See Hanushek, Link, and Woessmann (2013).

substantially higher in countries with larger shares of privately managed, but publicly funded schools.⁴⁶ The distinction between management and funding is crucial: Obviously, private schools can hurt equity if they charge high fees. But existing evidence suggests that, if combined with public funding, private management can be conducive notably for disadvantaged students whose choices may be mostly ignored in systems that restrict public money to publicly managed schools.

The conclusion that a good governance framework of the school system is important for achieving high levels of skills is closely linked to research pointing to the central role of **teachers** and to the impact that differences in teacher effectiveness have on student outcomes.⁴⁷ However, research has generally been unable to identify specific teacher characteristics that predict effectiveness, making it difficult to regulate or legislate having high-quality teachers in classrooms. Furthermore, the precise institutions of teacher hiring, pay, and retention differ widely across nations. Together, this suggests that a focus on a general set of performance incentives is useful.⁴⁸ Most of all, the key to successful educational reforms is an unwavering focus that the goal of policy has to be the improvement of student achievement.

There is much less research on the best way to ensure that **universities** foster the knowledge and skills needed to prosper. But it seems that a similar set of conclusions – about the importance of accountability, autonomy, choice, and competition – is warranted when considering improvements in the European system of higher education.⁴⁹

In a world of continuing structural and technological change, it is important to stress the role of general educational content in keeping people's skills adaptable. **Vocational** education programs should ensure that their participants gain sufficient general skills that enable them to adapt to future changes in skill demand. This may be particularly relevant in countries with strong dual apprenticeship systems. In addition, graduates from vocational programs should be particularly aware of the need for a lifelong learning process to regularly update their skills.

However, the best way to nurture skills among adults remains unclear. Continuing structural and technological change of the economies clearly asks for skill adaptations and a process of

⁴⁶ See, among others, Woessmann et al. (2009) and West and Woessmann (2010).

⁴⁷ See the reviews in Hanushek and Rivkin (2010, 2012) and the recent work by Chetty, Friedman, and Rockoff (2014a, 2014b) that traces teacher effects into the labor market.

⁴⁸ For more detailed analysis of how innovations in teacher qualifications, teaching methods, and curricula may be employed to improve skills, see the companion EENEE report by Torberg Falch and Constantin Mang.

⁴⁹ See Aghion et al. (2010).

lifelong learning. Our knowledge remains limited, however, about the best role that governments can play in the area of **adult education and training**. Available evidence suggests that government subsidization of job-related training of the workforce is generally inefficient.⁵⁰ Similarly, evidence on the effectiveness of public-sector job training for the unemployed is rather disappointing.⁵¹ Against this background, policy must be aware that government interventions tend to be more effective when instituted at younger ages.⁵² The best recommendation might be to make sure to properly evaluate the outcomes and effectiveness of any adult education and training programs in order to learn which policies might work to foster skills in the adult population.

7. Conclusions

This report makes the **economic case for education**. The available evidence clearly reveals that better education is very closely linked to individual and societal prosperity as reflected in earnings, employment, and economic growth.

At the country level, a 50 PISA-point increase in educational achievement translates into 1 percentage point higher rates of economic **growth** in the long run. This means that if the European Union was successful in improving average student achievement by the equivalent of 25 PISA points, the economic gain would amount to an astounding €35 trillion until 2090. Put differently, this amount is the cost to the EU of not improving the quality of its school systems.

At the individual level, widespread **unemployment** is predominantly a phenomenon among the low-skilled: Across European countries, unemployment rates are at 5% for those with a higher education, 8% for those with upper secondary education, and 15% for those who did not manage to finish an upper secondary degree. Among those who have a job, **earnings** increase on average by 7.4% for each additional year of education or, when measured directly as skills in PIAAC, by 17.4% for each step on the five-step competency scale.

Given this crucial economic importance of the knowledge and skills of the population, the lackluster performance of many EU countries in the PIAAC adult skills test and in the PISA student achievement test, and in particular the alarming downward trends in PISA achievement

⁵⁰ See Falch and Oosterbeek (2011) and Oosterbeek (2013).

⁵¹ See Heckman, LaLonde, and Smith (1999) and Card, Kluve, and Weber (2010) for surveys.

⁵² See Heckman (2006) and Cunha et al. (2006).

of some countries, call for an urgent need for further reform. In particular, policy-makers interested in advancing future prosperity should **focus on educational outcomes**, rather than just inputs or length of study. While existing evidence shows important directions on where to look for improvements, there is also need for additional research to close gaps in our current knowledge about what works best to improve educational outcomes, in particular in each specific context.

The crucial economic role of education does, of course, not mean that the case for education should be made solely from an economic perspective. But it would be highly irresponsible to think of education without its economic dimension. This would endanger the prosperity of future generations, with widespread repercussions for poverty, social exclusion, and the financial sustainability of social security systems. If policy-makers in the European Union want to foster economic prosperity for the future European population, a strong focus of the **EU policy agenda** on the importance of education, knowledge, and skills is warranted.

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