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Please cite this paper as:

Quintini, G. (2014), “Skills at Work: How Skills and their Use Matter in the Labour Market”, *OECD Social, Employment and Migration Working Papers*, No. 158, OECD Publishing.
http://dx.doi.org/10.1787/5jz44fdfjm7j-en

OECD Social, Employment and Migration Working Papers No. 158

Skills at Work: How Skills and their Use Matter in the Labour Market

Glenda Quintini

JEL Classification: I25, J08, J21, J24, J31

OECD

Unclassified **DELSA/ELSA/WD/SEM(2014)4**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

13-May-2014

English - Or. English

DIRECTORATE FOR EMPLOYMENT, LABOUR AND SOCIAL AFFAIRS
EMPLOYMENT, LABOUR AND SOCIAL AFFAIRS COMMITTEE

DELSA/ELSA/WD/SEM(2014)4
Unclassified

OECD SOCIAL, EMPLOYMENT, AND MIGRATION WORKING PAPERS No. 158

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JT03357180

English - Or. English

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ACKNOWLEDGEMENTS

1. The author is senior economist in the Employment Analysis and Policy Division of the Directorate for Employment, Labour and Social affairs at OECD. She is grateful to Stefano Scarpetta, Mark Keese, Andreas Schleicher, William Thorn and Michele Pellizzari for their useful comments to this work, in the context of the preparation of the OECD Skills Outlook 2013. She is also indebted to Anne Fichen and Paulina Granados for their statistical assistance.

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SUMMARY

3. Human capital is key for economic growth. Not only is it linked to aggregate economic performance but also to each individual's labour market outcomes. However, a skilled population is not enough to achieve high and inclusive growth, as skills need to be put into productive use at work. Thanks to the availability of measures of both the proficiency and the use of numerous types of skills, the Survey of Adult Skills offers a unique opportunity to advance knowledge in this area and this paper presents and discusses evidence on both these dimensions with a particular focus on their implications for labour market policy. This paper explores the role played in the labour market by skill proficiency in the areas of literacy, numeracy and problem solving in technology-rich environments. It also shows how skills use, not only proficiency, affects a number of key labour market phenomena, such as the gender wage gap. Finally, the paper combines information on skill proficiency, educational attainment, skill use and qualification requirements to construct indicators of qualification and skills mismatch and to explore their causes and consequences.

RESUME

4. Le capital humain est fondamental pour la croissance économique. Non seulement, il est lié à la performance économique à niveau agrégé mais il contribue aussi à la réussite individuelle sur le marché du travail. Toutefois, une population aux compétences élevées ne suffit pas pour obtenir une croissance soutenue et équitable, car les compétences doivent être utilisées de façon productive au travail. Grâce à la disponibilité de données sur les compétences dans plusieurs domaines et leurs utilisation au travail, l'Enquête sur les Compétences des Adultes (PIAAC) offre une opportunité unique d'améliorer les connaissances à ce sujet. Ce papier présente et discute ces deux dimensions en prêtant une attention particulière aux implication pour les politiques du marché du travail. Il analyse le rôle que les compétences en littératie, numératie et résolution de problème dans un environnement riche en technologie jouent sur le marché du travail. Il montre aussi comment l'utilisation de ces compétences, et non seulement leur niveau, impacte sur un nombre important de phénomènes du marché du travail, comme par exemple la différence entre la rémunération des femmes et des hommes. Pour conclure, ce papier joint l'information concernant les compétences en littératie et numératie et leur utilisation au travail ainsi que le niveau d'éducation des travailleurs et celui demandé dans leurs postes pour dériver des indicateurs d'apparemment entre l'offre et la demande de compétences et qualifications et en analyser les causes et les conséquences.

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INTRODUCTION AND OVERVIEW OF KEY FINDINGS

5. Skills form the bedrock of every country's economy. They are not only linked to aggregate economic performance but also to each individual's success in the labour market. However, having skills is not enough; to achieve growth, both for a country and for an individual, skills must be put to productive use at work. The Survey of Adult Skills (PIAAC) measures both adults' proficiency in key information-processing skills and how those skills are used in the workplace. It also assesses the use of a variety of generic competencies at work. This paper examines the relationships between proficiency and participation in the labour market, employment and earnings. It also presents an analysis of how both information-processing and generic skills are used in the workplace. Among the findings:

- Proficiency in literacy, numeracy and problem solving in technology-rich environments is positively and independently associated with the probability of participating in the labour market and being employed and with higher wages. After the effects of educational attainment are taken into account, an increase of one standard deviation in an individual's literacy proficiency (46 score points) is associated with a 20% increase in the probability of participating in the labour market and a 10% increase in the probability of being employed as opposed to being unemployed. An increase of one standard deviation in literacy proficiency is also associated with an 8% increase in hourly wages, on average across countries.

- The strength of the relationship between proficiency and labour market participation, employment and wages varies considerably among countries. This is likely to reflect differences in institutional arrangements (such as wage setting) as well as the relative weight given to educational qualifications and other factors in employers' hiring, promotion and wage-setting decisions.

- Educational qualifications and proficiency in literacy, numeracy and problem solving in technology-rich environments reflect different aspects of individuals' human capital that are separately identified and valued in the labour market.

- The results suggest that, independent of policies designed to increase participation in education and training, improvements in the teaching of literacy and numeracy in schools and programmes for adults with poor literacy and numeracy skills and limited familiarity with ICTs may provide considerable economic returns for individuals and society a whole.[1]

- The use of skills in the workplace influences a number of labour-market phenomena, including productivity, the gender wage gap and the wages gap between temporary and permanent workers.

- Skill-use indicators are only mildly correlated with measures of skills proficiency. As a result, it is not uncommon that more proficient workers use their skills at work less intensively than less proficient workers do.

- Gender, age, qualification level, working hours as well as the distribution of workers across occupations are found to be important in shaping the distribution of skills use. On the other hand, the correlation between skills use and contract type or industry is rather small.

1 This is line with findings from the British Birth Cohort Studies (Bynner, 2010), American Longitudinal Study of Adult Learning (Reder, 2010), Canadian Youth in Transition Survey (HRSDC, 2011).

- Workers tend to use information-processing skills together, often in association with influencing skills. Above-median use of ICT, reading, writing, numeracy, influence and problem-solving skills at work are jointly observed for up to one-fifth of workers in nine participating countries. In another eight countries, 20 to 30% of workers make an above-median use of influence and reading skills, at times associated with a frequent use of problem solving and writing skills or, in fewer cases, with influence and self-organising skills.

- Mismatches between skills proficiency and the use of skills in the workplace are pervasive, affecting just over one in seven workers. Over-skilled workers – those with higher skills than required by their jobs – tend to under-use their skills, resulting in a "waste" of human capital, while under-skilled workers – those with lower skills than required by their jobs – have to work harder to accomplish their tasks, which could lead to stress and lower job satisfaction, with negative consequences for productivity. Young people are particularly affected by over-skilling, as the incidence of over-skilling generally diminishes with age. Finally, over-skilling has a relatively small negative effect on wages. This suggests either that most employers succeed in identifying their employees' real skills, irrespective of their formal qualifications, and adapt job content accordingly or that wages are negotiated based on skills other than literacy, numeracy and problem solving in technology-rich environments and how those skills are used at work.

- On average across countries, about 22% of workers report that they are over-qualified – have higher qualifications than required by their jobs – and 13% report that they are under-qualified for their jobs – have lower qualifications than required by their jobs. Over-qualification is particularly common among young and foreign-born workers and those employed in small establishments, in part-time jobs or on fixed-term contracts. Over-qualification has a significant impact on wages, even after adjusting for proficiency, which, in turn, implies adverse effects on workers' productivity. However, some instances of this kind of mismatch occur when workers have lower skills proficiency than would be expected at their qualification level, either because they performed poorly in initial education or because their skills have depreciated over time. By contrast, under-qualified workers are likely to have the skills required at work, but not the qualifications to show for them.

- While workers with a given level of qualification would be better off if they worked in jobs that better matched their qualifications, this does not imply that either these workers or the economy as a whole would be better off if they had a *lower* level of educational qualification. Qualifications and skills in excess of those *required at work* are still valued in the labour market. On average, a tertiary graduate who holds a job requiring only an upper secondary qualification will earn *less* than if he or she were in a job requiring a tertiary qualification, but *more* than an upper secondary graduate in a job requiring upper secondary qualifications.

6. The paper is divided into four main sections. Section 1 explores the role played by skill proficiency in the areas of literacy, numeracy and problem solving in technology-rich environments on the labour market. Section 2 presents the data on skill use collected by the Survey of Adult Skills where respondents are asked to describe in details the tasks that they carry out in their jobs. Section 3 discusses qualification requirements at work as reported by respondents. Section 4 combines information on skill proficiency, educational attainment, skill use and qualification requirements to construct indicators of qualification and skills mismatch and to explore their causes and consequences.

7. Throughout the paper comparisons are made both across countries and within countries, across population subgroups and across skill domains, thus shedding light on the factors shaping the joint distribution of skill proficiency and skill use in the workplace as well as their implications for a number of important labour market phenomena.

1. The skill proficiency of the workforce

8. To the extent that workers' productivity is related to the knowledge and skills they possess, and that wages reflect such productivity, albeit imperfectly, individuals with more skills should expect higher returns from labour-market participation and would thus be more likely to participate. Most studies use educational qualifications attained in the past as a proxy for individuals' current productive potential when investigating the returns to investments in human capital; only a few recent studies examine the return on skills development (Leuven et al., 2004; Tyler, 2004). In contrast, the Survey of Adult Skills (PIAAC) measures key information-processing skills directly, and so can provide more precise information on how an individual's current proficiency in those skills influences their likelihood to work and their wages (see OECD, 2013).

9. These direct measures of key information processing skills offer a unique opportunity to advance knowledge on a number of important areas of labour market policy. At the macro level, the implications of unemployment and inactivity for the overall performance of the economy depend crucially on the distribution of skills across labour market statuses. For instance, a country with a relatively high-skilled pool of non-employed individuals will need to implement different policy measures to increase employment rates than a country in which the non-employed lack the key skills required at work. In normal times and unless unemployment is mostly frictional, a large share of high-skilled job seekers also signals inefficiencies in the allocation of individuals to jobs. Additionally, the high degree of cross-country comparability of the data allows assessing the extent to which countries are moving towards knowledge-based economies and competing on the basis of a high-skill, high-cost model rather than a low-skill, low-cost model.

1.1. How does proficiency vary by labour market status?

10. Considering first the group of employed individuals (Figure 1), only a minority score in the top two levels (Level 4 or 5) in either literacy or numeracy (13%-15%, on average[2]) and about the same proportion (13%-15%, on average) have the lowest level of proficiency. Differences across countries are marked: Italy and Spain have particularly large shares of workers at the bottom of the distribution and a smaller-than-average share at the top in both literacy and numeracy, whereas the opposite is true in Japan, Finland and the Slovak Republic. More generally, in all countries, including those with the highest levels of GDP per capita, such as Norway and the United States, a substantial proportion of workers score at low levels in both literacy and numeracy.

11. Strikingly, a majority of employed individuals in all countries either did not display proficiency or scored at Level 1 or below on the problem solving in technology-rich environments scale. In many cases, this majority is substantial (for example, about 66% in Korea and 59% in the Slovak Republic, the Russian Federation and the United States). Conversely, on average across all countries, only about 6% of workers score at the highest level in problem solving in technology-rich environments (Level 3). However, caution is advised when interpreting the results for problem solving in technology-rich environments because not all of the employed respondents completed the problem-solving assessment module. Scores for problem solving are not available for around 10% of all employed respondents, on average, ranging from a low of less than 5% in Sweden and the Netherlands to a high of 24% in Korea. In Figure 1, this group is shown below the lowest-scoring group, with the assumption that the group's performance in the test would have been poorer than the lowest performers. In addition, an average of 9.5% of workers refused to take the computer-based test altogether. They may have done so because of insufficient familiarity with ICTs, but there is no way to verify this. Thus, this group is classified separately in Figure 1.

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2 . All averages in the document refer to OECD member countries and their sub-national entities only.

12. When the total population is divided into the three standard labour-market groups – i.e. employed, unemployed and inactive – the average proficiency in literacy among the employed population is generally higher than that among unemployed and inactive individuals (Figure 2). However, the differences in proficiency are surprisingly small.[3] Across all participating countries, the average literacy score of the employed is 12.3 score points higher (about 5%) than the average score of the unemployed, which, in turn, is almost identical to that of the inactive.

13. This relatively small difference can be partly attributed to the high incidence of unemployment among young people, who are generally more proficient than their older counterparts. In addition, the difference in proficiency between the employed and the unemployed is larger when only those individuals who have been unemployed for longer than 12 months – the long-term unemployed – are used in the comparison. In this case, the difference in proficiency increases by about 5 score points, from 12.3 to 17.1 score points, on average across participating countries.

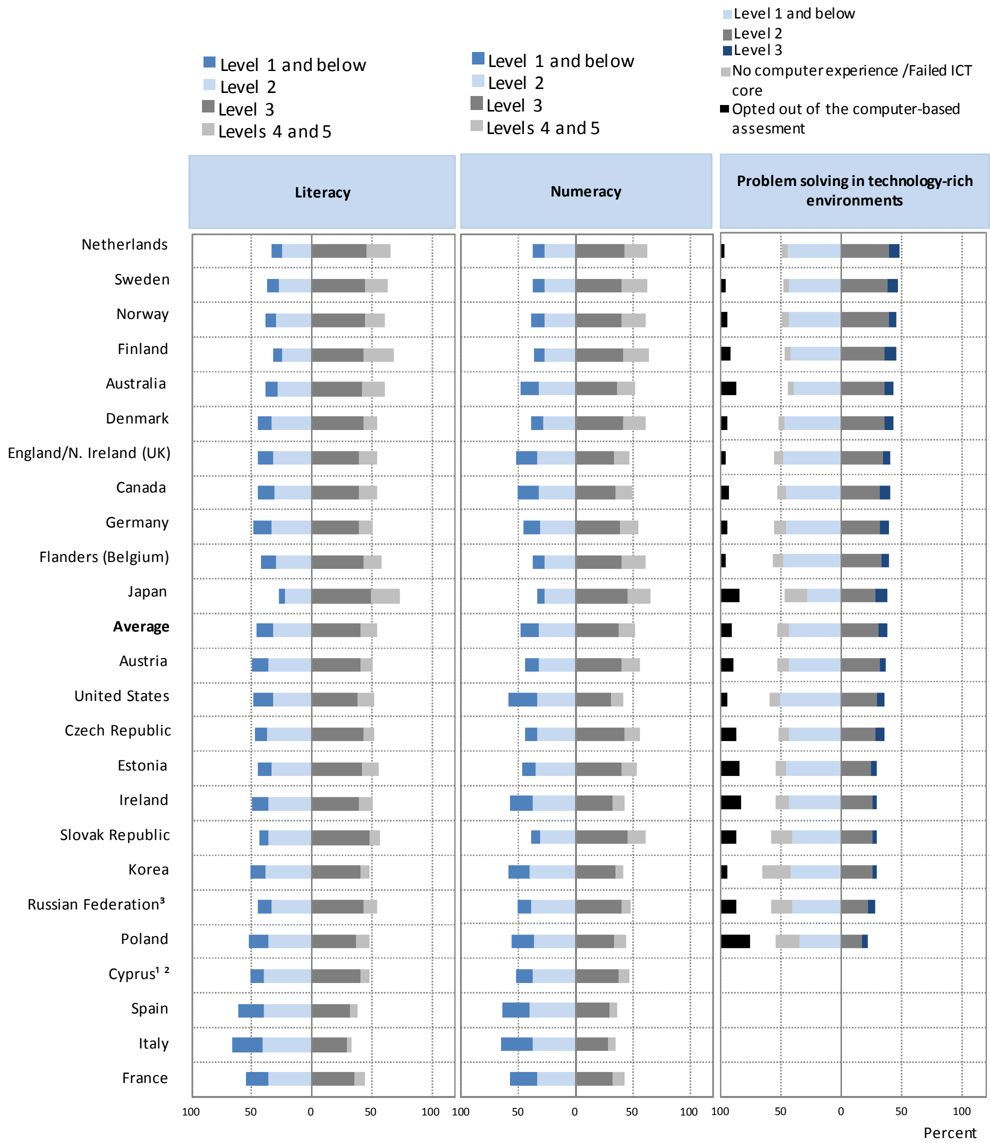
14. Overall, while there is a relatively large pool of skilled individuals who are out of work, either unemployed or inactive, some caveats are in order. First, it is important to keep in mind that while some unemployed individuals may have similar scores in literacy, numeracy and problem solving in technology-rich environments as employed individuals, they may lack other key skills needed to get a job, for example, job-specific skills or generic skills frequently required at work, such as self-organising skills. Second, some inactivity might be voluntary and temporary, such as among young people who are still engaged in full-time education or skilled women who are caring for family members. At the same time, to the extent that literacy is a proxy for a more comprehensive set of competencies, the relatively high proficiency found among unemployed individuals is important for labour-market policy. Mismatches between people's skills and the skill requirements for jobs, in addition to various institutional constraints, are likely to be preventing skilled people from engaging in employment or looking for work.

3 In some countries, particularly Japan and Korea, results might be driven by the relatively few cases of unemployed individuals in the survey.

Figure 1

Workers' proficiency levels

Percentage of workers at each level of proficiency, by skills domain



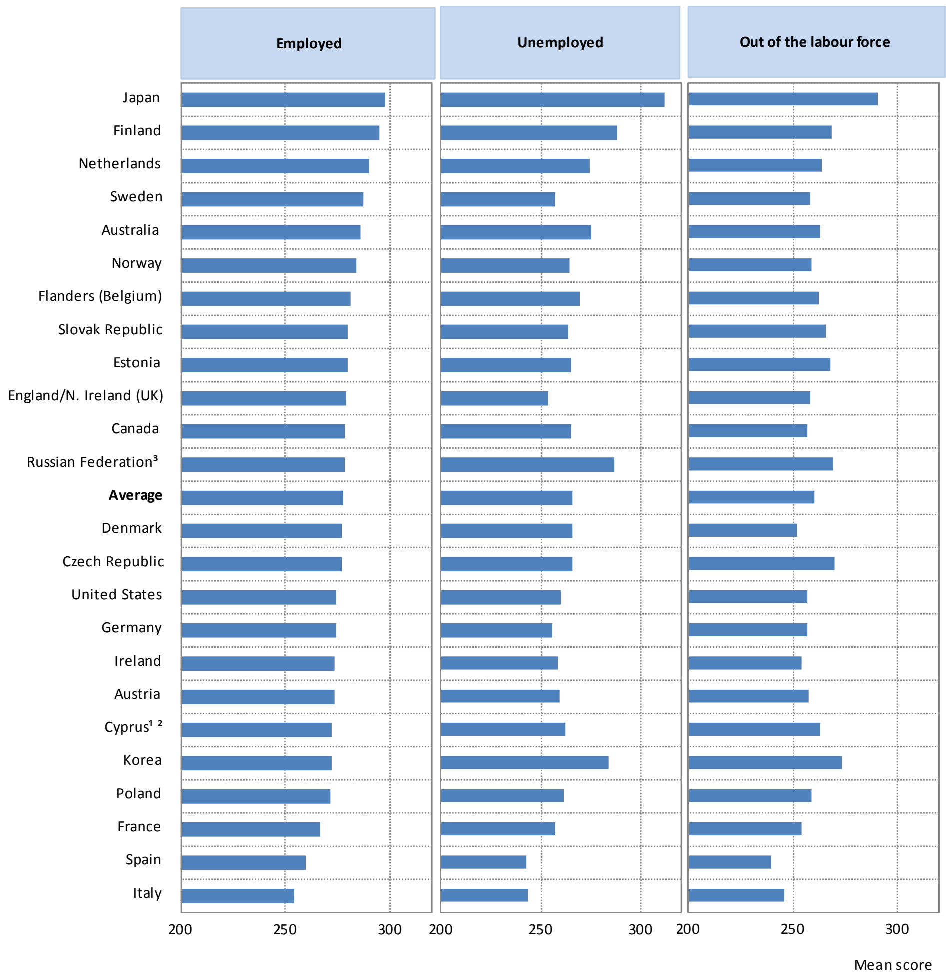
Countries are ranked in descending order of the percentage of workers in Levels 2 and 3 of problem solving in technology-rich environments.

1. Note by Turkey:
The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
2. Note by all the European Union Member States of the OECD and the European Union:
The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.
3. The sample for the Russian Federation does not include the population of the Moscow municipal area. The data published, therefore, do not represent the entire resident population aged 16-65 in Russia but rather the population of Russia excluding the population residing in the Moscow municipal area.

Source: Survey of Adults Skills (PIAAC) (2012).

Figure 2

Mean literacy score, by labour force status



Countries are ranked in descending order of workers' mean literacy score.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Source: Survey of Adults Skills (PIAAC) (2012).

1.2. Does proficiency guarantee a job and higher wages?

15. Another way of looking at the link between labour-market outcomes and proficiency is to determine how many individuals, at each proficiency level, are employed, unemployed or inactive (Figure 3). From this viewpoint, both unemployment and inactivity are more common among the least skilled (Level 1 and below). For example, on average, about 57% of those individuals who score at Level 1 or below are employed, 7% are unemployed, and the remaining 36% are inactive. Among the most proficient individuals, who score at Level 4 or 5, 79% are employed, about 4% are unemployed, and 17% are inactive.

16. This finding highlights the importance of taking stock of the skills held by unemployed individuals at the start of a period of unemployment, both in the domains assessed by the Survey of Adult Skills and in other key areas relevant to labour-market needs, including job-specific and generic skills. This

would help the public employment services to identify the most appropriate course of action for each job seeker.

Figure 3
Employment status, by literacy proficiency level

Percentage of adults in each labour market status

Countries are listed in alphabetical order.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Source: Survey of Adults Skills (PIAAC) (2012).

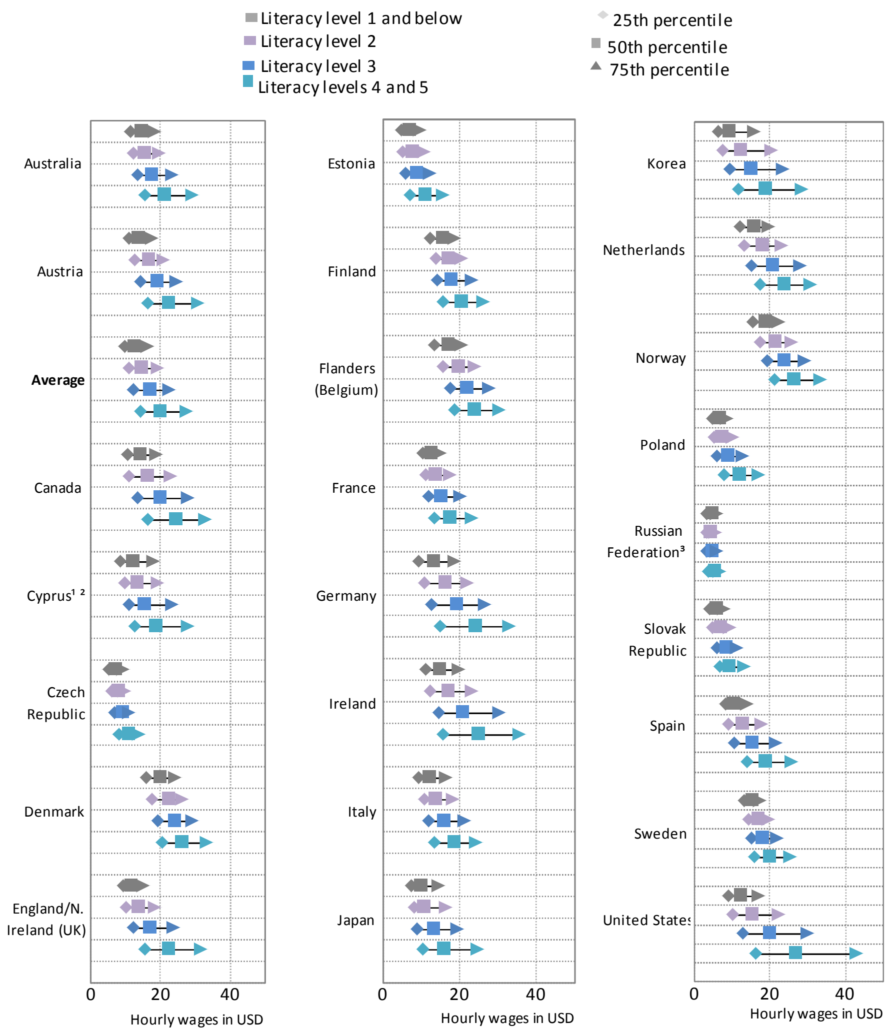
17. Hourly wages are strongly associated with proficiency levels (Figure 4) [4]. On average across countries, the median hourly wage of workers scoring at Level 4 or 5 on the literacy scale is 60% higher than that of workers scoring at Level 1 or below. Differences in returns as proficiency increases vary across countries, more so than for employment status. In several countries, such as the Czech Republic, Estonia, Poland, the Slovak Republic, Sweden and the Russian Federation, the distribution of wages appears to be rather compressed; at the other extreme, returns to greater proficiency appear to be extremely large in the United States, Korea, Ireland, Canada and Germany.

4 The measure of hourly wages includes bonuses.

18. However, the relationship between proficiency levels and hourly wages is not linear: there is significant overlap in the distribution of wages by proficiency level within and across countries. For instance, within countries, the top 25% best-paid Korean and Japanese workers scoring at Level 2 in literacy earn more than the median hourly wage of those scoring at Level 4 or 5 (Figure 4). Similarly across countries, workers scoring at Level 2 in the United States earn higher median hourly wages than workers scoring at Level 4 or 5 in the Czech Republic, Estonia, Poland, the Slovak Republic and the Russian Federation, raising interesting issues concerning work-related migration.

Figure 4
Distribution of wages, by literacy proficiency level

25th, 50th and 75th percentiles of the wage distribution



Countries are listed in alphabetical order.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes : Employees only. Hourly wages, including bonuses, in purchasing-power-parity-adjusted USD.

Source: Survey of Adults Skills (PIAAC) (2012).

1.3. How these relationships are affected by other individual and job characteristics

19. The relationships between proficiency levels and employment chances and hourly wages presented above could be the result of simple compositional effects. Most important, proficiency could simply be the reflection of higher educational attainment, which, in turn, affects wages as well as the

likelihood of labour-force participation and employment. This section shows that this is not the case, and that proficiency plays an important and independent role as a determinant of success in the labour market, over and above the role played by formal education.

20. The relationship between labour market participation and employment, on the one hand, and skills proficiency on the other is explored in more detail using simple linear regressions or logistic models and adjusting for several individual characteristics, including years of education.[5]To interpret the results correctly, it must be born in mind that, although it may be intuitive that higher levels of proficiency facilitate employment or active participation in the labour market and raise wages, causation is not necessarily self-evident. For example, employment may itself favour the acquisition of skills.[6]

1.4. Literacy, education and labour force participation

21. An individual who scores one standard deviation higher than another on the literacy scale (around 46 score points) is 20% more likely to participate in the labour market – i.e. to work or be looking for work (the relative probability being 1.2, see Figure 5).[7] This effect is computed holding constant the level of education (as well as all the other variables in the control set). If such a comparison were conducted without holding education constant, one standard deviation increase in literacy proficiency would be associated with a 36% rise in the probability of participation, suggesting that education and proficiency have, for the most part, distinct and separate effects. The link between proficiency and labour force participation is strongest in Sweden and Finland, where an increase of 46 points on the literacy scale raises the probability of being employed or looking for work by 56% and 43%, respectively. On the other hand, it is weakest in Estonia and Poland, where the likelihood of labour-force participation increases by 15% and 16%, respectively, following a 46-point rise in the literacy score.

22. Along with proficiency, more years spent in school increases the chances of labour-force participation. More specifically, an additional three years in education, corresponding to one standard deviation of years of education across all countries in the sample, is associated with a 43% increase in the probability of labour-force participation.[8] Interestingly, the link between educational attainment and labour-force participation is relatively strong in Estonia and Poland, the two countries where the relationship with proficiency is weakest. The inverse is true for Sweden and Finland, where proficiency has a strong impact on labour force participation while years of education play a more modest role.

23. On the basis of these results, it is possible to compare the likelihood of labour market participation for individuals with different combinations of education and proficiency. For example, moving up by three proficiency levels on the literacy scale – approximately three standard deviations on that scale – and keeping education constant would improve the likelihood of labour force participation by about 60%. An improvement of the same size would take an additional four years of education to achieve, keeping proficiency in literacy constant.

5 The set of control variables includes years of education, gender, age, marital status and immigrant background. In the wage analysis, the control set is augmented with tenure.

6 The literature on the identification and estimation of the returns on schooling may provide further guidance about the correct interpretation of the results in this section (Heckman et al., 2006).

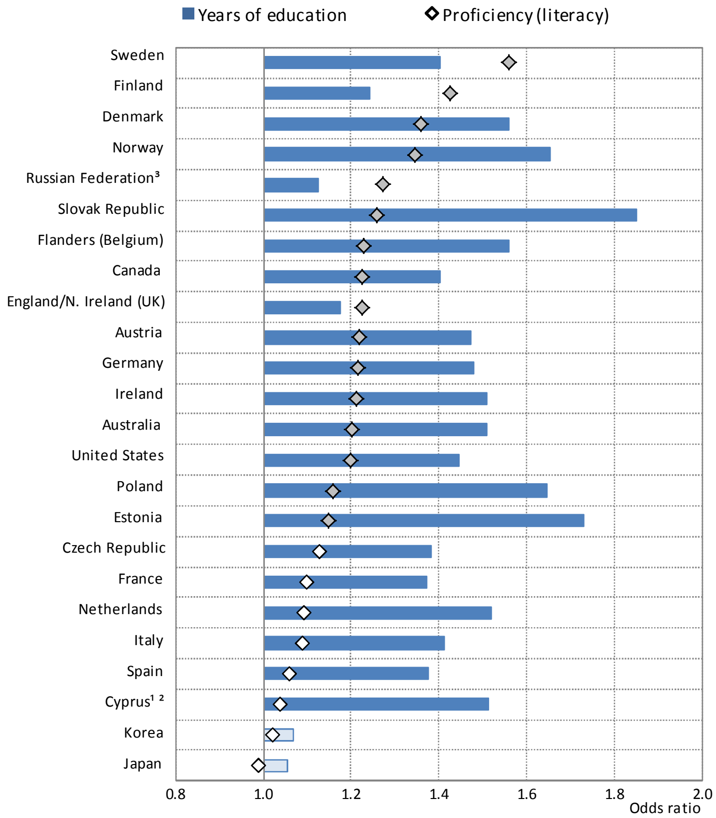
7 To interpret the magnitude of these effects, consider that literacy proficiency levels normally span 50 points and that in the pooled sample of all survey respondents in all countries one additional year of schooling is associated with an increase of approximately 7 score points on the literacy scale.

8 Once again, this effect is computed comparing individuals who are equally proficient in literacy; otherwise, if the comparison were carried out across proficiency levels, the result would be 56%, confirming the idea that the two effects overlap only partially.

Figure 5

Effect of education and literacy proficiency on labour market participation

Odds ratios showing the effect of education and literacy proficiency on the likelihood of participating in the labour market among adults not in formal education



Countries are ranked in descending order of the odds ratios of proficiency.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Results are adjusted for gender, age, marital and foreign-born status. The odds ratios correspond to a one-standard-deviation increase in proficiency/years of education. Statistically significant values are shown in darker tones. Years of education have a standard deviation of 3.05, literacy has a standard deviation of 45.76.

Source: Survey of Adults Skills (PIAAC) (2012).

24. The most important result of this analysis, which is confirmed in almost all countries, albeit to different extents, is that proficiency, beyond that acquired through initial education, plays an independent and sizeable role in the likelihood that an adult will participate in the labour force. This highlights the importance of lifelong learning and the development of skills beyond school. The separate effects of proficiency and education on labour force participation may be due to a number of factors. First, literacy is one of many skills and bodies of knowledge developed in formal education, all of which are jointly captured by the estimated effect of educational attainment. In addition, there is substantial variation in literacy proficiency among individuals with similar levels of education. Second, employers can readily "see" a prospective employee's educational qualifications when hiring; skills, such as literacy, are only seen during work. As a result, the effects of skills on labour force participation are not as direct as those of educational qualifications.

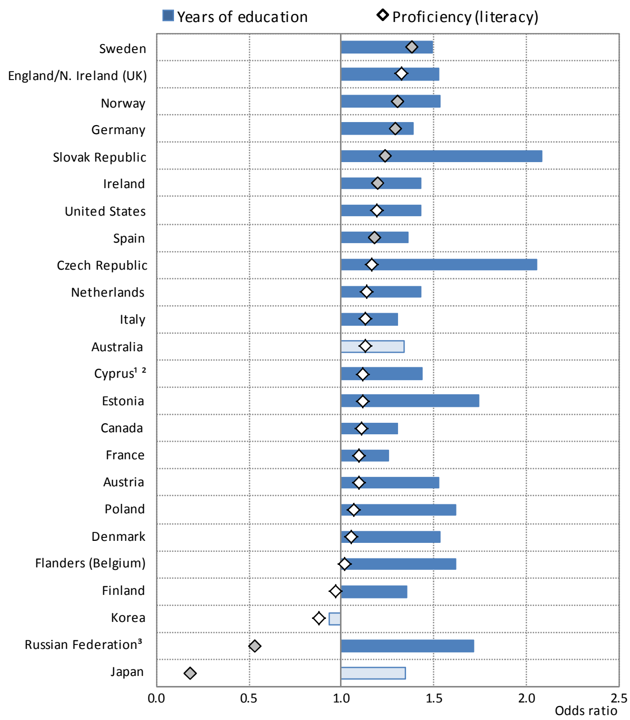
1.5. Literacy, education and employment

25. Active participants in the labour market include both individuals who are employed and those actively looking for work. Is, then, the positive association between literacy proficiency and labour market participation driven by a correlation with employment or with unemployment? An adult who scores 46 points higher on the literacy scale is 8% more likely to be employed, keeping education constant (Figure 6). On the other hand, an adult with three additional years of schooling is 49% more likely to be employed. Given these results, it can be inferred that the effect of literacy on labour market participation (estimated at 20%) is largely the result of its association with a greater likelihood of employment.[9] The same holds for years of education, which has an effect of a similar magnitude on both participation and employment.[10]

Figure 6

Effect of education and literacy proficiency on the likelihood of being employed

Adjusted odds ratios showing the effect of education and literacy on the likelihood of being employed rather than unemployed among adults not in formal education



Countries are ranked in descending order of the odds ratios of proficiency.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Results are adjusted for gender, age, marital and foreign-born status. The odds ratios correspond to a one standard deviation increase in literacy/years of education. Statistically significant values are shown in darker tones. Years of education have a standard deviation of 3.05, literacy has a standard deviation of 45.76.

Source: Survey of Adults Skills (PIAAC) (2012).

9 More precisely, about two-thirds of the estimated effect on participation is due to proficiency increasing the likelihood of employment.

10 The results for Japan are somewhat surprising and might be due to the relatively few cases of unemployed individuals in the survey (68 cases).

26. Analysis of survey results also finds that young people enjoy the highest returns to schooling, while the role of skills proficiency is similar across all age groups (young, prime-age and older workers). This is consistent with the notion that, when evaluating young job candidates with little work experience, employers attach high importance to educational qualifications in the absence of other information on the quality of potential employees. On the other hand, for older workers with longer labour-market experience, educational attainment is just one of the many pieces of information available about their qualities as employees.

27. Overall, these findings suggest that improving literacy, numeracy and problem-solving skills would have significant effects on the likelihood of labour-force participation and employment, beyond encouraging participation in education and training. Improving the quality of instruction in reading and mathematics in schools, for example, could have long-term beneficial effects, as could improving the quality and broadening the availability of adult learning opportunities.

1.6. Wage returns to proficiency and schooling

28. Proficiency and schooling have significant and distinct effects on hourly wages.[11] The increase in wages associated with one standard deviation rise in literacy proficiency ranges from less than 5% in Denmark, Finland and Italy, to above 10% in the United States and England/N. Ireland (UK) (Figure 7).[12] The effect of years of education on wages is larger, ranging from 8% in Sweden and the Russian Federation to more than 25% in Poland and the Slovak Republic.

29. Overall, the number of years of education tends to have a smaller impact on wages in countries with a more compressed wage distribution, such as the Nordic countries, Italy and the Flanders (Belgium) (see OECD, 2013).[13] By contrast, greater proficiency and educational attainment are associated with significantly higher wages in Korea and the United States, all of which have relatively high earnings inequality. However, this only suggests a link between the earnings distribution and returns to education, as other factors affect the ranking of countries. For instance, Canada – a country with a rather dispersed earnings distribution – shows average returns to education, while Germany, Poland and the Slovak Republic – where earnings inequality is relatively low – show relatively high returns to education.

11 The set of control variables used to produce the estimates presented in this section is more limited than those commonly used in the literature. The reason for this is twofold. First, the results are meant to be as comparable as possible with those on participation and employment (Figures 6.5 and 6.6). Second, the estimated effects are meant to capture a broad notion of the association between wages and proficiency or education. For example, since the control set does not include occupation or industry, some of the effects might be due to the fact that more educated or more proficient individuals are employed in higher-paying sectors or occupations. However, such individuals might obtain these jobs precisely because they are more educated or more proficient, so it is unclear whether it would be more interesting to broaden the control set.

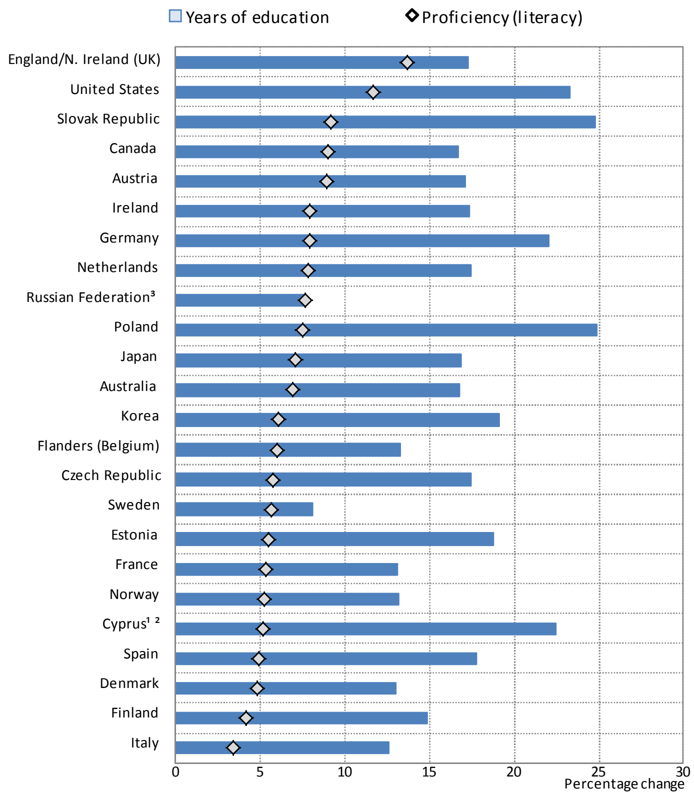
12 This is in line with findings in the literature and with the fact that the wage distribution is much more compressed in Nordic countries than in the United States.

13 A compressed wage distribution is one in which the differences in wages among individuals are limited.

Figure 7

Effect of education and literacy proficiency on wages

Percentage change in wages associated with a one standard deviation change in years of education and proficiency in literacy



Countries are ranked in descending order of the effect of proficiency.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Coefficients from the OLS regression of log hourly wages including bonuses, in PPP-adjusted US dollars on years of education and proficiency, directly interpreted as percentage effects on wages. Coefficients adjusted for age, gender, foreign-born status and tenure. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. All values are statistically significant. The regression sample includes only employees. Years of education have a standard deviation of 3.05, literacy has a standard deviation of 45.76.

Source: Survey of Adults Skills (PIAAC) (2012).

30. Further analyses of the survey data show that these results are only marginally driven by compositional effects. Differences between age groups and genders in returns to education and proficiency are small.[14] The returns to education as seen in hourly wages are slightly higher for men than for women, but differences between the genders in returns to proficiency vary. Contrary to what was found for labour-force participation, the number of years of education appears to have a stronger influence on wages among prime-age and older workers compared to young workers. While this result appears to be counterintuitive, the differences are small.

31. Finally, all of the above analyses assume that the effects of educational attainment and proficiency on wages are independent, while some recent research suggests that this may not be the case. Indeed, in the recent past, several OECD countries have reported a sharp increase in wage inequality at the

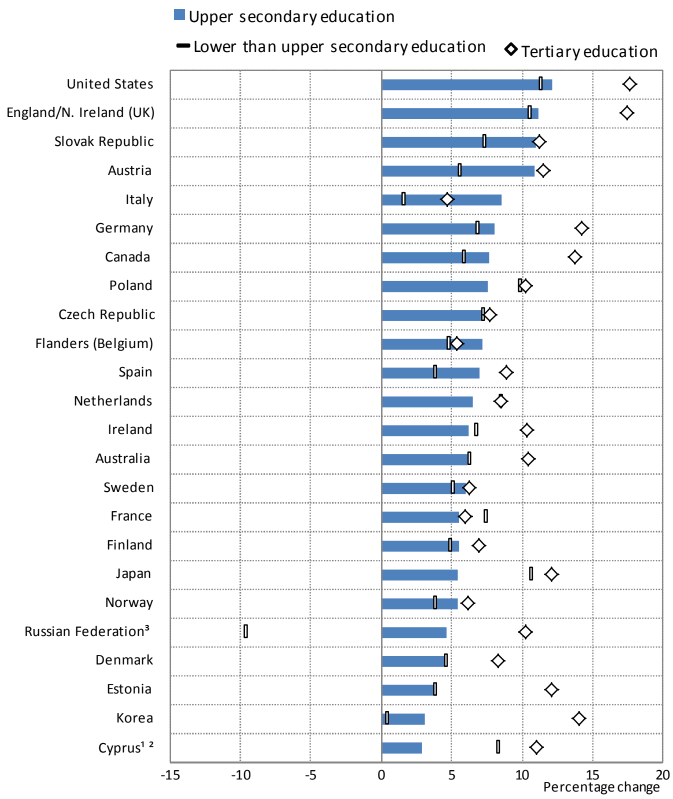
14 For brevity's sake, these results are not reported.

very top of the earnings distribution (Lemieux, 2006; OECD, 2011). One popular explanation for this is that the returns to education are significantly larger for the most educated individuals. Analysis of results from the Survey of Adult Skills confirms this hypothesis. In over half of the countries estimates of returns to proficiency increase with qualification levels (Figure 8), pointing to larger returns to training for those who are already highly proficient. But there are exceptions. In Poland, the Czech Republic, Australia, Ireland, the Netherlands, Japan, Denmark, France and Estonia, increasing proficiency among those with the least education has beneficial effects that are at least as great as those for upper secondary graduates. In the Flanders (Belgium) and Italy it is upper secondary graduates that stand to gain the most from increases in proficiency. More generally, in line with earlier findings in this chapter, the distribution of returns to proficiency by qualification level tends to be more compressed in Nordic countries, notably, Norway, Finland and Sweden. On the other hand, it is more dispersed in Germany, Canada, Estonia and Korea.[15]

Figure 8

Effect of literacy proficiency on wages, by educational attainment

Percentage change in wages associated with a one standard deviation change in proficiency in literacy, by educational attainment



Countries are ranked in descending order of the effect of literacy proficiency on wages for upper seconday-educated employees.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Coefficients from the OLS regression of log hourly wages including bonuses, in PPP-adjusted US dollars on proficiency, directly interpreted as percentage effects on wages. Coefficients adjusted for age, gender, foreign-born status and tenure. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. The regression sample includes only employees. Literacy has a standard deviation

Source: Survey of Adults Skills (PIAAC) (2012).

15 . It is noteworthy that the results for the Russian Federation are not statistically significant and the group with lower than upper secondary qualifications comprises only 38 observations.

32. These results suggest that educational attainment and proficiency in literacy, numeracy and problem solving in technology-rich environments reflect different aspects of individuals' human capital, each of which has independent and statistically significant effects on wages. Educational attainment, either in itself or expressed as years of education, represents a wider set of knowledge and skills, including job- and domain-specific competencies, as well as personal attributes, than does proficiency in the three domains tested in the Survey of Adult Skills. Since it is more difficult for a prospective employer to assess skills than qualifications, the relative strength of the influence of years of education and proficiency on wages may also reflect the fact that wage negotiations that occur during hiring are based on the observable characteristics of individuals, i.e. qualifications, and have a lasting impact on wages. In the course of the employment relationship, employers learn more about the competencies of their employees, which is then translated into the effect of proficiency on wages (Pinkston, 2009). However, the fact that proficiency has an independent influence on wages, beyond that of educational attainment, confirms the importance of acquiring skills throughout a lifetime. Differences across countries in the magnitude of the effects are heavily influenced by how wages are distributed across occupations and, in turn, by the labour-market institutions, such as minimum wages and unions, that affect that distribution.

2. Using skills in the workplace

33. While the previous section sheds light on how information processing skills influence labour market outcomes, the information collected in the Job Requirements section of the survey questionnaire (JRA) allows exploring skills use in the labour market from a different point of view. Instead of assuming that all the skills possessed by workers are used in their job, the JRA asks about the tasks accomplished at work, from which skills use indices can be derived. Twelve indicators were created (see Table 1), five of which refer to *information-processing skills* (reading,[16] writing, numeracy, ICT skills and problem solving); the remaining seven correspond to *generic skills* (task discretion, learning at work, influencing skills, co-operative skills, self-organising skills, gross physical skills and dexterity).[17]

34. Table 1 lists the items of the section of the questionnaire on skills use at work that are associated with each of the 12 skills-use indicators. For example, the reading and writing indices are derived from a large set of questions concerning the frequency with which several types of documents (directions, instructions, memos, e-mails, articles, manuals, books, invoices, bills and forms) are read or written during one's regular work activity. A value of 1 indicates that the worker *never* uses that specific skill while a value of 5 indicates that the corresponding skill is used *every day* or *all the time* (see Box 1 for further details).

16 . Although there is some parallel between the skills included in the direct assessment exercise – literacy, numeracy and problem solving in technology-rich environments – and the use of reading, numeracy, problem solving and ICT at work (and at home), there are important differences. The skills use variables are derived by aggregating background questions on tasks carried out at work (or at home). For instance, these questions cover both reading and writing at work but only reading is used to maintain, to the extent possible, consistency with the direct assessment module which only tests reading skills in the literacy module. Similarly, the use of problem solving and ICT skills at work are not to be confused with the assessment of proficiency in problem solving in technology-rich environments. Finally, it should be kept in mind that even when there is a parallel between skills use and skills proficiency concepts – notably between reading use and literacy proficiency and between numeracy use and proficiency – there is no correspondence between the questions concerning the tasks performed at work (or at home) and those asked in the direct assessment modules. These issues should be kept in mind when comparing skill proficiency to skill use. . . .

17 . The labels *information-processing* and *generic skills* serve a mere presentational purpose and should not be over-interpreted.

Table 1. Indicators of skills use at work

	Indicator	Group of tasks
Information-processing skills	Reading	Reading documents (directions, instructions, letters, memos, e-mails, articles, books, manuals, diagrams, maps)
	Writing	Writing documents (letters, memos, e-mails, reports, forms)
	Numeracy	Calculating prices, costs or budgets; use of fractions, decimals or percentages; use of calculators; preparing graphs or tables; algebra or formulas; use of advanced math or statistics (calculus, trigonometry, regressions)
	ICT skills	Using e-mail, Internet, spreadsheets, word processors, programming languages; conducting transactions on line; participating in online discussions (conferences, chats)
	Problem solving	Facing hard problems (at least 30 minutes of thinking to find a solution)
Other generic skills	Task discretion	Choosing or changing sequence of job tasks, the speed of work; choosing how to do the job
	Learning at work	Learning new things from supervisors or co-workers; learning-by-doing; keeping up-to-date with new products or services
	Influencing skills	Instructing, teaching or training people; making speeches or presentations; advising people; planning others' activities; persuading or influencing others; negotiating.
	Co-operative skills	Co-operating or collaborating with co-workers
	Self-organising skills	Organising one's time and activities
	Dexterity	Using skill or accuracy with one's hands or fingers
	Physical skills (gross)	Working physically for a long period

Box 1. How to interpret skills-use variables

A number of skills use variables are taken directly from questions asked in the background questionnaire of the Survey of Adult Skills (PIAAC):

- Problem-solving skills: How often are you usually confronted with more complex problems that take at least 30 minutes to find a good solution?
- Co-operative skills: What proportion of your time do you usually spend cooperation or collaborating with co-workers?
- Self-organising skills: How often does your job usually involve organising your own time?
- Physical skills: How often does your job usually involve working physically for a long period?
- Dexterity: How often does your job usually involve using skill or accuracy with your hands or fingers?

For these skills use variables, a value of 1 indicates that the skill is never used; a value of 2 indicates that it is used less than once a month; a value of 3 indicates that it is used less than once a week but at least once a month; a value of 4 indicates that it is used at least once a week but not every day; and a value of 5 indicates that it is used every day.

All other variables described in Table 1 have been derived based on more than one question from the background questionnaire. Cronbach's Alpha, a statistical technique, is used to test that the items used to derived each skills use variable are grouped appropriately. The resulting scale for these variables is a continuous but ranges from 1 to 5 as it is the case for the underlying items: a value close to 1 indicates that the person does not use that particular skill at work while a value close to 5 suggests that the person uses the skill every day.

It should be noted that the items used to calculate the scales related to ICT skill use at work and at home are only asked to people who report having used a computer before, thus few individuals report "never" using their ICT skills at work. As a result, the scale of ICT skills at work needs to be interpreted slightly differently from the other scales.

Because all indices are expressed on the same scale going from 1 to 5 numerical comparisons between countries and indicators are possible, with the exception of the use of ICT skills for the reason mentioned above. Nevertheless, some comparisons may not be conceptually meaningful. For instance, the appropriate frequency of use of self-organising skills may not be the same as the frequency with which workers are required to solve complex problems.

2.1. What skills are most often used at work and where?

35. In most countries, writing skills are used more frequently than either reading or numeracy skills. Based on Figure 9, ICT skills appear to be the most used but it must be borne in mind that only workers who actually use the computer in their job are asked to answer the questions about frequency of use, biasing average frequency of use upwards relative to the other skills use indices.

36. Reading skills are used at work most frequently in Australia and the United States, writing skills are used most frequently in Japan and Norway, and numeracy skills are most frequently used in Finland and the Check Republic (Figure 9). Korea and Estonia are the two countries where ICT skills are used the most at work while problem-solving skills are more frequently used in Australia and the United States. For all five information processing skills, the highest frequency of use corresponds to about 3, hence to a frequency of "less than once a week but more than once a month". These results show surprisingly little connection between the rankings of countries in the average use of each foundation skill at work, emphasising the importance of measuring these skills separately. Australia and the United States are the two countries that rank most consistently near the top of the distribution in all the skills domains measured, while Italy and Poland tend to rank at the bottom for reading, writing and numeracy skills.[18]

18 . It should be borne in mind that these data are self-reported by respondents, and that cross-country variations may be partly due to cultural differences in response behaviours.

Figure 9

Average use of information-processing skills at work

Countries are ranked in descending order of the average use of reading skills at work.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.

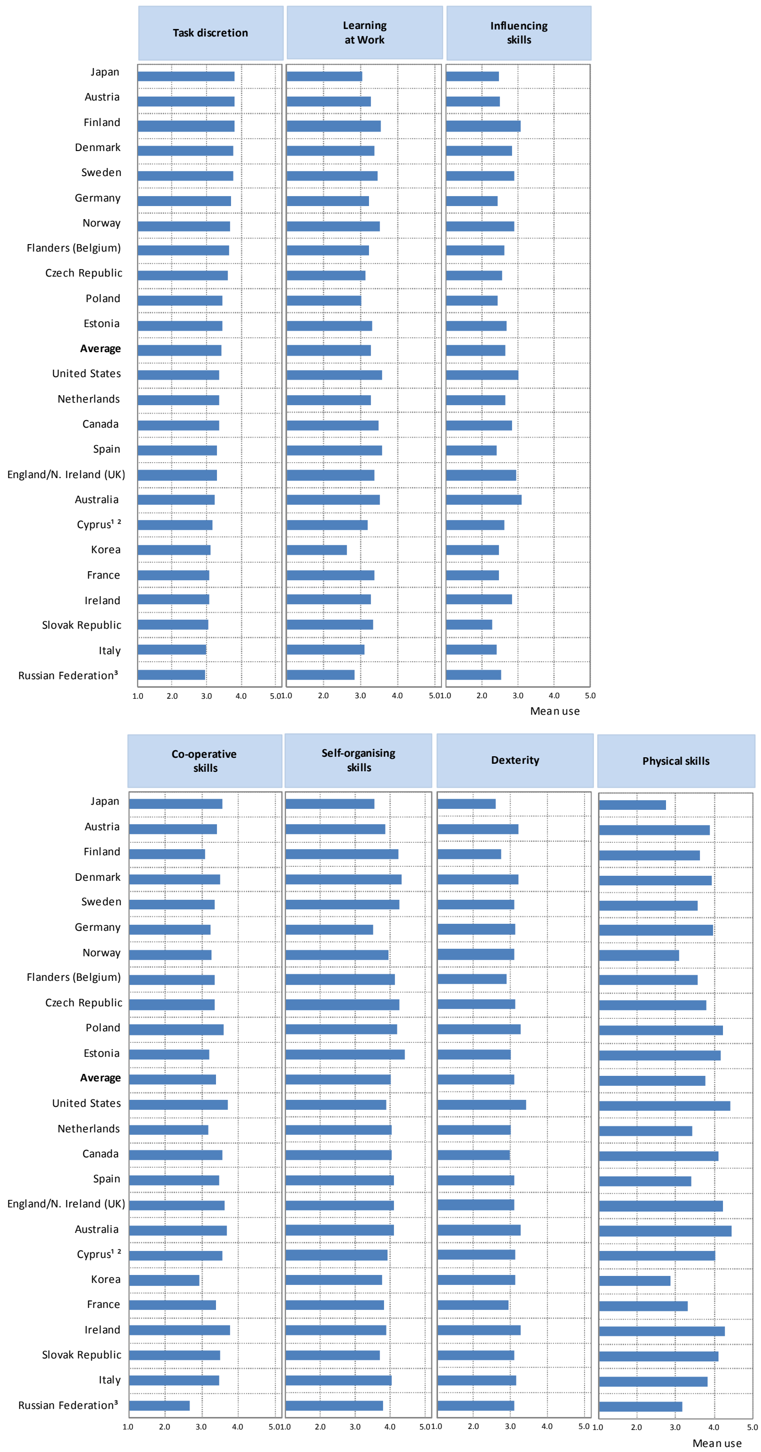
Source: Survey of Adults Skills (PIAAC) (2012).

37. A similar analysis is conducted for the seven indicators of generic skills (Figure 10). As with the use of information-processing skills, the rankings of countries, according to the use of generic skills, vary substantially – even more than for information-processing skills.

38. With the exception of influence and physical skills, generic skills are used more often than information processing skills. For instance, self-organising skills and dexterity are used about once per week on average across countries. It is noteworthy that variance in the use of dexterity at work is rather high, about three times as high as the variance in the use of task discretion or influencing skills for instance. Also, its relatively high use at work – particularly in countries where information processing skills are used very frequency at work, such as Australia and England/Northern Ireland – is surprising and suggests that respondents may have taken relatively minor activities involving accurate use of hands and fingers into account.

Figure 10

Average use of generic skills at work



Countries are ranked in descending order of the average use of task discretion at work.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

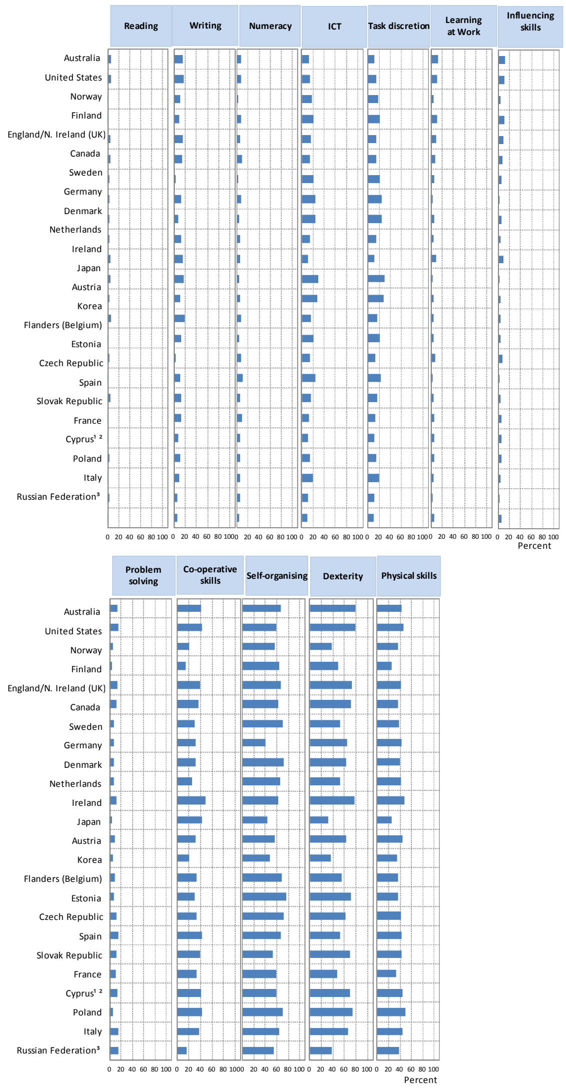
Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.

Source: Survey of Adults Skills (PIAAC) (2012).

Figure 11

High use of skills at work

Percentage of workers using the skills shown everyday



Countries are ranked in descending order of the average use of reading at work (Fig. 9).

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Source: Survey of Adults Skills (PIAAC) (2012).

39. Another way of looking at skills use at work is by focusing on the proportion of workers who use their skills the most frequently (Figure 11). Concerning the use of information-processing skills, surprisingly few workers – 3 to 6% on average – use reading, numeracy and ICT skills on a daily basis. Slightly more workers – 10 to 12% on average – use writing skills and problem solving every day. On the other hand, confirming the results presented in Figure 10, over 60% of workers on average use self-organising skills and dexterity every day and about a third on average use co-operative and physical skills with the same high frequency.

2.2. What skills are used together in the workplace?

40. Many of the skills described above are used in concert at work. Cluster analysis suggests that, in nine participating countries, ICT, reading, writing, problem-solving and influence skills are often used

together at work. In these countries, 19 to 25% of workers use these skills at work with above-median frequency (Table 2). In another nine countries, 20 to 30% of workers make an above-median use of influence and reading, at times associated with a frequent use of problem solving and writing or, in fewer cases, with influence and self-organising skills. Overall, the results of the cluster analysis show that while information-processing skills tend to be used together, generic skills are not. The only exceptions are influencing skills, which tend to be associated with reading, writing and problem-solving skills. Interestingly, an above-median use of ICT skills is most often associated with an above-median use of numeracy and reading skills.

Table 2. Skills used jointly at work

	Percentage of workers with above-median use of multiple skills	Skills-use clusters
Canada	18.9	ICT, Numeracy, Reading, Writing, Problem Solving
Finland	18.5	ICT, Numeracy, Reading, Writing, Problem Solving
Japan	19.5	ICT, Numeracy, Reading, Writing, Problem Solving
Korea	21.0	ICT, Numeracy, Reading, Writing, Problem Solving
Sweden	24.6	ICT, Numeracy, Reading, Writing, Problem Solving
Flanders (Belgium)	19.3	ICT, Numeracy, Reading, Writing, Influence
Austria	18.5	ICT, Numeracy, Reading, Writing, Influence
Czech Republic	23.9	ICT, Numeracy, Reading, Writing
Spain	21.3	ICT, Numeracy, Reading, Writing
Australia	24.9	ICT, Reading, Writing, Problem Solving
England/N. Ireland (UK)	21.5	Influence, Reading, Writing, Problem Solving
France	23.1	Influence, Reading, Writing, Problem Solving
United States	22.1	Influence, Reading, Problem Solving, Learning
Denmark	28.2	Influence, Reading, Writing
Netherlands	27.7	Influence, Reading, Writing
Norway	25.6	Influence, Reading, Writing
Estonia	28.6	Influence, Reading, Problem Solving
Italy	25.2	Influence, Reading, Problem Solving
Poland	27.5	Influence, Reading, Problem Solving
Ireland	30.9	Influence, Reading, Self-organising
Germany	32.4	Reading, Writing, Problem solving
Cyprus[1,2]	35.5	Influence, Reading
Russian Federation[3]	38.4	Learning, Reading
Slovak Republic	34.9	Reading, Problem Solving

Note: High use of skill is defined as above the median of the within country distribution of the indicator of skill use.

1,2,3) See footnotes 1, 2 and 3 of Figure 1.

Source: Survey of Adult Skills (PIAAC) (2012).

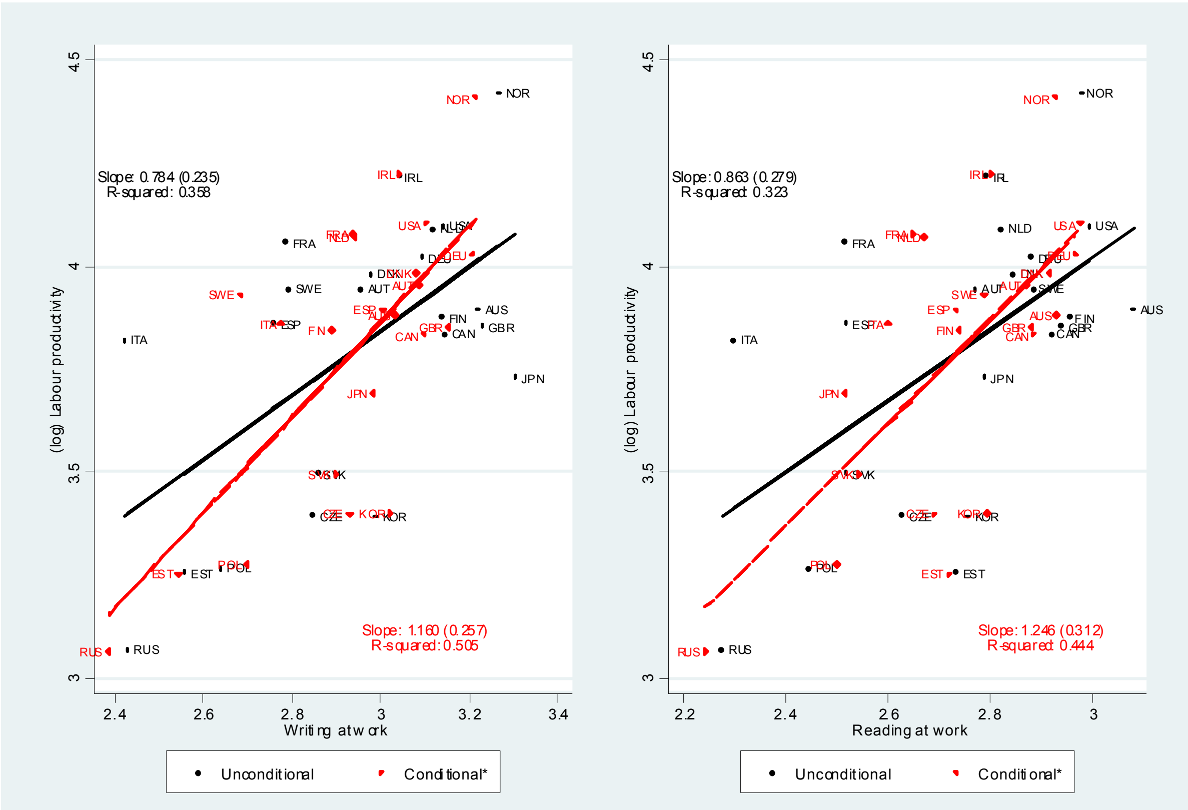
2.3. The extent of skills use at work and productivity

41. In theory, countries where skills are used more intensively at the workplace also enjoy greater productivity, although the strength of the link depends on a number of factors, such as the capital stock, the quality of production technologies, and the efficiency of matching workers to jobs. Analysis of results show that the use of reading skills at work correlates most strongly with a standard indicator of labour productivity, namely output per hour worked. Obviously, productivity may also be affected by the use of many other skills or by the nature of the work environment. As a result, the link between reading at work and productivity may reflect the fact that reading is associated with these other skills and/or with capital-intensity in the workplace.

42. Despite these caveats, labour productivity and the use of reading and writing skills are positively and statistically significantly correlated across participating countries. Differences in the average use of

reading and writing skills explain about a third of the variation in labour productivity across countries (Figure 12). In other words, how skills are used at work can affect productivity. One possible explanation for this is that skills use simply reflects workers' proficiency in those skills. If so, the link between the use of reading and writing skills at work and productivity could actually reflect a relationship between literacy proficiency and productivity.[19] But this is not what the data show. The positive link between labour productivity and reading and writing at work remains strong and statistically significant even after adjusting for average proficiency scores in literacy and numeracy.[20] If anything, once these adjustments are made, the average use of reading and writing skills explains more (50% and 44% respectively) of the variation in labour productivity across countries.[21] Put simply, the way skills are used at work is important, in itself, in explaining differences in labour productivity over and above the effect of proficiency.

Figure 12. Labour productivity and the use of reading and writing skills at work



* The conditioning set includes the country's mean scores in literacy and numeracy

19 . Only proficiency in literacy and numeracy is considered in this analysis, as the average score in the problem-solving section of the assessment does not take into account the relatively large and variable proportion of respondents who did not take that part of the assessment, either because they refused to or because they could not use a personal computer.

20 . The adjustment is based on multivariate regression analysis. First, both labour productivity and the average use of reading at work are separately regressed on average proficiency scores in literacy and numeracy, i.e. they are adjusted to control for the effect of literacy and numeracy proficiency. Then, the residuals of such two regressions are, in turn, regressed on one another. The adjusted results displayed in Figure 12 come from such a regression. This is a rather standard econometric procedure, commonly known as *partitioned regression*.

21 . In fact, the average levels of proficiency in literacy and numeracy are only weakly correlated with productivity: in a simple linear regression, they jointly capture less than 2% of the cross-country variation.

Source: Survey of Adult Skills (PIAAC) (2012).

43. These results emphasise the importance of putting skills to productive use, beyond having a skilled workforce (Hanushek and Woessmann, 2008). Too often workers are not employed in the jobs that make the best use of their skills. This issue will be discussed at greater length below, in the section on mismatch.

2.4 The distribution of skills use according to workers' and jobs' characteristics

44. Table 3 sheds light on the link between socio-demographic and job characteristics and the use of information processing and generic skills at work. Women are less likely to use information processing skills at work than men, even after controlling for job characteristics and proficiency in literacy. Women are also less likely to use most generic skills at work but the difference in use between genders is very small. The only sizeable exception concerns the use of dexterity in the workplace which is higher for women than for men.

Table 3
Skills use by socio demographic and job characteristics
OLS coefficients

	Skills use variables					
Controls	Reading	Writing	Numeracy	Influence	Learning	Task discretion
Ref: Men						
Women	-0.25 ***	-0.14 ***	-0.13 ***	-0.16 ***	-0.03 ***	-0.08 ***
Ref: Youth (16-24)						
Prime-age (25-54)	0.15 ***	0.14 ***	0.07 ***	0.09 ***	-0.31 ***	0.10 ***
Older workers (55-65)	0.12 ***	0.02	-0.04 ***	0.00	-0.51 ***	0.15 ***
Ref: No qulifications						
Upper-secondary qualification	0.21 ***	0.24 ***	0.16 ***	0.18 ***	0.16 ***	0.10 ***
Post-secondary non tertiary qualification	0.37 ***	0.38 ***	0.26 ***	0.24 ***	0.20 ***	0.11 ***
Tertiary qualification	0.43 ***	0.40 ***	0.37 ***	0.33 ***	0.25 ***	0.15 ***
Ref: Indefinite contract						
Fixed-term	-0.05 ***	-0.13 ***	-0.12 ***	-0.09 ***	0.12 ***	-0.12 ***
Temporary work agency/apprentice/no contract	-0.11 ***	-0.21 ***	-0.09 ***	-0.14 ***	0.02 *	-0.10 ***
Ref: Full-time						
Part-time	-0.25 ***	-0.32 ***	-0.27 ***	-0.27 ***	-0.18 ***	-0.09 ***
Ref: Managers						
Professionals	-0.01	-0.28 ***	-0.43 ***	-0.41 ***	-0.02	-0.36 ***
Technicians and associate professionals	-0.20 ***	-0.11 ***	-0.41 ***	-0.68 ***	-0.08 ***	-0.39 ***
Clerical support workers	-0.39 ***	-0.22 ***	-0.43 ***	-1.04 ***	-0.28 ***	-0.48 ***
Services and sales workers	-0.63 ***	-0.71 ***	-0.93 ***	-0.83 ***	-0.22 ***	-0.65 ***
Skilled agricultural, forestry and fishery workers	-0.87 ***	-1.16 ***	-1.31 ***	-1.20 ***	-0.46 ***	-0.59 ***
Craft and related trades workers	-0.73 ***	-1.03 ***	-1.33 ***	-1.28 ***	-0.31 ***	-0.74 ***
Plant and machine operators and assemblers	-0.94 ***	-1.02 ***	-1.54 ***	-1.58 ***	-0.62 ***	-1.11 ***
Elementary occupations	-1.19 ***	-1.45 ***	-1.57 ***	-1.61 ***	-0.76 ***	-0.80 ***
Ref: Agriculture/foresty/fishing						
Manufacturing/mining/other	0.10 ***	0.19 ***	0.17 ***	0.08 **	0.06 *	0.07 **
Construction	0.10 ***	0.08 **	0.18 ***	0.22 ***	0.14 ***	0.13 ***
Trade/transport/storage/accomodation/food	0.14 ***	0.15 ***	0.21 ***	0.24 ***	0.18 ***	0.03
Communication	0.24 ***	0.30 ***	-0.12 ***	-0.01	0.25 ***	0.14 ***
Financial	0.34 ***	0.48 ***	0.33 ***	0.23 ***	0.33 ***	0.01
Real Estate	0.16 ***	0.37 ***	0.08	0.07	-0.01	0.30 ***
Professional/scientific/tech/admin-support-service	0.21 ***	0.38 ***	0.04	-0.01	0.09 ***	0.09 ***
Public services	0.20 ***	0.38 ***	-0.40 ***	0.28 ***	0.09 ***	0.01
Other services	0.13 ***	0.02	-0.23 ***	0.18 ***	0.00	0.15 ***
Ref: Less than 10 workers						
11-50	0.04 ***	0.08 ***	-0.07 ***	0.08 ***	0.07 ***	-0.16 ***
51-250	0.07 ***	0.13 ***	-0.10 ***	0.06 ***	0.08 ***	-0.20 ***
251-1000	0.08 ***	0.18 ***	-0.12 ***	0.00	0.10 ***	-0.22 ***
more than 1000	0.10 ***	0.20 ***	-0.10 ***	0.04 ***	0.16 ***	-0.18 ***
Ref: currently studying for a formal qualification						
Not studying	0.12 ***	0.08 ***	0.10 ***	0.08 ***	0.10 ***	0.05 ***
Ref: Private sector						
Public sector	0.13 ***	-0.01	-0.15 ***	-0.01	0.02 **	-0.06 ***
Non-profit sector	0.08 ***	0.13 ***	-0.18 ***	0.06 ***	0.01	0.14 ***
Literary score*100	0.18 ***	0.24 ***	0.40 ***	0.15 ***	-0.08 ***	0.21 ***

Note: Country dummies are included as controls but not shown.
Source: Survey of Adults Skills (PIAAC) (2012)

Table 3 (Cont.)
Skills use by socio demographic and job characteristics
OLS coefficients

	Skills use variables					
Controls	Self-organising	ICT	Problem solving	Co-operative	Physical	Dexterity
Ref: Men						
Women	-0.05 ***	-0.11 ***	-0.23 ***	0.03 ***	-0.05 ***	0.20 ***
Ref: Youth (16-24)						
Prime-age (25-54)	0.27 ***	0.17 ***	0.08 ***	-0.26 ***	-0.18 ***	-0.09 ***
Older workers (55-65)	0.30 ***	0.07 ***	-0.07 ***	-0.50 ***	-0.39 ***	-0.19 ***
Ref: No qulifications						
Upper-secondary qualification	0.19 ***	0.17 ***	0.17 ***	0.05 ***	-0.07 ***	0.07 ***
Post-secondary non tertiary qualification	0.24 ***	0.26 ***	0.26 ***	0.01	-0.09 ***	0.10 ***
Tertiary qualification	0.31 ***	0.37 ***	0.35 ***	-0.04 **	-0.39 ***	-0.15 ***
Ref: Indefinite contract						
Fixed-term	-0.12 ***	-0.08 ***	-0.05 ***	0.01	0.10 ***	-0.03
Temporary work agency/apprentice/no contract	-0.17 ***	-0.13 ***	-0.12 ***	-0.06 ***	0.03 *	-0.10 ***
Ref: Full-time						
Part-time	-0.30 ***	-0.32 ***	-0.34 ***	-0.21 ***	-0.01	-0.09 ***
Ref: Managers						
Professionals	-0.18 ***	-0.31 ***	-0.19 ***	-0.46 ***	0.11 ***	0.22 ***
Technicians and associate professionals	-0.30 ***	-0.33 ***	-0.29 ***	-0.27 ***	0.22 ***	0.35 ***
Clerical support workers	-0.49 ***	-0.24 ***	-0.52 ***	-0.44 ***	-0.17 ***	0.32 ***
Services and sales workers	-0.71 ***	-0.94 ***	-0.73 ***	-0.09 ***	1.27 ***	0.43 ***
Skilled agricultural, forestry and fishery workers	-0.71 ***	-1.04 ***	-0.88 ***	-0.14 **	2.02 ***	0.92 ***
Craft and related trades workers	-0.80 ***	-1.24 ***	-0.62 ***	-0.25 ***	1.84 ***	1.20 ***
Plant and machine operators and assemblers	-1.19 ***	-1.58 ***	-1.07 ***	-0.56 ***	1.48 ***	0.77 ***
Elementary occupations	-1.06 ***	-1.44 ***	-1.19 ***	-0.39 ***	1.89 ***	0.50 ***
Ref: Agriculture/foresty/fishing						
Manufacturing/mining/other	0.07	0.08 *	0.00	0.09 **	-0.22 ***	-0.02
Construction	0.19 ***	0.19 ***	0.10 **	0.27 ***	-0.09 *	-0.01
Trade/transport/storage/accomodation/food	0.07	-0.02	-0.09 **	0.02	-0.08 *	-0.04
Communication	0.11 **	0.43 ***	0.25 ***	-0.05	-0.95 ***	-0.28 ***
Financial	0.15 ***	0.35 ***	0.24 ***	-0.15 ***	-1.05 ***	-0.32 ***
Real Estate	0.29 ***	0.27 ***	0.09	-0.42 ***	-0.62 ***	-0.38 ***
Professional/scientific/tech/admin-support-service	0.11 **	0.25 ***	0.08 **	-0.19 ***	-0.64 ***	-0.28 ***
Public services	0.17 ***	-0.13 ***	-0.01	-0.06	0.03	0.12 **
Other services	0.13 ***	0.07	-0.13 ***	-0.21 ***	-0.09	-0.01
Ref: Less than 10 workers						
11-50	-0.12 ***	-0.05 ***	0.06 ***	0.23 ***	0.05 ***	-0.01
51-250	-0.16 ***	-0.04 ***	0.11 ***	0.22 ***	-0.05 ***	-0.08 ***
251-1000	-0.23 ***	-0.03 ***	0.17 ***	0.35 ***	-0.09 ***	-0.09 ***
more than 1000	-0.15 ***	0.00	0.23 ***	0.49 ***	-0.07 ***	-0.08 ***
Ref: currently studying for a formal qualification						
Not studying	0.03 *	0.12 ***	0.08 ***	0.01	-0.10 ***	-0.03
Ref: Private sector						
Public sector	-0.05 ***	-0.01	0.02	0.09 ***	-0.12 ***	-0.04 **
Non-profit sector	0.07 **	0.12 ***	0.13 ***	0.07 **	-0.10 ***	-0.11 ***
Literary score*100	0.35 ***	0.34 ***	0.26 ***	-0.23 ***	-0.46 ***	-0.28 ***

Note: Country dummies are included as controls but not shown.
Source: Survey of Adults Skills (PIAAC) (2012)

45. Young people make the least use of information processing skills at work, including ICT, but older workers are also less likely to use these skills compared to prime-age workers. Unsurprisingly, among generic skills, learning at work declines with age as does the use of manual skills, both physical and dexterity. More puzzling is the decline in the use of co-operative skills with age, which could reflect less reliance on mentoring as experience is accumulated in the workplace. Finally, the use problem solving skills is lowest among older workers, followed by youth and highest among prime-age workers, although the differences across age groups are small.

46. Unsurprisingly, the use of information processing skills increases with the level of education as does the use of learning, influence, task discretion and self-organising skills. On the other hand, the use of physical skills declines with education.

47. The use of most skills in the workplace tends to decline with job stability, although in most cases the differences between contract types are small. The only exceptions are the use of learning and of physical skills at work which are highest among fixed-term contract employees. Differences between working hours arrangements are more sizeable with part-time workers significantly less likely to use all skills but physical ones than their full-time counterparts.

48. Coefficients by occupation and by industry are rather unsurprising, with managers and finance workers using information processing skills the most and workers in elementary occupation and in the agricultural sector using them the least. The results are less clear-cut when considering generic skills, with workers in relatively low skilled occupations – such as construction workers – using co-operative and self-organising skills the most.

49. Workers in larger firms use more writing, reading and problem solving skills at work. They are also more likely to learn in the workplace and co-operate with their colleague. On the other hand, workers in smaller firms appear to be in jobs that grant them more autonomy as they are more likely to have task discretion and use self-organising skills.

50. Finally, a higher literacy score is associated with higher use of all information processing skills as well as most generic skills with the exception of physical, co-operative and learning skills. However, the correlation is extremely small.[22]

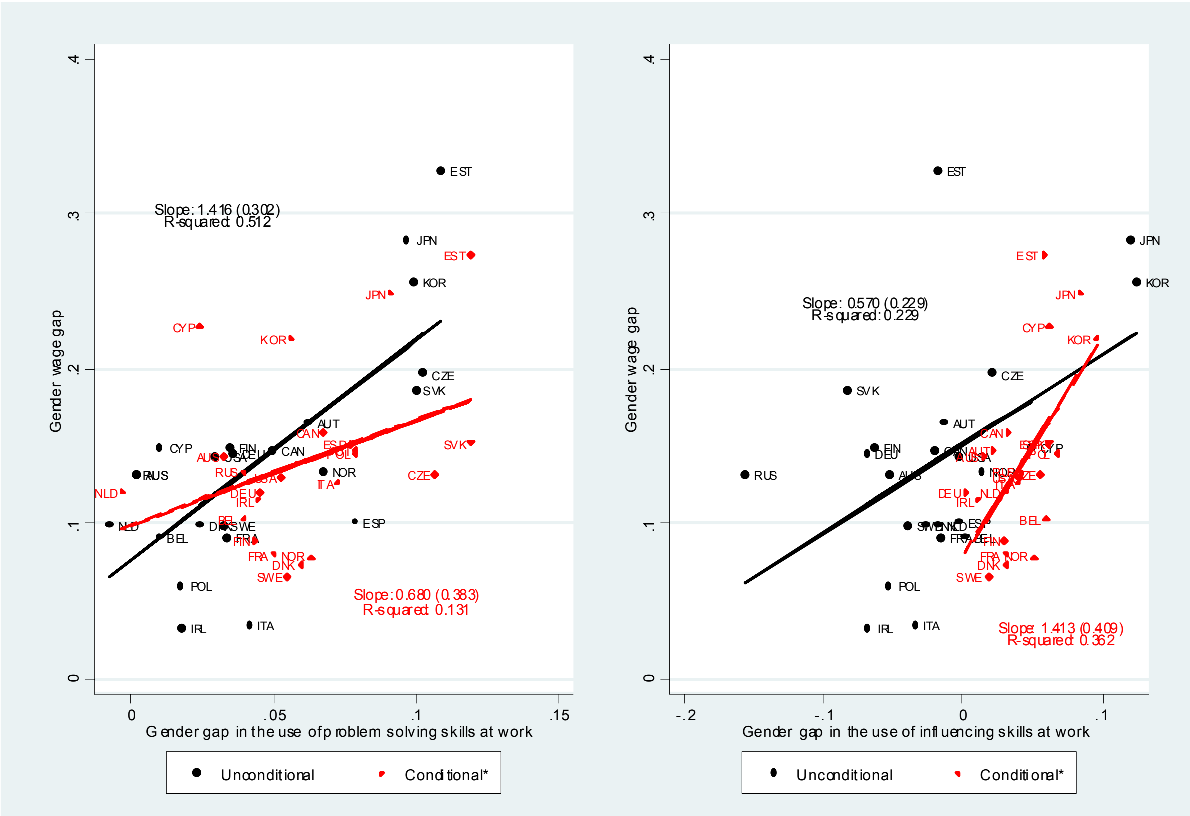
51. Country dummies, which are included in the regressions presented in Table 3 but not shown, confirm that Australia tends to rank at the top for the use of information processing skills at work, even after controlling for the characteristics of the workforce and of jobs. This is the case for writing, reading and problem solving skills. At the other hand of the scale, Japan ranks among the countries with the lowest use of self-organising and problem solving skills as well as dexterity. With few exceptions, these rankings are similar to the unadjusted ones presented in Figures 9 and 10.

2.5. Skills use and wage differentials by gender, contract type and qualification

52. The use of skills at work has the potential to explain a number of labour phenomena, including gender wage gap, the college premium or wage differentials between temporary and permant workers. For instance, the use of problem-solving skills at work explains about half of the gender gap in wages. Despite the extensive literature on wage differences between genders (see OECD, 2012 for a review), little is known about the extent to which the use of skills at work explains such differences. An analysis of survey results finds that about 51% of the cross-country differences in the gender gap in wages can be predicted by differences in the use of problem-solving skills at work (Figure 13). This relationship is statistically significant and remains so, although just at the 10% level, after gender differences in a number of other factors, namely proficiency in literacy and numeracy skills, educational qualifications, occupation, and industry of the jobs, are taken into account. Similar results are obtained when the use of influencing skills at work is used to explain the gender wage gap.

22 . Note that Table 3 shows the increase in skills use following a 100 score point increase in literacy.

Figure 13. The gender gap in wages and in the use of problem-solving skills at work



* The conditioning set includes individual literacy and numeracy scores, dummies for educational qualifications (4), occupations (9) and industry (10).

Note: The gender gap in wages is computed as the percentage difference between men's and women's average hourly wages, including bonuses. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. Lines are best linear predictions. The sample includes only full-time employees. Standard errors in parentheses.

Source: Survey of Adult Skills (PIAAC) (2012).

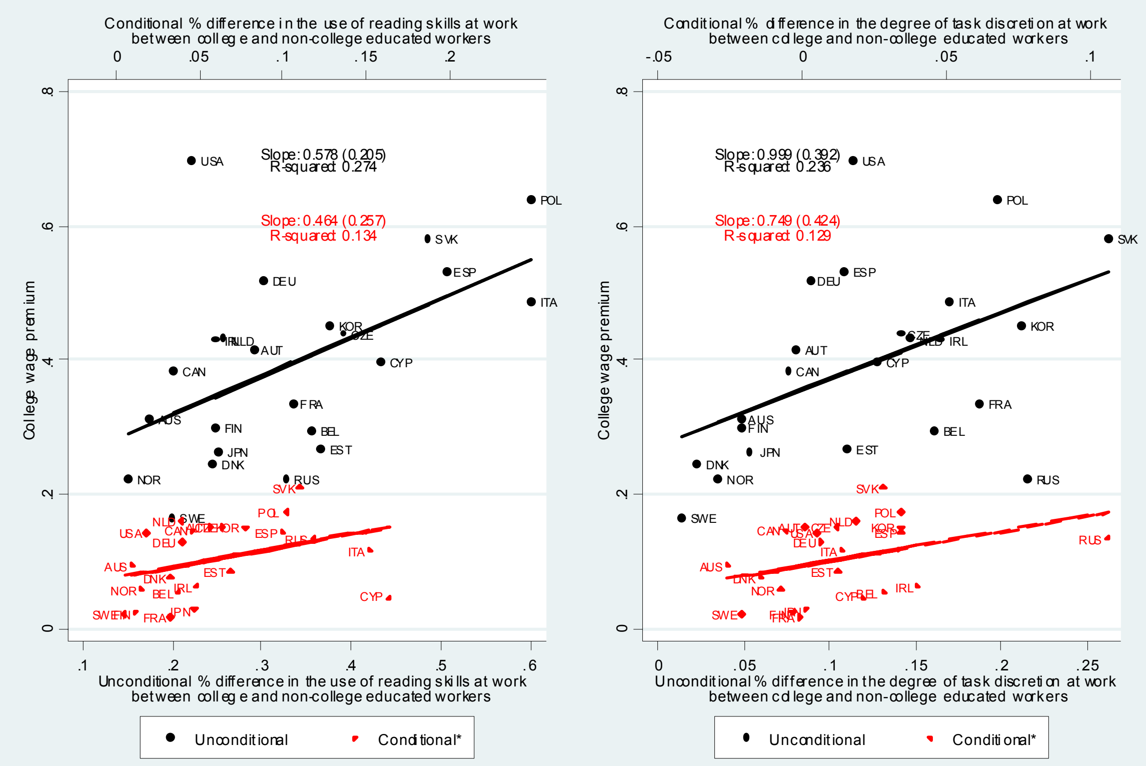
53. These findings suggest that detailed understanding of skills use at work can help to identify the roots of the gender gap in pay. As a consequence, policies that aim to improve the match between the skills in the labour supply and those in demand may also affect the gender gap in wages (Black and Spitz-Oener, 2010).

54. Similarly, the results on skills use by level of qualification have implications for a number of hotly debated issues in labour market policy, particularly regarding the sources and evolution of wage inequality (Card and Lemieux, 2001; Katz and Murphy, 1992; Juhn, Murphy and Pierce, 1993; Lemieux, 2006). One such issue is the college premium in wages, i.e. the average wage advantage of tertiary graduates compared to other employed individuals. The Survey of Adult Skills (PIAAC) allows for an investigation of how this phenomenon correlates with the use of reading skills and task discretion, the two (information processing and generic) skills that appear to be linked most strongly with it.

55. The link between skills use and the premium earned by tertiary graduates compared to their less-educated counterparts is primarily due to differences in proficiency and in the type of jobs graduates hold. Across countries, the correlation between the tertiary wage premium and the average difference in the use of reading skills at work is statistically significant; and differences in skills use predict 27% of the variation in the wage premium (Figure 14). However, this correlation is almost entirely due to differences in skills

proficiency and in the type of jobs and industries in which graduates and non-graduates work. This is also true for the link between the use of task discretion and the tertiary wage premium.

Figure 14. The tertiary premium and the use of reading skills and task discretion at work



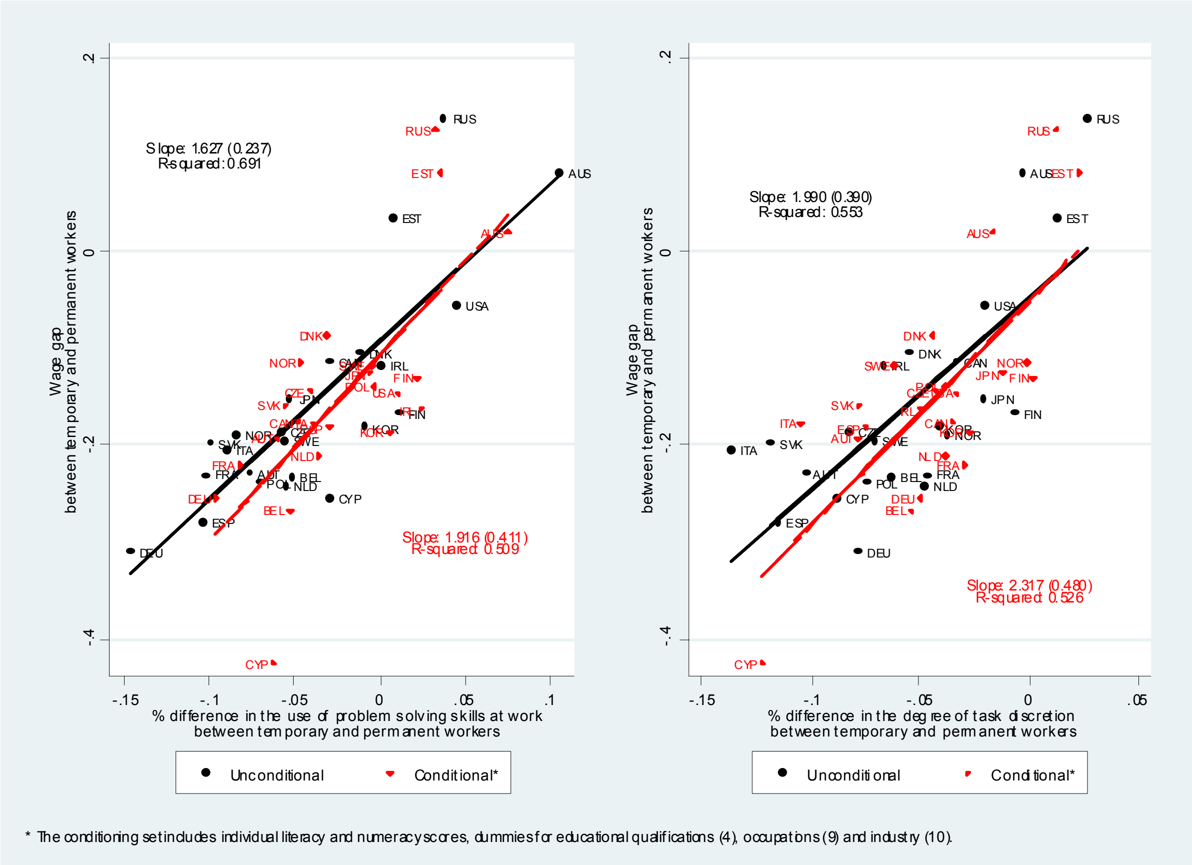
* The conditioning set includes individual literacy and numeracy scores, dummies for occupation (9) and for industry (10).

Notes: The bottom axes correspond to the unadjusted series and the top axes to the adjusted series. The tertiary wage premium is computed as the percentage difference between the average hourly wages, including bonuses, of tertiary-educated (ISCED 5 or more) and less-educated (from less than ISCED 1 to ISCED 4) workers. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. Lines are best linear predictions. The sample includes full-time employees only. Standard errors in parentheses.

Source: Survey of Adult Skills (PIAAC) (2012).

56. Analysis of the results re-affirms the idea that fixed-term contracts are normally associated with jobs where information-processing and other productive generic skills are used less intensively than they are in jobs associated with permanent contracts. In addition, data analysis shows that differences in the use of problem solving skills correlate strongly with the average wage penalty associated with temporary contracts compared to permanent contracts (Figure 15). Of the five foundation skills that are reviewed in the Survey of Adult Skills (PIAAC), problem solving appears to have a strong power to predict differences in pay between temporary and permanent contracts. This suggests that the type of tasks carried out by workers differ substantially depending on contractual arrangements. Moreover, this relationship remains statistically significant even after accounting for skills proficiency, education, industry and occupation. The right panel of Figure 15 shows a very similar pattern with regard to task discretion, the one generic skill that is most strongly correlated with pay differences.

Figure 15. The wage penalty for temporary contracts and the use of problem-solving skills and task discretion at work



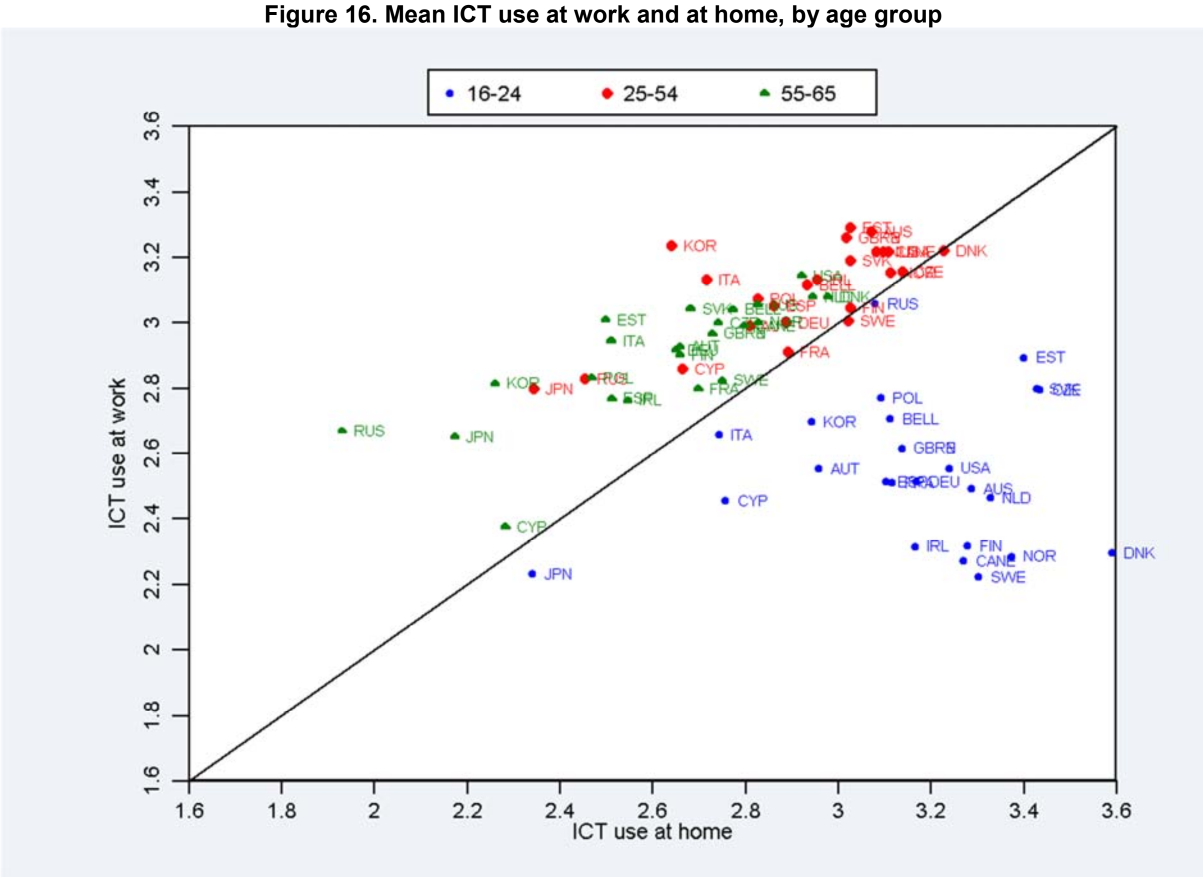
Note: The wage penalty for temporary contracts is computed as the percentage difference between the average hourly wages (including bonuses) of temporary and permanent workers. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. Lines are best linear predictions. The sample includes only full-time employees. Standard errors in parentheses.

Source: Survey of Adult Skills (PIAAC) (2012).

57. Finally, Table 3 shows that, contrary to the conventional wisdom that young people are more intense users of information and communication technologies, the average index of ICT use among youth is lower than that among prime-age workers in all participating countries. However, the picture is different for home use of ICT. Workers aged 16-24 use ICT consistently more at home than in the office, whereas the opposite is true among prime-age (25-54 year-old) and older (55-65 year-old) workers (Figure 16).[23] Of course, some of the computer activities in which young adults engage at home (videogames, Internet browsing, chatting) may not be the same as those required on the job. Nevertheless, it would be useful to explore further the extent to which young people's ICT skills are being underused in the labour market.

23 . The populations over which the averages of the skills use indicators are taken are the same for both ICT use at home and ICT use at work in all countries.

Figure 16. Mean ICT use at work and at home, by age group



Note: The sample includes only workers.

Source: Survey of Adult Skills (PIAAC) (2012).

2.6. Skills use at work and wages

58. Part of the effect of proficiency on hourly wages shown in Figure 7 may be based on the type of tasks and responsibilities workers are expected to carry out in their job. To check whether this is the case, one can also adjust the estimates by indicators of skills use at work. Unsurprisingly, the inclusion of skills-use variables weakens the effect of both education and proficiency on wages by about a third, on average. In about half of the countries, cooperative skills, influence and task discretion, are positively and significantly correlated with wages, while dexterity is negatively and significantly correlated with wages. Also, in all countries but one, the use of physical skills is negatively and significantly correlated with wages. Similarly, the use of information-processing skills, such as writing, familiarity with ICTs and problem solving, is positively and significantly correlated with wages. The fact that skills use, over and above general proficiency and education, influences wages suggests the existence of mismatch between use and proficiency as illustrated in the remainder of this paper.

Figure 17
Workers in high-skilled and unskilled jobs

Percentage of workers in jobs requiring primary education (ISCED-1) or less and in jobs requiring tertiary education (ISCED-5 or higher)

Countries are ranked in ascending order of the percentage of workers in jobs requiring tertiary education.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes : Required education is the qualification the w orker deems necessary to get his or her job today.

Source: Survey of Adults Skills (PIAAC) (2012).

3. The level of education required for the job

59. In addition to measuring the use of skills, the Survey of Adult Skills (PIAAC) also questions respondents about the level of education that would be required to get their jobs. This is an important piece of information that is useful for describing the industrial structure of the economy. It is also used to measure "qualification mismatch", or the phenomenon by which workers are often employed in jobs that require a lower or higher level of education than they have (Leuven and Oosterbeek, 2011; Quintini, 2011a and 2011b).

60. Across all participating countries, 9% of existing jobs are characterised as having low educational requirements (primary education or none), whereas almost 35% require tertiary qualifications (Figure 17).

61. In many countries, the fewer the jobs requiring low levels of education, the more the jobs requiring high levels of education. However, this is not always true. In Spain and England/N.Ireland (UK), the distribution of jobs by educational requirements is highly polarised: there are many jobs with low educational requirements and many with high educational requirements (Autor et al., 2006; Goos and Manning, 2007; Goos et al. 2009; Wilson and Homenidou, 2012). By contrast, in Austria, Italy, the Czech Republic and the Slovak Republic, jobs characterised by medium-level educational requirements seem to be most prevalent.

62. These results are based on self-reported information provided by workers and therefore may not reflect the employers' views nor the actual outcomes of the recruitment process (Green and James, 2003). Moreover, the survey specifically asks about the qualifications required to obtain the job at the time of the interview, which may not necessarily be the same as the requirements demanded of the respondents when they were hired. Despite these caveats, these results illustrate both the demand for workers with post-secondary education and the level of complexity of jobs, as perceived by currently employed workers.

63. The differences across countries in job requirements could be due to at least two different phenomena. First, the more technologically advanced countries are also likely to be those where jobs require more knowledge and where different hiring strategies may be used for different jobs. Second, in some countries, job requirements might not necessarily be linked to task complexity. To the extent that employers use educational qualifications to sort out the best candidates for the job (Spence, 1973), rising levels of educational attainment in the population would force recruiters to raise hiring standards, even if the jobs are not necessarily more complex.

4. Exploring mismatch between workers' skills and job requirements

64. Ensuring a good match between the skills acquired in education and on the job and those required in the labour market is essential if countries want to make the most of their investments in human capital and promote strong and inclusive growth. A mismatch between the two has potentially significant economic implications. At the individual level, it affects job satisfaction and wages. At the firm level, it increases the rate of turnover and may reduce productivity.[24] At the macro-economic level, it increases unemployment and reduces GDP growth through the waste of human capital and/or a reduction in

24 . Evidence on the link between mismatch and productivity is mixed. Because of the difficulty of measuring the relationship directly, studies infer the consequences of mismatch on productivity either by relying on human capital theory, equating wages to productivity, or by studying the effect of mismatch on job satisfaction. Using these approaches, most studies conclude that mismatch has a negative impact on productivity. However, some researchers have cast doubts on these findings. Notably, Kampelman and Rycx (2012) find evidence of a positive link between mismatch and productivity which they attribute to positive effects associated with a pool of higher skills, as more educated individuals can positively shape not only the nature of their own job tasks but also those of their colleagues.

productivity. That said, some mismatch is inevitable. Requirements regarding skills and qualifications are never fixed. The task content of jobs changes over time in response to technological and organisational change, the demands of customers, and in response to the evolution of the supply of labour. Young people leaving education and people moving from unemployment into employment, for example, may take jobs that do not necessarily fully match their qualifications and skills. Thus, for a number of reasons, some workers are likely to be employed in jobs for which they are too qualified and others may be in jobs, at least temporarily, for which they lack adequate schooling.

65. Mismatch, understood as a poor fit between an individual worker's qualifications or skills and those demanded or required by his or her job, needs to be distinguished from aggregate balances or imbalances in the supply of and demand for different types of qualifications and skills in the labour market, such as skill shortages or the over- or under-supply of people with different educational qualifications or skills. Although these two phenomena are distinct, they are, nevertheless, related. Imbalances (e.g. shortages or over-supply of individuals with particular qualifications or skills) are likely to have an effect on the incidence and type of mismatches observed at the individual level. But that relationship is not automatic: a balance between the supply of and demand for workers at a given qualification level does not guarantee that individual workers will be matched to jobs that require the level of education they have attained. A high level of mismatch at the individual level does not imply any particular level of imbalance between aggregate supply and demand.

66. The discussion of qualification and skills mismatch that follows focuses on the question of mismatch at the individual level, that is, on the outcomes of allocating individuals to jobs and adapting job tasks to workers' skills. It does not address the extent of the balance or imbalance in the supply of and demand for individuals with particular educational qualifications or skills. From this perspective, any evidence of mismatch between workers' qualifications and skills and those required by their jobs should be interpreted primarily as suggesting that there are economic benefits (and benefits in terms of the well-being of workers) to be gained from better management of human resources, including practices that involve hiring workers, designing jobs and providing training, apart from action concerning the adjustment of supply and demand in the aggregate. The evidence should not be interpreted as indicating the existence of "over-education" or "over-skilling" in the economy as a whole.

4.1 Constructing better indicators of mismatch using the Survey of Adult Skills (PIAAC)

67. The Survey of Adult Skills (PIAAC) provides a rare opportunity to measure more precisely both qualification and skills mismatch. Qualification mismatch is determined based on a comparison of a worker's qualification level – expressed as the International Standard Classification of Education (ISCED) level corresponding to his or her highest educational qualification – and what is thought to be the required qualification level for his or her occupation code – the International Standard Classification of Occupations (ISCO) code attached to the job he or she holds. Because ISCED levels do not accurately reflect skills – not even those acquired in initial education – and ISCO codes do not accurately describe jobs, the resulting measure does not precisely describe how a worker's skills set matches the skills needed to carry out his or her tasks at work. Skills mismatch, however, refers more precisely to a worker's actual skills and to the skills needed in his or her specific job.

68. Despite these important differences, the two measures of mismatch overlap to some extent, in the same way as education and skills do. Some researchers use the term *genuine mismatch* to indicate when a worker is both over-qualified <u>and</u> over-skilled (or both under-qualified <u>and</u> under-skilled) for his or her job. The term *apparent qualification mismatch*[25] is used to refer to workers who are over-qualified/under-

25. Most often, this term is employed with reference to apparent over-qualification. See for example, Chevalier (2003).

qualified but not over-skilled/under-skilled, i.e. there is a discrepancy between their skills and their qualifications or a discrepancy between the skills and the qualification requirements of their specific jobs.

69. Although qualifications are an imperfect proxy for skills, qualification mismatch should not be simply dismissed as a "bad" measure of skills mismatch. First, by uncovering the causes of *apparent* qualification mismatch, for example when there is a mismatch between the skills learned in school and those required in the labour market, the areas requiring policy intervention are revealed. Second, workers have many different skills, ranging from information-processing skills, to occupation-/sector-specific knowledge and abilities, to generic skills. As a result, any concept of mismatch based on individual skills offers only a partial view of the match between a worker and his or her job. Qualifications reflect several different skills, including both information-processing and job-specific competences, and could complement narrower, though more precise, skills measures. In addition, skills use depends, at least partly, on the effort that workers decide to put into their jobs, making it difficult to define precise skills requirements; qualification requirements are easier to define.

70. Thus, several measures of qualification and skills mismatch can be derived using the data available from the Survey of Adult Skills (PIAAC) on qualifications, skill requirements and skills use (Table 4).

Table 4. Glossary of key terms

	Mismatch concept	Measure used in this paper
Qualification mismatch	**Over-qualification**	A worker is classified as over-qualified when the difference between his or her qualification level and the qualification level required in his or her occupation is positive.
	Under-qualification	A worker is classified as under-qualified when the difference between his or her qualification level and the qualification level required in his or her occupation is negative.
	Required qualification	Based on respondents' answers to the question "If applying today, what would be the usual qualifications, if any, that someone would need to get this type of job?" Qualifications were translated into years of education based on the structure of each country's education system.
Skills mismatch in literacy, numeracy or problem solving	**Over-skilling in literacy, numeracy or problem solving**	When a worker's proficiency is above the maximum required by his or her job.
	Under-skilling in literacy, numeracy or problem solving	When a worker's proficiency is below the minimum required by his or her job.
	Skill requirements	The minimum and maximum levels required correspond to the minimum and maximum observed proficiency of workers who answer negatively to both questions used to identify self-reported over- and under-skilling.

Deriving measures of qualification mismatch

71. The key way of determining the extent of qualification mismatch is to measure the level of education required at work.[26] The most frequently used measure is the modal qualification of workers in each occupation and country. However, this measure combines current and past qualification requirements as it reflects the qualifications of people who were hired at different times.

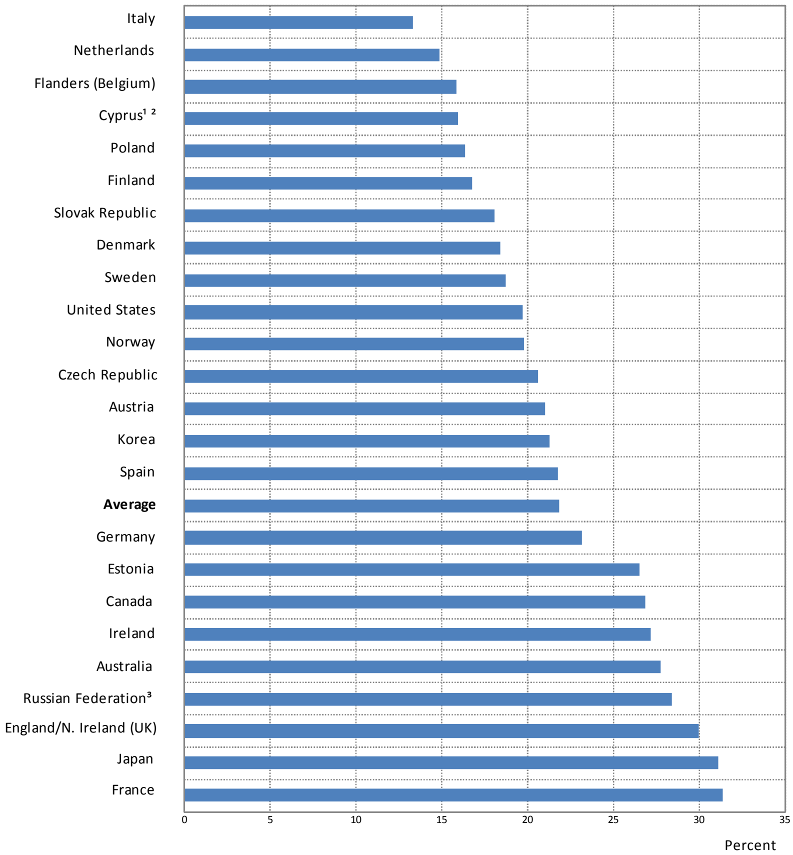
26 . While this is complicated by the fact that some jobs may not have an obvious requirement in terms of qualifications or workers may not be fully aware of it, survey experts have found that both workers and employers tend to find it easier to define jobs in terms of required qualifications than in terms of individual skills.

72. The Survey of Adult Skills (PIAAC), however, asks workers to report the qualification they consider necessary to *get* their job today. The comparison between workers' qualifications and this self-reported requirement shows that, on average, 22% of workers are over-qualified while about 13% are under-qualified (Figures 18 and 19). The incidence of qualification mismatch varies significantly across countries: the share of over-qualified workers ranges from less than 15% in Italy and the Netherlands to 30% or more in France, Japan and England/Northern Ireland (UK); while the incidence of under-qualification varies between less than 10% in the Slovak Republic, the Czech Republic, Japan, the Russian Federation, Poland and Spain to just over 20% in Italy and Sweden.[27]

Figure 18

Incidence of over-qualification

Percentage of workers whose highest qualification is higher than the qualification they deem necessary to get their job today



Countries are ranked in ascending order of the share of over-qualified workers.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

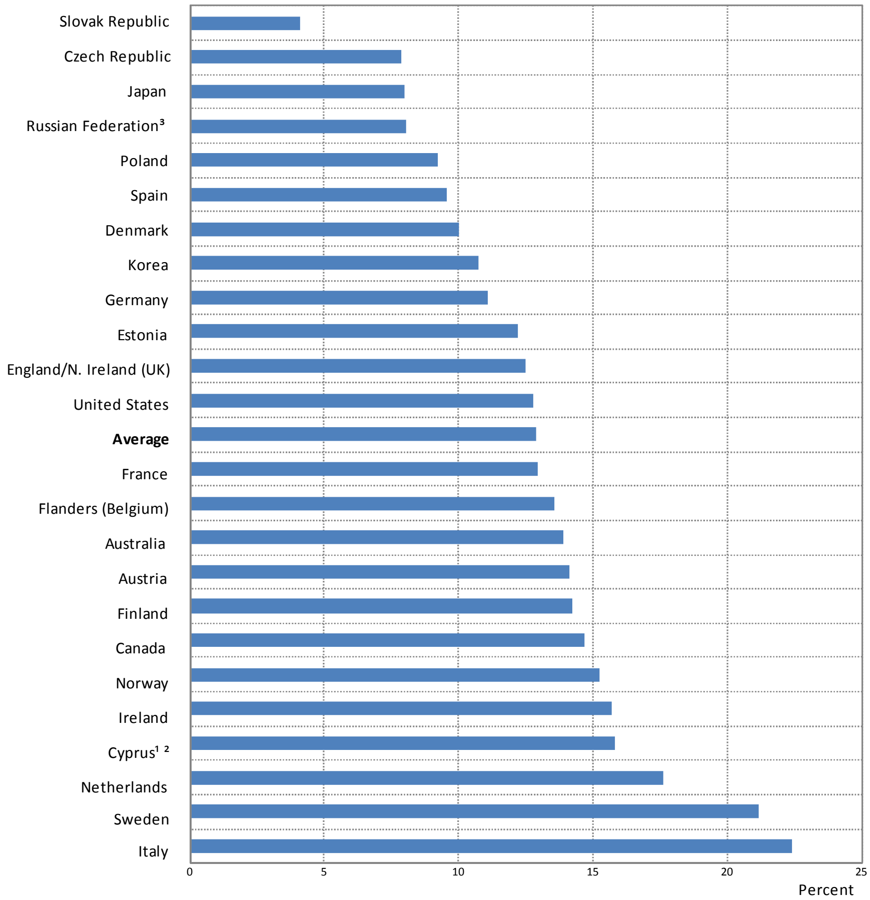
Source: Survey of Adults Skills (PIAAC) (2012).

27 . Because Figures 18 and 19 are based on workers' views of what qualification is required to get their job the results may be affected by respondent's bias – i.e. the tendency to over- or under- value the content of one's work – or by qualification inflation – i.e. whereby employers raise minimum job requirements as a result of an increase in the number of tertiary-qualified candidates without upgrading job content. The latter would tend to reduce the incidence of over-qualification when the self-reported measure is used, while the former may bias the results in either direction.

Figure 19

Incidence of under-qualification

Percentage of workers whose highest qualification is lower than the qualification they deem necessary to get their job today



Countries are ranked in ascending order of the share of under-qualified workers.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Source: Survey of Adults Skills (PIAAC) (2012).

Mismatch in literacy

73. The measures of skills mismatch that have been used in previous research all suffer from various problems, most of which are related to the difficulty of measuring the skill requirements of jobs from surveys of employees. A novel approach to measuring skills mismatch in literacy (or numeracy) is now possible thanks to the wealth of information provided by the Survey of Adult Skills (PIAAC).

74. The survey asked workers whether they feel they "*have the skills to cope with more demanding duties than those they are required to perform in their current job*" and whether they feel they "*need further training in order to cope well with their present duties*". According to the survey's measure of skills mismatch, workers are classified as well-matched in a domain if their proficiency score in that domain is between the minimum and maximum score observed among workers who answered "no" to both

questions in the same occupation and country.[28] Workers are over-skilled in a domain if their score is higher than the maximum score of the self-reported well-matched worker, and they are under-skilled in a domain if their score is lower than the minimum score of the self-reported well-matched worker.

Box 2. Deriving the survey's measures of skills mismatch in literacy, numeracy or problem solving

The Survey of Adult Skills (PIAAC) allows for producing a more robust measure of skills mismatch than the two commonly used in the literature, namely self-reported skills mismatch and measures derived by the direct comparison of skill proficiency with skills use at work. Indeed, both these methodologies are unsatisfactory and their limitations have been highlighted in the literature. When asked directly, workers in most countries tend to be highly over-confident: too many of them report being qualified to perform more demanding jobs, thus undermining the validity of skills mismatch measures based on self-reported information. On the other hand, the comparison of skills proficiency and skills use rests on the assumption that the two can be measured on the same scale, an assumption that is very difficult to defend for concepts that are so clearly distinct theoretically and that cannot be represented along the same metrics (Krahn and Lowe, 1998). Additionally, the measures of skills proficiency and skills use are based on structurally different pieces of information: indicators of skills use normally exploit survey questions about the frequency (and/or the importance) with which specific tasks are carried out in the respondents' work activities, whereas skills proficiency is usually measured through foundation tests.

Using the Survey of Adult Skills, it is possible to combine three pieces of information, namely self-reported skills mismatch, skills use and skills proficiency, into a novel indicator of skills mismatch derived as follows:

Step 1. Identify workers who self-report being well-matched as those workers who neither feel they have the skills to perform a more demanding job nor feel the need of further training in order to be able to perform their current jobs satisfactorily.

Step 2. For each skill dimension (literacy, numeracy and problem solving), define the minimum and maximum skill level required in an occupation as the minimum and the maximum proficiency of self-reported well-matched workers (defined as in Step 1) by country and within each 1-digit ISCO code. To limit the potential impact of outliers on these measurements, it is useful to use the 5th and the 95th percentile instead of the actual minimum and maximum, which is the approach adopted in the main text of this report. Because of sample size, ISCO group 0 (armed forces) and ISCO group 6 (skilled agricultural workers) were dropped and ISCO group 1 was merged to ISCO group 2 for the purpose of calculating skill requirements.

Step 3. For each skills dimension (literacy, numeracy and problem solving), classify workers as under-skilled if their proficiency is lower than the minimum requirement in their occupation and country and as over-skilled if their proficiency is higher than the maximum requirement in their occupation and country. All other workers are classified as well-matched.

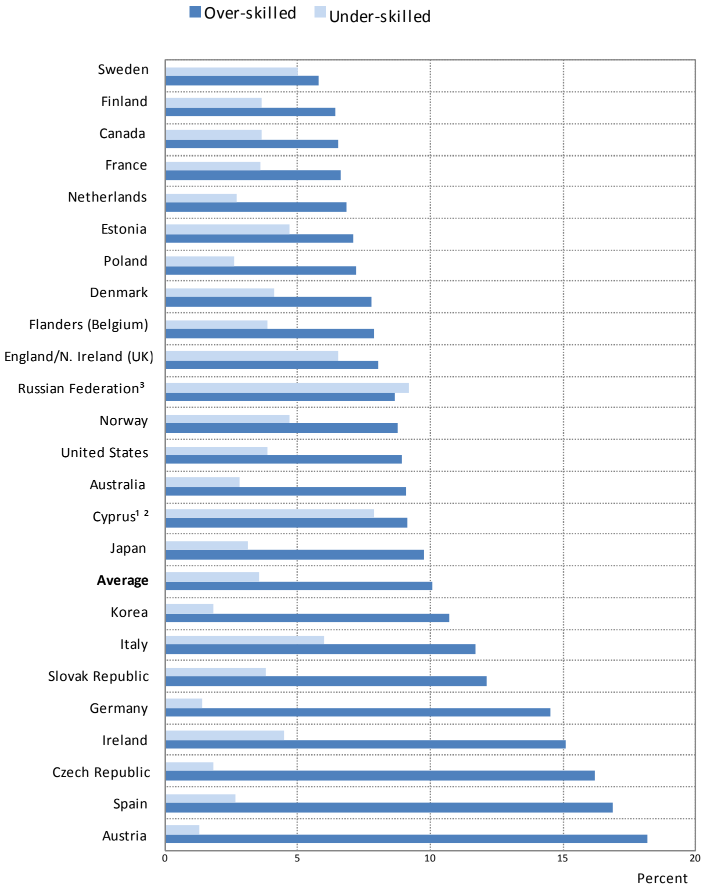
The above procedure allows for calculating the shares of workers who are under-skilled, well-matched and over-skilled in each occupation and for each skill. In a further step, the skills use of workers who are over- and under-skilled is compared with that of equally-proficient workers – i.e. workers with similar proficiency scores – who are well-matched.

28 . To limit the potential impact of outliers on these measurements, the 5th and the 95th percentiles instead of the actual minimum and maximum are used for computing skill mismatch.

Figure 20

OECD measure of skills mismatch in literacy

Percentage of over- and under-skilled workers



Countries are ranked in ascending order of the percentage of workers over-skilled in literacy.

1.2.3. See footnotes 1, 2 and 3 o

Notes: Over-skilled workers are those whose proficiency score is higher than that corresponding to the 95th percentile of self-reported well-matched workers – i.e. workers who neither feel they have the skills to perform a more demanding job nor feel the need of further training in order to be able to perform their current jobs satisfactorily – in their country and occupation. Under-skilled workers are those whose proficiency score is lower than that corresponding to the 5 th percentile of self-reported well-matched workers in their country and occupation.

Source: Survey of Adults Skills (PIAAC) (2012).

75. The survey's measure of skills mismatch is an improvement over existing indicators as it is more robust in reporting bias, such as over-confidence, and it does not impose the strong assumptions needed when directly comparing skills proficiency and skills use.[29] However, this approach does not measure all forms of skills mismatch; rather, it focuses on mismatch in the proficiency domains assessed by the Survey of Adult Skills (PIAAC), leaving out mismatch related to job-specific skills or that involving generic skills.

29 The comparison of skills proficiency and skills use rests on the assumption that the two can be measured on the same scale, an assumption that is very difficult to defend for concepts that are so clearly distinct theoretically and that cannot be represented along the same metrics. In addition, the measures of skills proficiency and skills use are based on structurally different pieces of information: indicators of skills use normally exploit survey questions about the frequency (and/or the importance) with which specific tasks are carried out in the respondents' work activities, whereas skills proficiency is measured through information-processing tests. See Box 2 for more details.

(A detailed discussion of the survey's measure of skills mismatch, its advantages and disadvantages as well as its underlying theoretical framework is presented in Fichen and Pellizzari [2013]).

76. On average among the countries participating in the Survey of Adult Skills (PIAAC), about 10% of workers are over-skilled in literacy while about 4% are under-skilled in this proficiency domain (Figure 20). Austria, the Czech Republic and Spain show the highest incidence of over-skilling in literacy, while Canada, Finland and Sweden are at the low end of the scale. On the other hand, the highest incidence of under-skilling in literacy is observed in the Russian Federation, Italy and England/N.Ireland (UK), while the lowest is found in Austria and Germany.

How do skills and qualification mismatch interact?

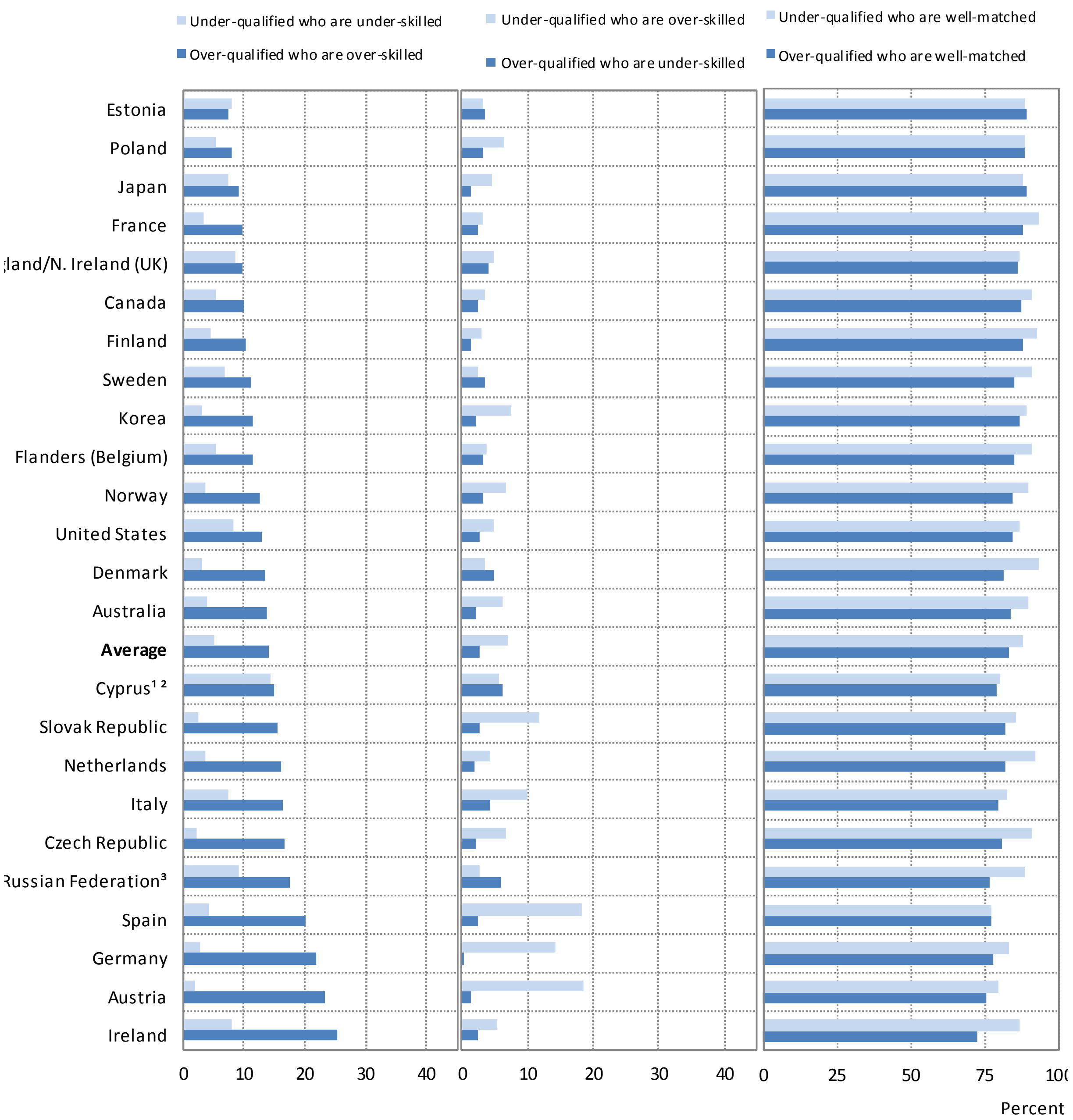
77. There is little overlap between qualification mismatch and skills mismatch in literacy.[30] On average, 14% of over-qualified workers are also over-skilled, based on the survey's measure of skills mismatch in literacy (Figure 21). This varies between 25% in Ireland to just 7% in Estonia. Overall, only a subset of over-qualified workers has literacy skills that exceed those required for their jobs. This confirms that qualifications are an imperfect proxy for skills, and also suggests that over-qualification may reflect the under-use of skills other than literacy.

78. Under-qualification and under-skilling in literacy also appear to be two distinct phenomena, with very little (on average, just 5%) overlap. This suggests that under-qualified workers actually have the literacy skills required to carry out their jobs, but do not have the corresponding qualifications. This hypothesis is supported by the fact that, in several countries, a relatively large share of under-qualified workers is actually over-skilled – just under one in five under-qualified workers in Austria and Spain. For these workers, under-qualification could be due to what is known as "qualification inflation", when having a larger number of graduates in the labour force inflates qualification requirements, or to the fact that workers have acquired the necessary skills and knowledge on the job, but these skills are not certified by an official educational qualification.

30 . Similar results are obtained when using skills mismatch in numeracy.

Figure 21
Overlap between qualification- and skills-mismatch measures

Percentage of qualification-mismatched who are in each literacy mismatch status



Countries are ranked in ascending order of the percentage of over-qualified workers who are over-skilled in literacy.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: Over- and under-qualification are defined relative to the qualification needed to get the job, as reported by the respondents. Literacy mismatch is defined according to the OECD measure.

Source: Survey of Adults Skills (PIAAC) (2012).

4.2. How does mismatch interact with proficiency and other individual and job characteristics?

Qualification mismatch and proficiency

79. Several studies show that there are significant differences in skills proficiency among workers with the same qualifications. In the context of qualification mismatch, the best-skilled individuals in a given qualification category may get jobs that require higher formal qualifications while the least-skilled will only be able to get jobs requiring lower formal qualifications. Hence, individuals in the former group will appear as under-qualified, despite having the skills required for their jobs, while those in the latter group will appear as over-qualified, even though they lack some of the key skills needed to get and do a job with higher qualification requirements.[31]

80. On average, under-qualified individuals score higher in literacy proficiency than their well-matched counterparts (Figure 22), while over-qualified workers have lower scores than their well-matched peers. [32,33] This supports the theory that differences in proficiency within qualification levels could explain some qualification mismatch. And the differences in average scores are not negligible: each year of schooling corresponds to around seven points on the literacy proficiency scale.

81. Individual and job characteristics may influence the likelihood of qualification mismatch too. For example, it may take young people, as new entrants to the labour market, some time to sort themselves into well-matched jobs. Or, some workers may choose to accept a job for which they are over-qualified. This can happen when workers wish to remain close to their families or better reconcile work and family life and accept part-time jobs. An analysis of the impact of socio-demographic characteristics on qualification mismatch shows clearly that foreign-born workers are more likely to be over-qualified than their native counterparts (Figure 23). This could be because qualifications acquired outside the host country are not recognised, and so highly-qualified migrants are relegated to working in low-skilled jobs. In addition, 16-24-year-olds are more likely to be over-qualified than prime age workers (aged 25 to 44),[34] although the relationship is often not statistically significant. And, contrary to the assumption that women are more likely to be over-qualified because of family constraints, once socio-demographic and job characteristics are controlled for, married women (and single women, though this is not shown in Figure 23) are less likely to be over-qualified than their single male counterparts, with the only exceptions found in the Czech Republic.[35]

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31. These differences in skills proficiency within a qualification level are not necessarily related to performance in initial education. Some graduates may lack the generic skills, such as communication, team-work and negotiation skills, that the education system can foster, but that are better learned in the workplace. In addition, some workers may have the skills expected of their qualification level at graduation, but these skills may atrophy or become obsolete over time, particularly if they are not used or upgraded.

32 . These personal characteristics are likely to influence both the level of proficiency and the likelihood of mismatch.

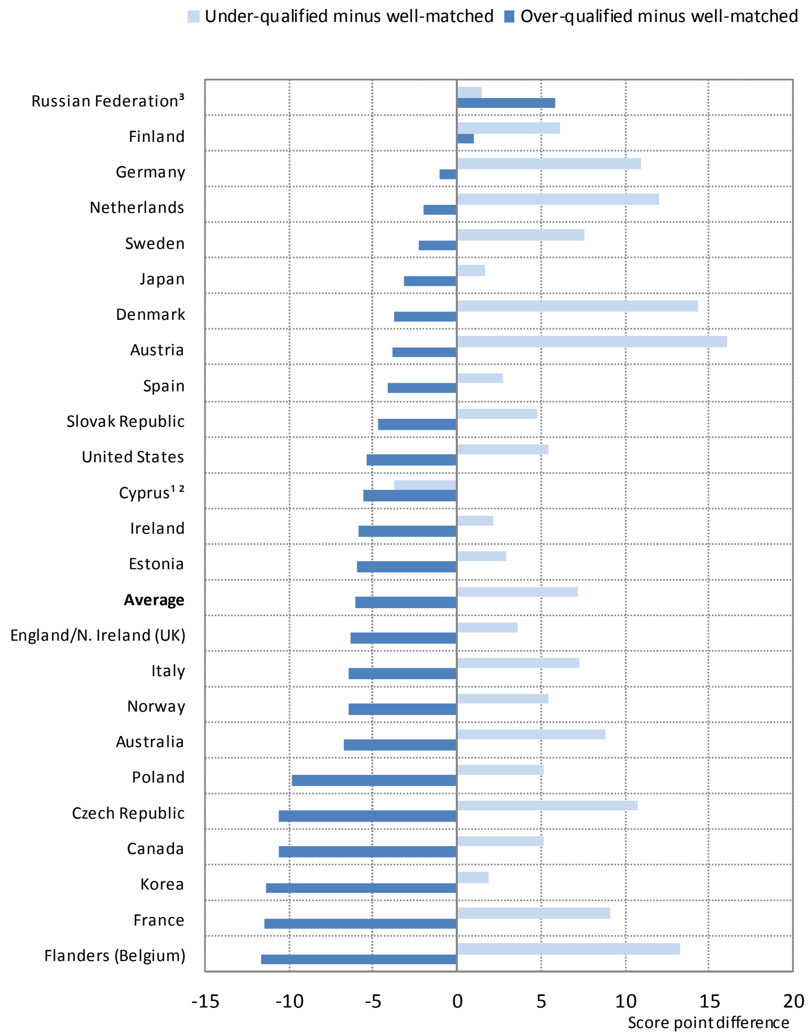
33 . Similar results are obtained when using scores in numeracy or problem solving in technology-rich environments.

34 . This could be explained by the fact that young people entering the labour market for the first time lack experience and are more likely to be hired for jobs that are below their qualification levels. However, it could also be due to an increase in the incidence of over-qualification over time, such that younger adults are more affected. Unfortunately, the data does not allow for separating these two effects.

35 . This is consistent with the mixed results, found in other studies, concerning the role played by gender and family status in explaining qualification mismatch (Quintini, 2011a). Husbands tend to optimise their job search, while their wives' job search is considered – by both the husband and the wife – to be of secondary

Figure 22
Literacy proficiency scores among over- and under-qualified workers

Difference in literacy scores between over-qualified[a] and well-matched workers and between under-qualified and well-matched workers, adjusted by socio-demographic characteristics[b]



Countries are ranked in decending order of the difference in literacy score between over-qualified and well-matched workers (over-qualified minus well-matched).

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: a. Over- and under-qualification are defined relative to the qualification needed to get the job, as reported by the respondents. b. The scores presented in the figure are adjusted for years of education, gender, age and foreign-born status.

Source: Survey of Adults Skills (PIAAC) (2012).

importance. Also, some researchers have argued that women with children may be more likely to be over-qualified because of the constraints on job choice imposed by child-rearing. However, there is no empirical evidence to support these claims.

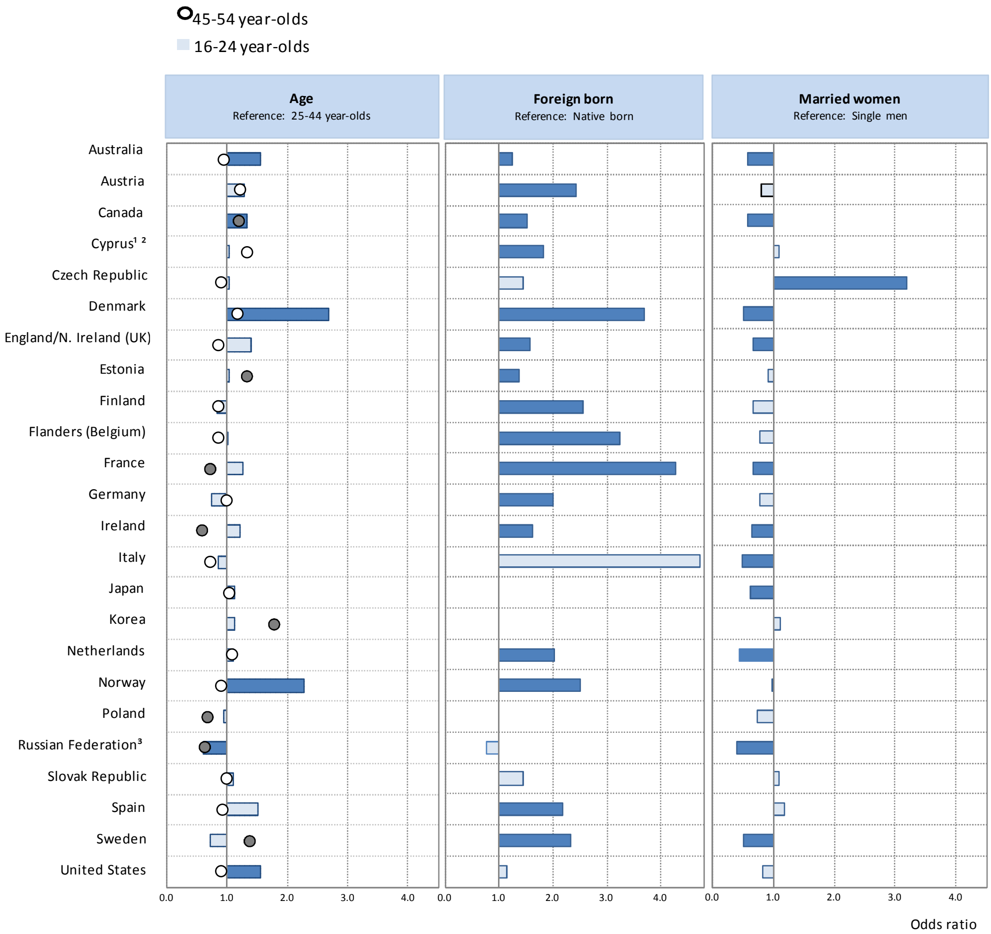
Socio-demographic and job characteristics and mismatch

82. An analysis of results also finds that working for a large firm reduces the likelihood of over-qualification in most countries, as does working full-time (Figure 24). One possible explanation for this is that firm size is a proxy for the quality of human-resource policies, with larger firms being better at screening candidates and at understanding how over-qualification may affect satisfaction at work and, ultimately, productivity. Large firms also have larger internal labour markets through which workers can be transferred to better matches inside the firm. Part-time jobs may have lower skills content, but they attract qualified workers because they are more compatible with personal/family life. Fixed-term contract jobs could be expected to have lower qualification requirements than permanent jobs, but they often attract tertiary-educated workers who cannot find a permanent position. This hypothesis is supported by the data in most countries.

Figure 23

Over-qualification, by socio-demographic characteristics

Adjusted odds ratios showing the likelihood of over-qualification[a], by socio-demographic characteristics[b]



Countries are listed in alphabetical oder.

1.2.3. See footnotes 1, 2 and 3 of Figure :

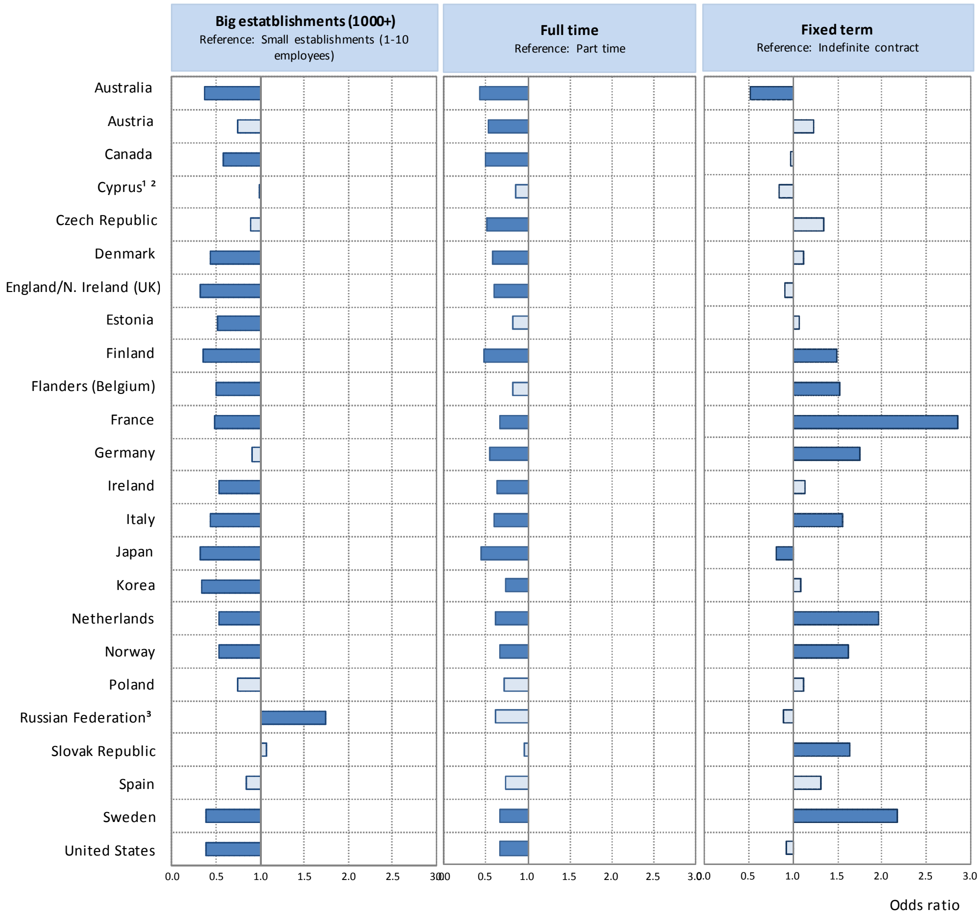
Notes: a. Over-qualification is defined relative to the qualification needed to get the job, as reported by the respondents. b.From logit regressions including controls for years of education, age, gender and marital status, foreign-born status, establishment size, contract type, hours worked. Statistically (at the 10% level) significant values are shown in darker tones. Estimates based on a sample size less than 30 (odds ratio of foreignborn with respect to native born for Japan, Korea and Poland) are not shown.

Source: Survey of Adults Skills (PIAAC) (2012).

Figure 24

Over-qualification, by job characteristics

Adjusted odds ratios showing the likelihood of over-qualification[a], by job characteristics[b]



Countries are listed in alphabetical oder.

1.2.3. See footnotes 1, 2 and 3 of Fig

Notes: a. Over-qualification is defined relative to the qualification needed to get the job, as reported by the respondents. b. From logit regressions including controls for years of education, age, gender and marital status, foreign-born status, establishment size, contract type, hours worked. Statistically (at the 10% level) significant values are shown in darker tones.

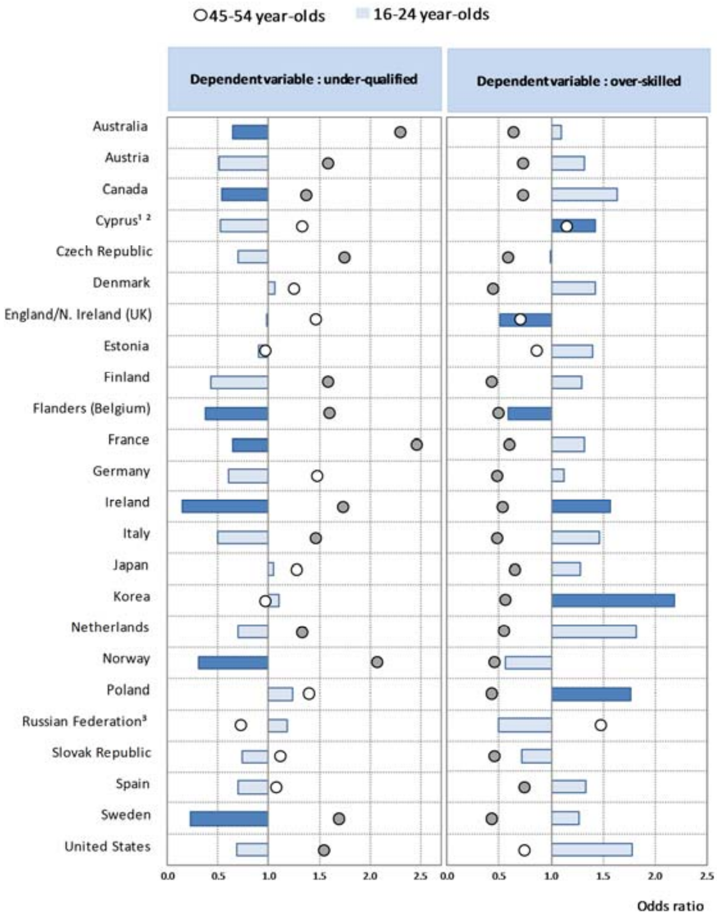
Source: Survey of Adults Skills (PIAAC) (2012).

83. No statistically significant patterns emerge across countries for under-qualification or skills mismatch, with the only exception of the association with age. The likelihood of over-skilling declines with age (Figure 25). Also, older workers are more likely to be under-qualified than prime-age workers with the same skills and qualifications – a result that is statistically significant in about a third of the countries that participated in the Survey of Adult Skills (PIAAC). This finding lends some support to the hypothesis that under-qualified workers may be well matched to their jobs in terms of their skills but lack the qualifications that would formally certify those skills.

Figure 25

Under-qualification and over-skilling, by age

Adjusted odds ratios showing the likelihoods of being under-qualified[a] or over-skilled, by age group (reference : 25-44 year-olds) [b]



Countries are listed in alphabetical oder.

1.2.3. See footnotes 1, 2 and 3 of Figu

Notes: a. Under-qualification is defined relative to the qualification needed to get the job, as reported by the respondents. b. From logit regressions including controls for years of education, age, gender and marital status, foreign-born status, establishment size, contract type, hours worked. Statistically (at the 10% level) significant values are shown in darker tones. Estimates based on a sample size less than 30 (odds ratio of 16-24 year-olds with respect to 25-44 year-olds for Spain) are not shown.

Source: Survey of Adults Skills (PIAAC) (2012).

4.3. The effect of mismatch on the use of skills and wages

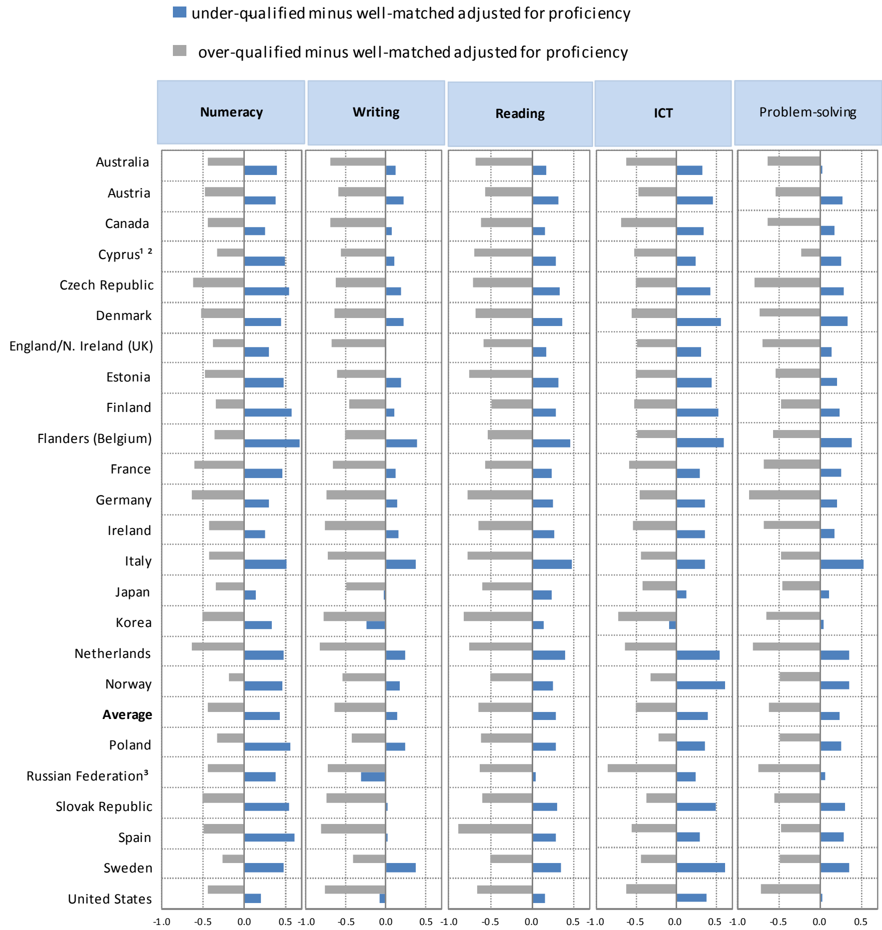
84. Analysis of data from the Survey of Adult Skills (PIAAC) confirms that workers who are over-qualified and over-skilled in literacy use their skills less than their well-matched counterparts with the same level of proficiency. The inverse is true for those who are under-skilled in literacy. Workers in the latter group probably have to exert extra effort at work, given their levels of skills, and that can have a negative impact on job satisfaction.

85. Overall, numeracy skills appear to be better used at work, while problem-solving skills appear to be most often and most extensively ill-used. Across countries and skills, the largest "waste" of human capital resulting from over-qualification in information-processing skills is observed in Canada, Ireland, Flanders (Belgium) and the Netherlands (Figure 26). By contrast, over-skilling has more negative consequences for the use of skills in Canada, the Netherlands and the United States (Figure 27).

Figure 26

Skills use and qualification mismatch

Difference in the use of information-processing skills between under/over-qualified[a] and well-matched workers, adjusted for literacy and numeracy proficiency scores[b]



Countries are listed in alphabetical order.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

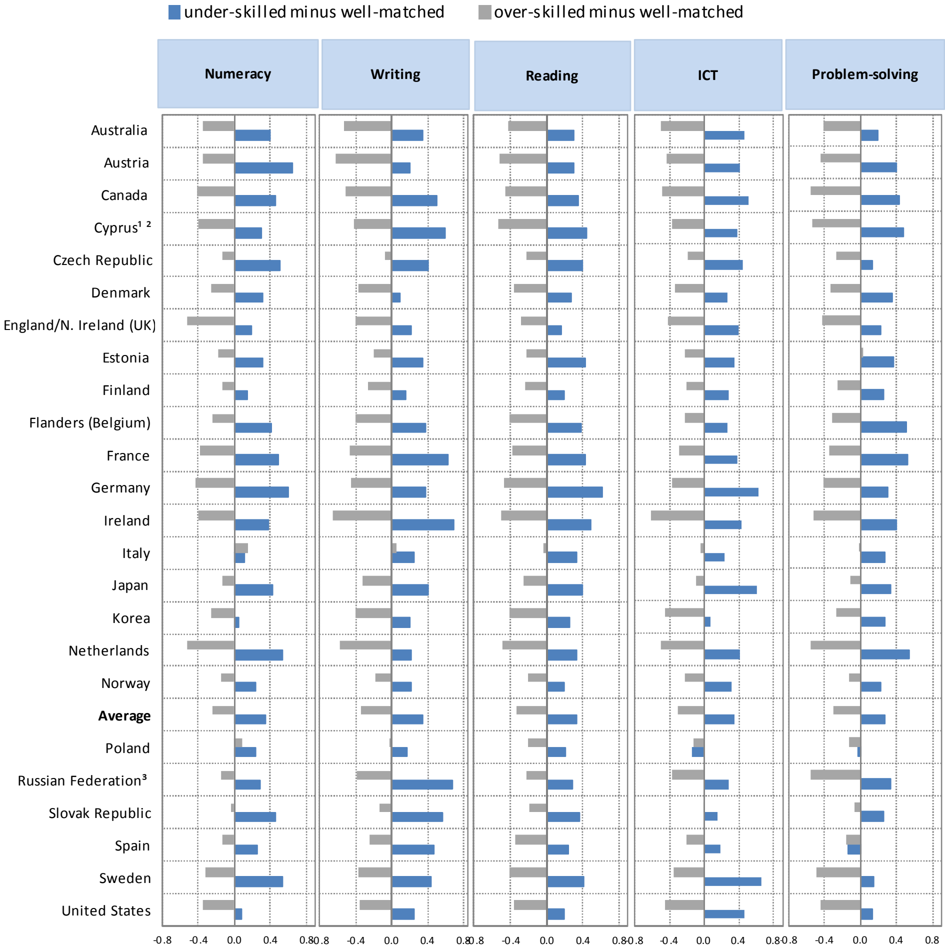
Notes: a. Over- and under-qualification are defined relative to the qualification needed to get the job, as reported by the respondents.
b.OLS regressions including literacy and numeracy proficiency scores as controls.

Source: Survey of Adults Skills (PIAAC) (2012).

Figure 27

Skills use and skills mismatch

Difference in the use of information-processing skills between workers under/over-skilled in literacy and well-matched workers, adjusted by literacy and numeracy proficiency scores[a]



Countries are listed in alphabetical order.

1.2.3. See footnotes 1, 2 and 3 of Figure 1.

Notes: a. OLS regressions including literacy and numeracy proficiency scores as controls.

Source: Survey of Adults Skills (PIAAC) (2012).

86. Over-qualification has a stronger negative effect on real hourly wages than over-skilling, when workers are compared with equally-qualified and equally-proficient well-matched counterparts (Figure 28). On average, across countries, over-qualified workers earn about 12% less than well-matched workers with the same qualification and proficiency levels. The largest differences – at or exceeding 18% – are observed in Estonia, Korea, Poland and the United States. These results remain unchanged when controls for skills mismatch are removed.

87. The effect of over-skilling on wages is small and often not statistically significant, and remains so even when the controls for qualification mismatch are removed. The largest and statistically significant differences are observed in Poland and the United States, where over-skilled workers earn about 3% less

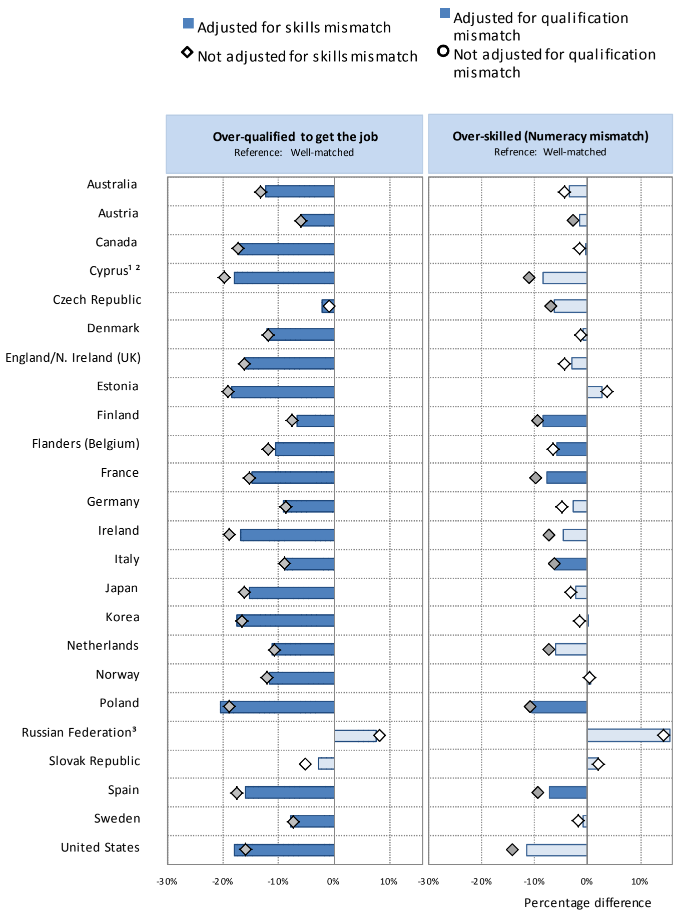
than their equally skilled,[36] well-matched counterparts. In both countries, this relatively large negative effect is in addition to the sizeable adverse effect of over-qualification on wages.

88. Both under-skilling and under-qualification are associated with higher wages compared to the wages of workers who are well-matched and equally qualified and skilled, although the effect of under-skilling is usually not statistically significant and is negative in Ireland (Figure 4.29).

Figure 28

Effect of over-qualification and over-skilling on wages

Percentage difference[a] in wages[b] between over-qualified[c]/skilled and well-matched employees



Countries are listed in alphabetical oder.

1.2.3. See footnotes 1, 2 and 3 of Figu

Notes: a.From OLS regressions including controls for years of education, age groups, gender, marital status, working experience, tenure, foreign-born status, establishment size, contract type, hours worked, public sector dummy, proficiency in numeracy and use of skills at work. The sample includes only employees. Statistically (at the 10% level) significant values are shown in darker tones. b.Hourly wages. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. c.Over-qualification is defined relative to the qualification needed to get the job, as reported by the respondents.

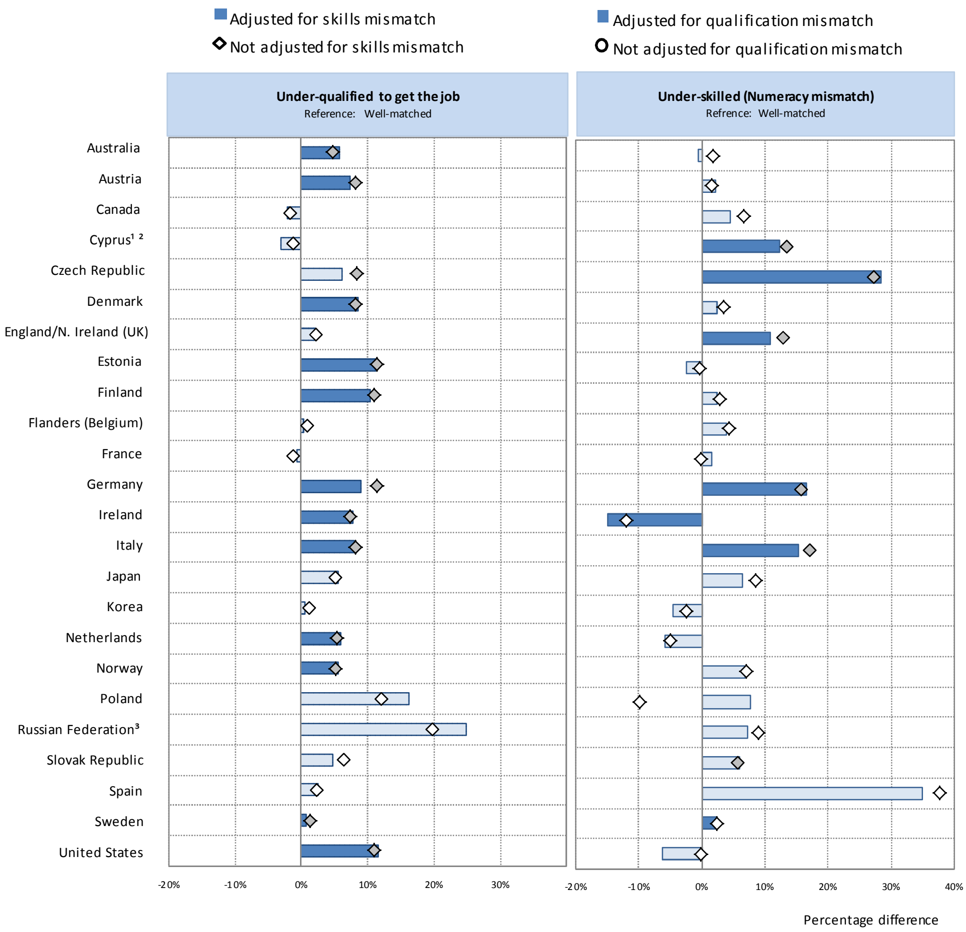
Source: Survey of Adults Skills (PIAAC) (2012).

36. Excluding the Russian Federation whose coefficients are particularly large but not statistically significant, gives an average wage penalty of 10%.

Figure 29

Effect of under-qualification and under-skilling on wages

Percentage difference[a] in wages[b] between under-qualified [c]/skilled and well-matched employees



Countries are listed in alphabetical oder.

1.2.3. See footnotes 1, 2 and 3 of Figu

Notes: a. From OLS regressions including controls for years of education, age groups, gender, marital status, working experience, tenure, foreign-born status, establishment size, contract type, hours worked, public sector dummy, proficiency in numeracy and use of skills at work. The sample includes only employees. Statistically (at the 10% level) significant values are shown in darker tones. b.Hourly wages. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. c.Under-qualification is defined relative to the qualification needed to get the job, as reported by the respondents.

Source: Survey of Adults Skills (PIAAC) (2012).

89. This evidence should not be interpreted as suggesting that having skills in excess of those required at work is not valued at all on the labour market. On average across countries, over-qualified workers earn about 4% more than well-matched workers in similar jobs. In other words, a tertiary graduate who holds a job requiring only an upper secondary qualification will earn *less* than if he were in a job requiring a tertiary qualification, but *more* than an upper secondary graduate in a job requiring upper secondary qualifications. Similarly, on average, an under-qualified individual earns about 17% *less* than workers who are well-matched in similar jobs. Hence, an upper secondary graduate in a job requiring tertiary qualifications will earn *more* than an upper secondary graduate in a job requiring upper secondary qualifications but *less* than a tertiary graduate in a job requiring tertiary qualifications.

90. Qualification mismatch and skills mismatch may both have distinct effects on wages, even after adjusting for both qualification level and proficiency scores, because jobs with similar qualification requirements may have different skill requirements. This may happen because employers can evaluate

qualifications but they cannot measure skills directly. In addition, the kinds of mismatch in skills captured by the two indicators are different: the survey's indicators of skills mismatch are based on numeracy, literacy and problem solving, while skills mismatch captured by qualification-based indicators may be interpreted as more general and may be based, for example, on the level of job-specific skills.

Conclusions

91. Analysis of results from the Survey of Adult Skills (PIAAC) shows that the use of skills in the workplace influences a number of labour-market phenomena, including productivity, the gender wage gap and the wage gap between temporary and permanent workers. Age, gender, qualification level, work time arrangements as well as the distribution of workers across occupations are found to be important in shaping the distribution of skills use. In addition, skills-use indicators are found to correlate only weakly with measures of skills proficiency. As a result, it is not uncommon that more proficient workers use their skills at work less intensively than less proficient workers do. This latter finding points to the existence of significant mismatch between skills and their use at work, particularly for some socio-demographic groups. Data shows that over-qualification is particularly common among young and foreign-born workers and those employed in small establishments, in part-time jobs or on fixed-term contracts. Over-qualification has a significant impact on wages, even after adjusting for proficiency, and on workers' productivity. It also implies a "waste" of human capital, since over-qualified workers tend to under-use their skills. However, part of this type of mismatch is due to the fact that some workers have lower skills proficiency than would be expected at their qualification level, either because they performed poorly in initial education or because their skills have depreciated over time. By contrast, under-qualified workers are likely to have the skills required at work, but not the qualifications to show for them. Mismatches in skills proficiency have a weaker impact on wages than qualification mismatch. This suggests that either labour-market mismatch may be more often related to job-specific or generic skills than to those measured in the three domains covered by the survey; and/or that employers succeed in identifying their employees' real skills, irrespective of their formal qualifications, and adapt job content accordingly.

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