



## 5

# Developing and Maintaining Key Information-Processing Skills

This chapter examines the processes and practices that help to develop and maintain skills – and the factors that can lead to a loss of skills. It discusses the impact of age, educational attainment and participation in adult learning activities on proficiency in literacy, numeracy and problem-solving skills, as measured by the Survey of Adult Skills (PIAAC), and how engagement in relevant activities outside of work has an even stronger relationship with proficiency in the skills assessed than engagement in the corresponding activities at work.



An individual's measured proficiency in literacy, numeracy and problem solving in technology-rich environments represents the cumulative outcome of a range of factors, including the volume, quality and timing of participation in education, work history, engagement in various practices, such as regular reading or use of ICTs, and the effects of biological maturation and age-related cognitive development and decline. This chapter explores the information available from the Survey of Adult Skills (PIAAC) regarding the processes and practices through which proficiency is developed and maintained and the factors that lead to its decline. In so doing, the chapter deepens the analysis of the relationships between age and educational attainment and proficiency undertaken in Chapter 3. The relationship between participation in adult education and training and proficiency is also explored, as are the relationships between literacy- and numeracy-related practices and ICT use and proficiency.

#### Among the main findings:

- Proficiency in literacy, numeracy and problem solving in technology-rich environments is closely related to age in all countries, reaching a peak at around 30 years of age and then declining steadily, with the oldest age groups displaying lower levels of proficiency than the youngest. The gain in proficiency observed for each additional year of age for adults between 16 and 30 reflects the fact that, in most countries, significant proportions of young people continue in education or training until their mid- to late 20s. The decline in proficiency associated with increasing age is related both to differences in the amount and quality of the opportunities that individuals have had to develop and maintain proficiency (particularly, but not exclusively, through formal education and training) over their lifetimes and to the effects of biological ageing.
- The level of education and training completed has a close relationship to proficiency. In all countries, individuals with tertiary qualifications have higher levels of proficiency than those with upper secondary qualifications who, in turn, have higher proficiency than those who have not attained upper secondary education. At the same qualification level, proficiency varies considerably between countries.
- There is a clear relationship between the extent of participation in organised adult learning and the average level of key information-processing skills in a given country. The large variation among countries at similar levels of economic development suggests major differences in learning cultures, learning opportunities at work, and adult-education structures.
- What adults do, both at work and outside work, is closely related to proficiency. Adults who engage more often in literacy- and numeracy-related activities and use ICTs more (both at work and outside of work) have higher proficiency in literacy, numeracy and problem solving in technology-rich environments. Engagement in relevant activities outside of work has an even stronger relationship with the skills assessed than engagement in the corresponding activities at work.

The relationship among proficiency in information-processing skills and participation in education and training (initial and ongoing) and engagement in activities such as reading and writing, use of numeracy and the use of ICTs is two-way. Participation in education is expected to develop information-processing skills. Individuals with higher levels of such skills are also expected to be more likely to participate in higher levels of education. Similarly, while reading often is likely to aid in developing and maintaining reading skills, having better reading skills is also likely to result in greater enjoyment of reading and, thus, in reading more frequently. The challenge to policy makers and other stakeholders, including employers and social partners, is ensuring that individuals with low proficiency do not become caught in a vicious cycle in which low proficiency and limited opportunities to maintain and develop proficiency become mutually reinforcing.

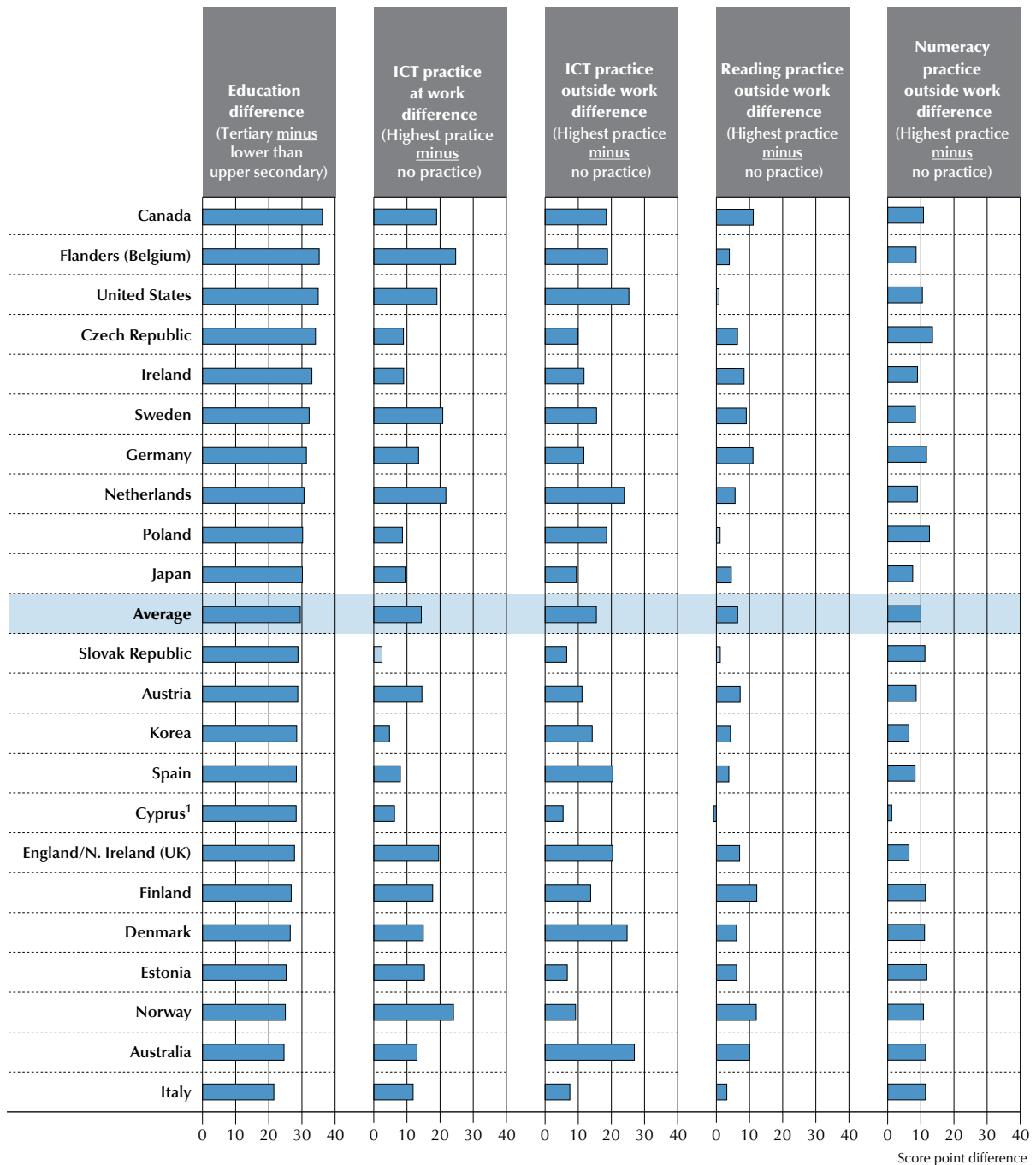
The findings confirm the importance of ensuring that all young people leave secondary school with well-developed skills in literacy, numeracy and the use of ICTs so that they can access, analyse and communicate information. For adults who left initial education with low proficiency, the availability of adult learning programmes tailored to their needs is essential. Beyond instruction, the opportunity to engage in relevant practices over the long term is also important both for developing proficiency and preventing its loss. Within the workplace, for example, redesigning work tasks to maximise engagement in activities that require the use of literacy, numeracy and ICT skills should be considered in conjunction with providing training. Overall, some countries have been better than others in establishing systems that combine high-quality initial education with opportunities and incentives for the entire population to continue to develop proficiency in information-processing skills after the completion of initial education and training, whether outside work or at the workplace.



■ Figure 5.1 (L) ■

### Synthesis of practice-oriented differences in literacy proficiency

Adjusted differences in literacy scores by educational attainment levels and practice-oriented factors



1. See notes at the end of this chapter.

**Notes:** Statistically significant differences are marked in a darker tone. Differences are adjusted for all other variables and their categories included in the model: age, gender, education, immigration and language background, socio-economic background, adult education participation, and ICT, reading and numeracy practice at and outside work. Only the contrast differences between lowest and highest levels of education and four other practice-oriented factors associated with the largest average score-point differences are shown in this chart. For more detailed model results for each category of each variable included in the model, see Table B5.3 (L) in Annex B.

Countries are ranked in descending order of the difference in literacy scores between tertiary and lower than upper secondary educational attainment.

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.1(L).

**StatLink** <http://dx.doi.org/10.1787/888932901961>



## OVERVIEW OF EDUCATION AND TRAINING AND PRACTICE-ORIENTED FACTORS LINKED TO DEVELOPING AND MAINTAINING PROFICIENCY

A summary of the relationships among past and present participation in education, the practice of skills and proficiency in literacy is presented in Figure 5.1 (L). The factors presented are among those with the strongest relationship to proficiency. Similar relationships are found concerning proficiency in numeracy, although further analyses are needed regarding the results on the problem-solving in technology-rich environments scale.<sup>1</sup> The net differences in the average scores of individuals who fall into contrasting categories of the factors in question (e.g. individuals with tertiary-level qualifications compared to those with lower-than-upper secondary attainment) are presented for the following variables: educational attainment, level of engagement in ICT practices at and outside work, and the level of engagement in literacy and numeracy practice outside work. In each case, the adjusted differences in scores account for the differences associated with age, immigration and language background, as well as other relevant education and practice-related factors.

Educational attainment and ICT use, both at work and at home, are found to have the strongest relationship to proficiency in literacy. As is discussed in Chapter 3, educational attainment has a strong relationship with both literacy and numeracy proficiency after accounting for other factors. While taking into account practice-related factors in addition to background characteristics reduces the strength of the relationship, adults with higher-than-upper secondary attainment score, on average across countries, nearly 30 points higher in literacy than those with lower-than-upper secondary attainment when background characteristics and engagement in relevant practices are taken into account.

A striking finding is the strong relationship between the frequent use of ICTs at and outside work and proficiency in literacy. Across countries, the average proficiency gap between adults who frequently engage in ICT-related practices *at work* and those who never do is about 15 score points. The average score-point advantage on the literacy scale for adults who frequently use ICTs *outside work* compared to those who never do is just over 15 score points. Regardless of the level of education, engaging more frequently with ICTs is strongly related to literacy proficiency, on average. The strength of the relationship varies between countries. In England/Northern Ireland (UK), Flanders (Belgium), the Netherlands, Norway, Sweden and the United States, frequent engagement in ICT practices at work is associated with approximately a 20-point advantage on the literacy scale over those who never use ICTs at work. In contrast, the advantage for frequent users is around 10 points or less in the Czech Republic, Ireland, Korea, Poland, the Slovak Republic and Spain. Similar results are found for numeracy.

Adults who read frequently and frequently engage in numeracy-related activities outside work have higher scores on the literacy scale (6 and 10 points), on average, than their counterparts who rarely engage in such activities. Interestingly, reading and ICT use are closely linked. If the use of ICTs is removed from the analysis, the strength of the association between literacy proficiency and reading in and outside work increases significantly.

Participation in adult education and training is found to have a positive, but not particularly strong, relationship to proficiency when educational attainment and practice-oriented factors are taken into account (see Table A5.1 [L]). This is partly due to the fact that educational attainment and participation in adult education and training are closely correlated. It is well documented that adults with higher levels of education are much more likely to participate in adult education and training than adults with lower levels of education (e.g. Desjardins and Rubenson, 2013).

## AGE, AGEING AND PROFICIENCY

As noted in Chapter 3, there is an overall negative relationship between age and proficiency in information-processing skills. Given the demographic changes occurring in most OECD countries, it is important to understand the underlying reasons for the observed differences in performance. Many OECD countries have experienced steep drops in fertility combined with a continued increase in longevity and increased rates of labour force participation among adults over 55. As a result, the average age of the workforce is rising.<sup>2</sup> As the proportion of young people in the labour force shrinks, additions to the stock of skills available to the labour market become more dependent on up-skilling and/or re-skilling the existing workforce. This is why it is important to gain a better understanding of the causes and consequences of skills gain and loss over a lifetime.



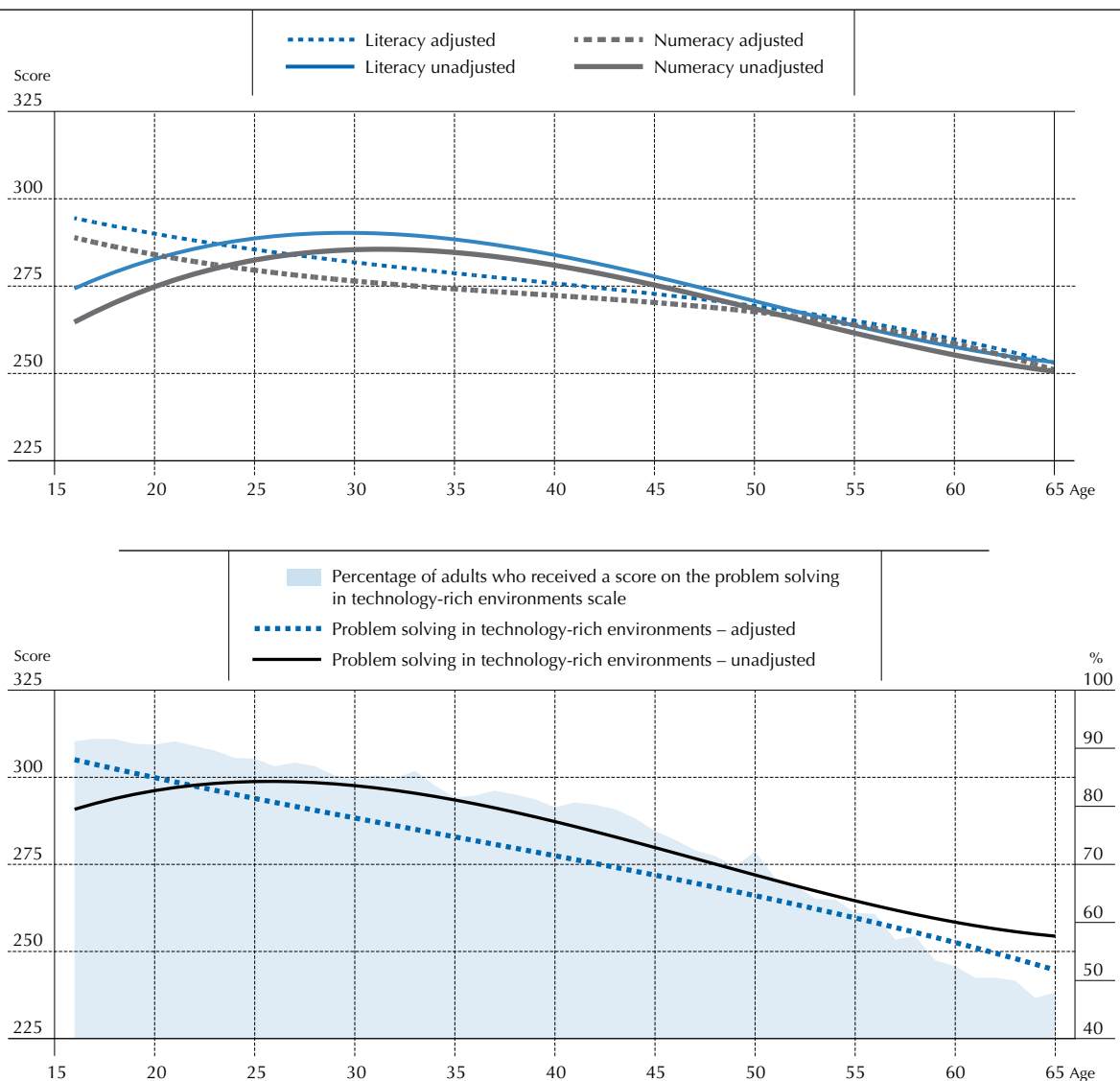
## Observed age differences

Figure 5.2a shows the relationship between the skills measured and age, before and after accounting for educational qualifications and language background. The unadjusted results show an inverted U-shape relationship between proficiency and age for all three measured skills. Proficiency reaches a peak at around 30 years of age and then declines steadily, with the oldest age groups displaying lower levels of proficiency than the youngest. Once educational qualifications are taken into account, proficiency declines consistently with increasing age. Figures 5.2b (L) and 5.2c (L) show the same analysis on the literacy scale for individual countries. The age-skills profiles presented exclude foreign-born adults, since inflows of migrants constitute a major compositional change to the population base.

■ Figure 5.2a ■

### Relationship between skills proficiency and age

Average trend scores by age, adjusted for educational attainment and language background, foreign-born adults excluded

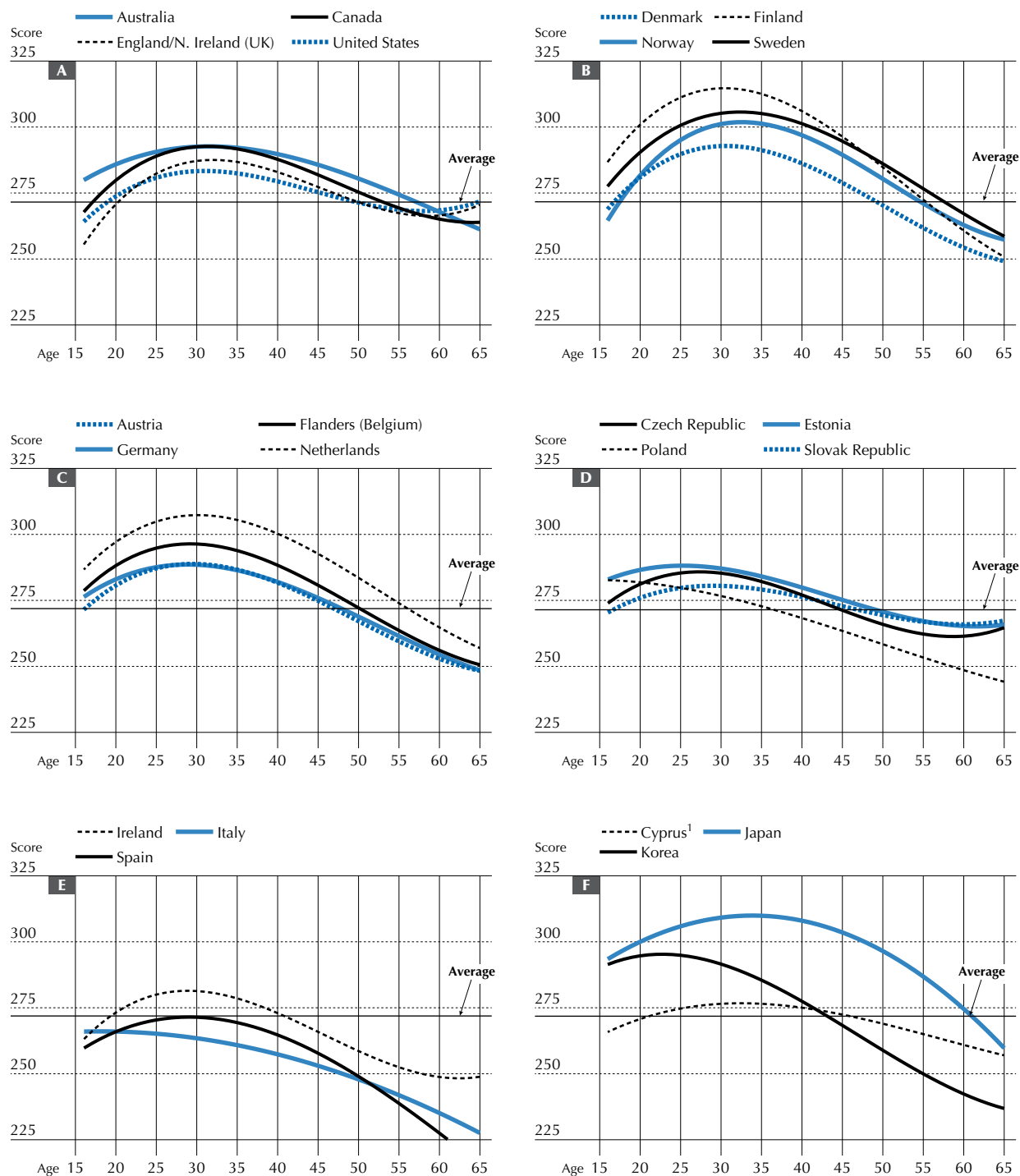


**Notes:** A cubic specification of the trend curves is found to be most accurate in reflecting the distribution of scores by age in most countries. Unadjusted and adjusted results account for cross-country differences in average scores by age cohort. Adjusted results also account for educational attainment and language background differences. The reference group for which the adjusted curves are drawn is adults who have attained upper secondary education and whose first or second language learned as a child is the same as the language of the assessment. Foreign-born adults are excluded from the analysis. See corresponding tables mentioned in the source below for regression parameters and significance estimates.

**Source:** Survey of Adults Skills (PIAAC) (2012), Table A5.2 (L), and Tables A5.2 (N) and A5.2 (P) (available on line).

**StatLink** <http://dx.doi.org/10.1787/888932901980>

■ Figure 5.2b (L) ■

**Relationship between literacy proficiency and age***Trend scores in literacy, by age, foreign-born adults excluded*

1. See notes at the end of this chapter.

**Notes:** A cubic specification of the trend curves is found to be most accurate in reflecting the distribution of scores by age in most countries. Foreign-born adults are excluded from the analysis. See corresponding table mentioned in the source below for regression parameters and significance estimates.

**Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.**

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.2 (L).


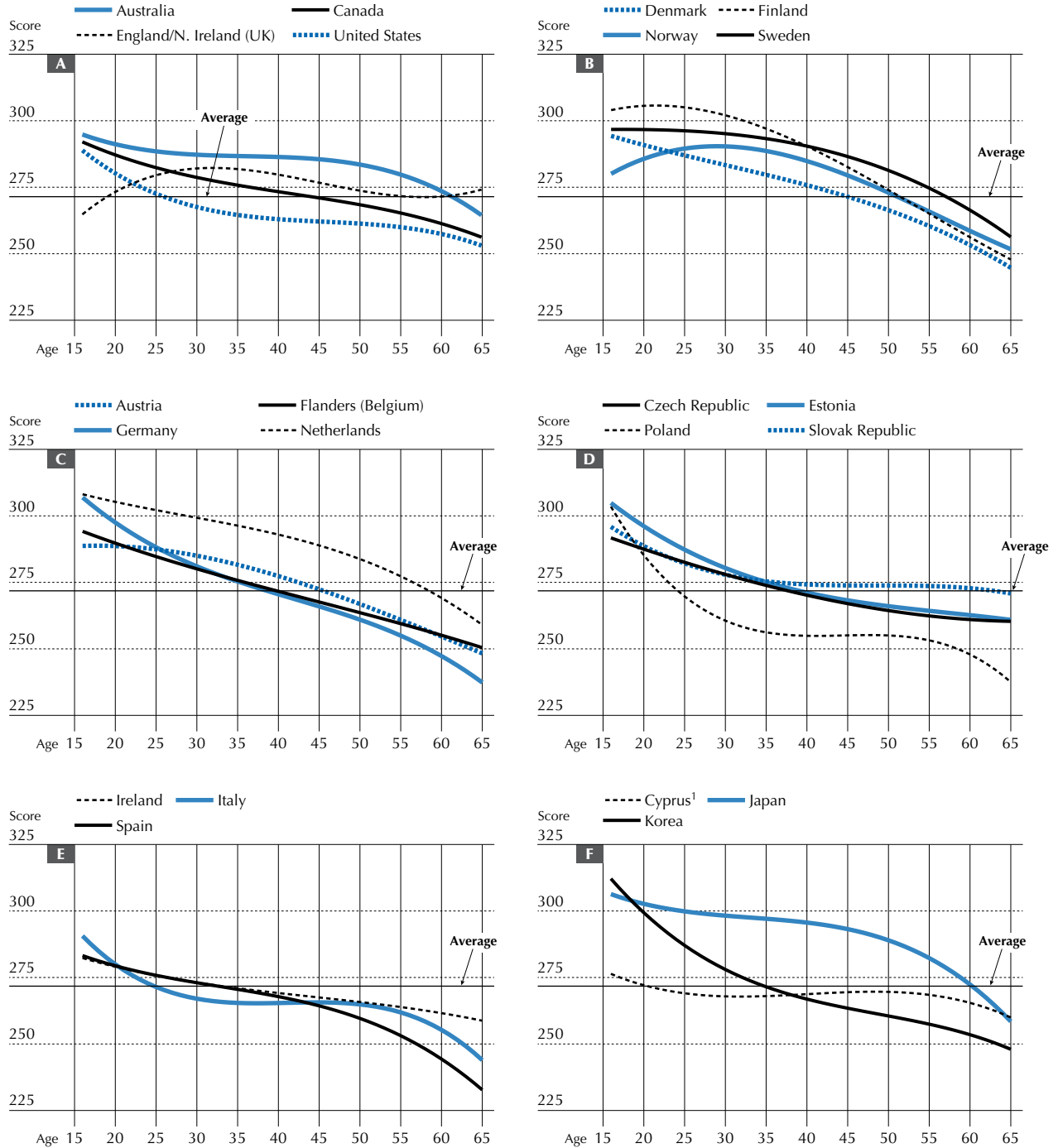
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Figure 5.2c (L)

**Relationship between literacy proficiency and age (adjusted)**

Trend scores on the literacy scale, by age, adjusted for educational attainment and language background, foreign-born adults excluded



1. See notes at the end of this chapter.

**Notes:** A cubic specification of the trend curves is found to be most accurate in reflecting the distribution of scores by age in most countries. Adjusted results also account for educational attainment and language background differences. Foreign-born adults are excluded from the analysis. See corresponding table mentioned in the source below for regression parameters and significance estimates.

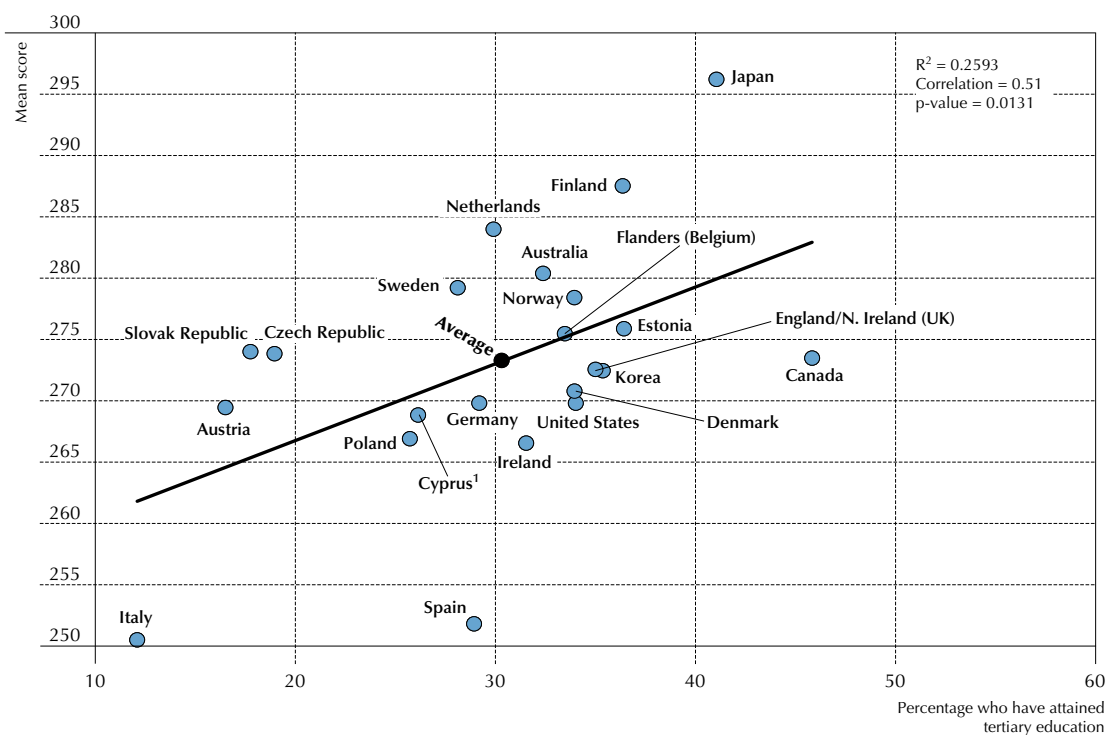
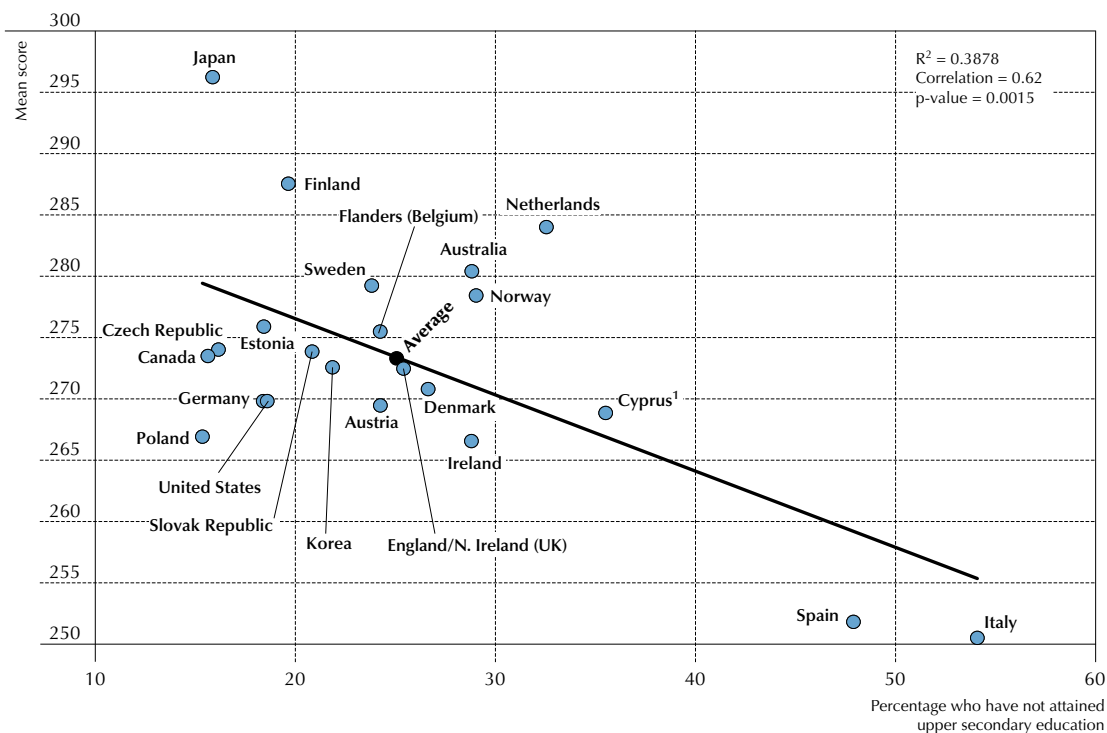
Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.2 (L).

**StatLink** <http://dx.doi.org/10.1787/888932902018>


■ Figure 5.3 (L) ■

**Educational attainment, by average literacy proficiency**  
*Percentage of adults who have not attained upper secondary education  
 and of those who have attained tertiary education, by literacy proficiency score*



1. See notes at the end of this chapter.

Source: Survey of Adults Skills (PIAAC) (2012), Table A5.3 (L).

StatLink  <http://dx.doi.org/10.1787/888932902037>





The increments in proficiency observed for each additional year of age for adults between 16 and 30 can be linked to the fact that, in most countries, significant proportions of young people continue in education or training until their mid- to late 20s. In other words, participation in education and training after the age of 16 continues to add “value” by increasing proficiency in information-processing skills. This conclusion is also supported by the fact that the mean literacy proficiency of adults is positively related to the overall level of educational qualifications (see Figure 5.3 [L]). There is a positive and moderately strong relationship between average proficiency and the proportion of the population that has attained tertiary-level qualifications, and a moderately strong negative relationship to the proportion of the population that has not attained upper secondary education.

The decline in proficiency in information-processing skills seen in adults over 30 suggests that there are also other factors and processes involved in maintaining skills. Indeed, when educational attainment is accounted for, as shown in Figure 5.2c (L), from as early as the age of 16, older cohorts score progressively lower, on average, than younger cohorts in nearly all countries. This reveals that the negative relationship between key information-processing skills and age cannot be accounted for solely on the basis of generational differences in average levels of educational attainment. Different age cohorts may, of course, have experienced a different quality of education such that similar qualifications do not necessarily translate into similar levels of proficiency as measured by the Survey of Adult Skills. To the extent that differences in the quality of education explain observed differences in proficiency related to age, the results would then suggest that the quality of education, in terms of the skills measured by the Survey of Adult Skills, has steadily improved over time across all participating countries. While this may be possible to some extent, it is likely only part of the explanation. For example, the negative relationship between skills and age can also be related to other developments in society over time or to the loss of skills among individuals or within cohorts as they age.

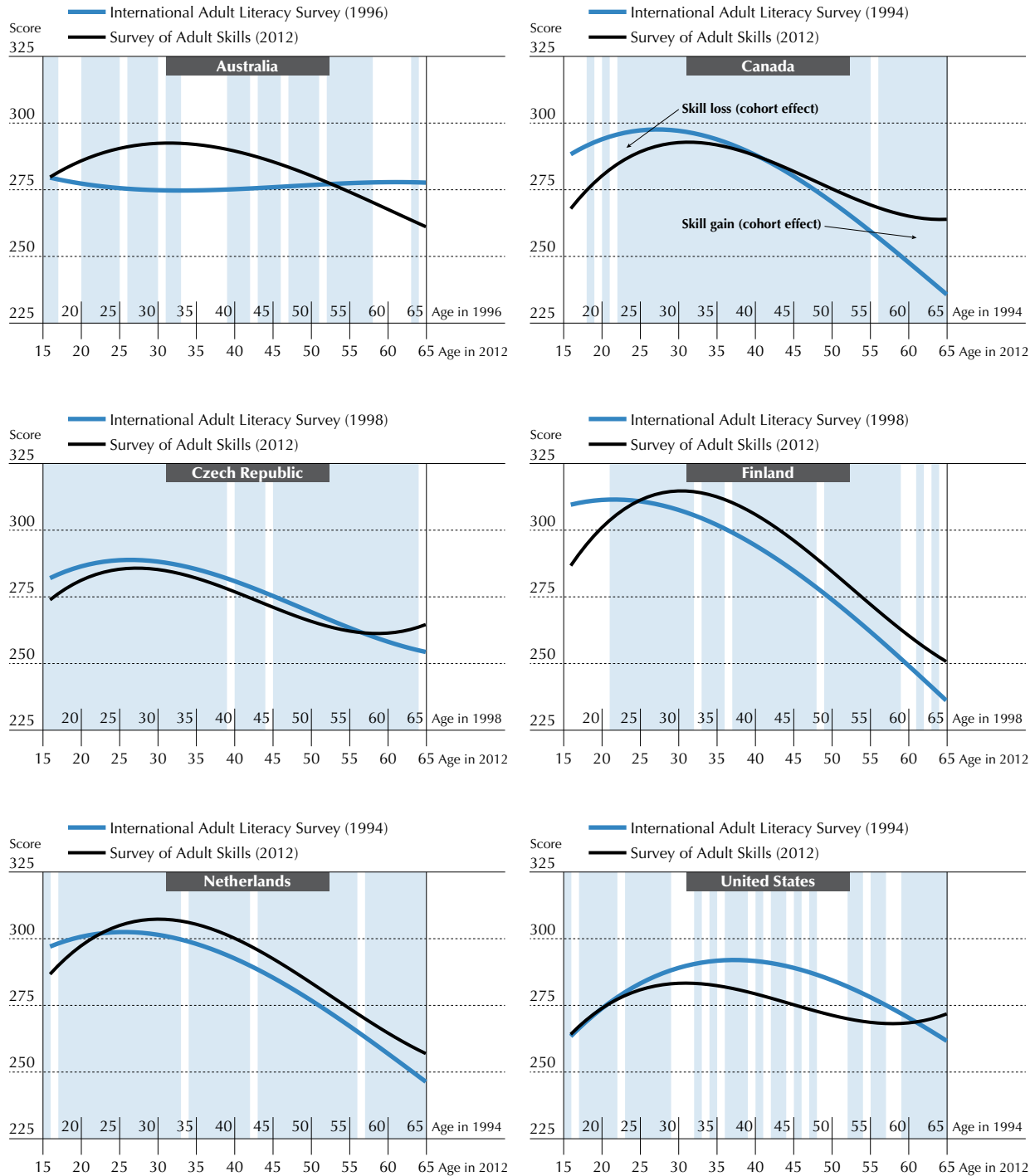
Despite the striking similarities that emerge when comparing age-skill profiles across countries, there are important country differences. This suggests that policy and other circumstances may weaken the impact of the factors responsible for the otherwise negative relationship between key information-processing skills and age. For example, Italy, Korea and Poland show unadjusted age-skill profiles with progressively lower skills, on average, already from the age of 16. This suggests that, compared with other countries, the quantity and/or quality of post-compulsory education in the recent past may have been insufficient to improve the information-processing skills base of 16-30 year-olds or that the quality of initial schooling has recently increased. The adjusted profile for England/Northern Ireland (UK) and Norway show that young adults aged 16-24 score lower than those aged 25-29, despite adjusting for the quantity of education. This suggests that post-compulsory learning may add considerably to the stock of information-processing skills in those countries or that the quality of initial schooling has recently declined. Also, in Australia, Finland and Japan, the adjusted age profiles show comparatively high average scores with less rapid declines for specific cohort ranges, which suggests variations in the factors and processes that may help adults maintain skills longer.

### Explaining age differences: Cohort and ageing effects

In understanding the relationships between age and other variables using cross-sectional data, it is useful to distinguish age, cohort and period effects. Age effects are the consequences of growing older, such as the effects of neurological development or behavioural maturation. Cohort effects are the consequences of being born at different times: individuals who attended school in the 1960s will not have received the same type of education as adults who went to school in the 1980s. Period effects are the consequences of influences that vary through time, such as economic recessions. The age-skill profiles depicted in Figure 5.2a, 5.2b (L) and 5.2c (L) combine these effects. However, since there are links between the measures of literacy and numeracy in the Survey of Adult Skills and those in previous surveys of adult skills, it is possible to disentangle some of these effects. The *Reader's Companion* to this report provides a brief overview of the relationship between the Survey of Adult Skills and the International Adult Literacy Survey and the Adult Literacy and Life Skills Survey.

In brief, the Survey of Adult Skills, the International Adult Literacy Survey and the Adult Literacy and Life Skills Survey provide repeated cross-sectional measures of literacy proficiency that are representative at the cohort level. These can be used to explore whether the observed differences in proficiency by age are related to the experiences of different age cohorts (cohort effects) or skills loss as adults age (ageing effects) or both. For example, younger cohorts attain higher average levels of education compared with older cohorts. This important difference may explain age differences in proficiency. Alternatively, there is also evidence to suggest that adults experience skills loss as they age (see Desjardins and Warnke, 2012).

■ Figure 5.4a (L) ■

**Effect of belonging to a certain age group on literacy proficiency***Trend scores on the literacy scale, by age (cohort effect), for selected countries, foreign-born adults excluded*

**Notes:** Sections of the chart shaded in light blue reveal score differences that are not statistically significant at the 5% level using a one-tailed test. A cubic specification of the trend curves is found to be most accurate in reflecting the distribution of scores by age in most countries. Foreign-born adults are excluded from the analysis. See corresponding table mentioned in the source below for regression parameters and significance estimates.

*Only a random sample of countries are shown as an example.*

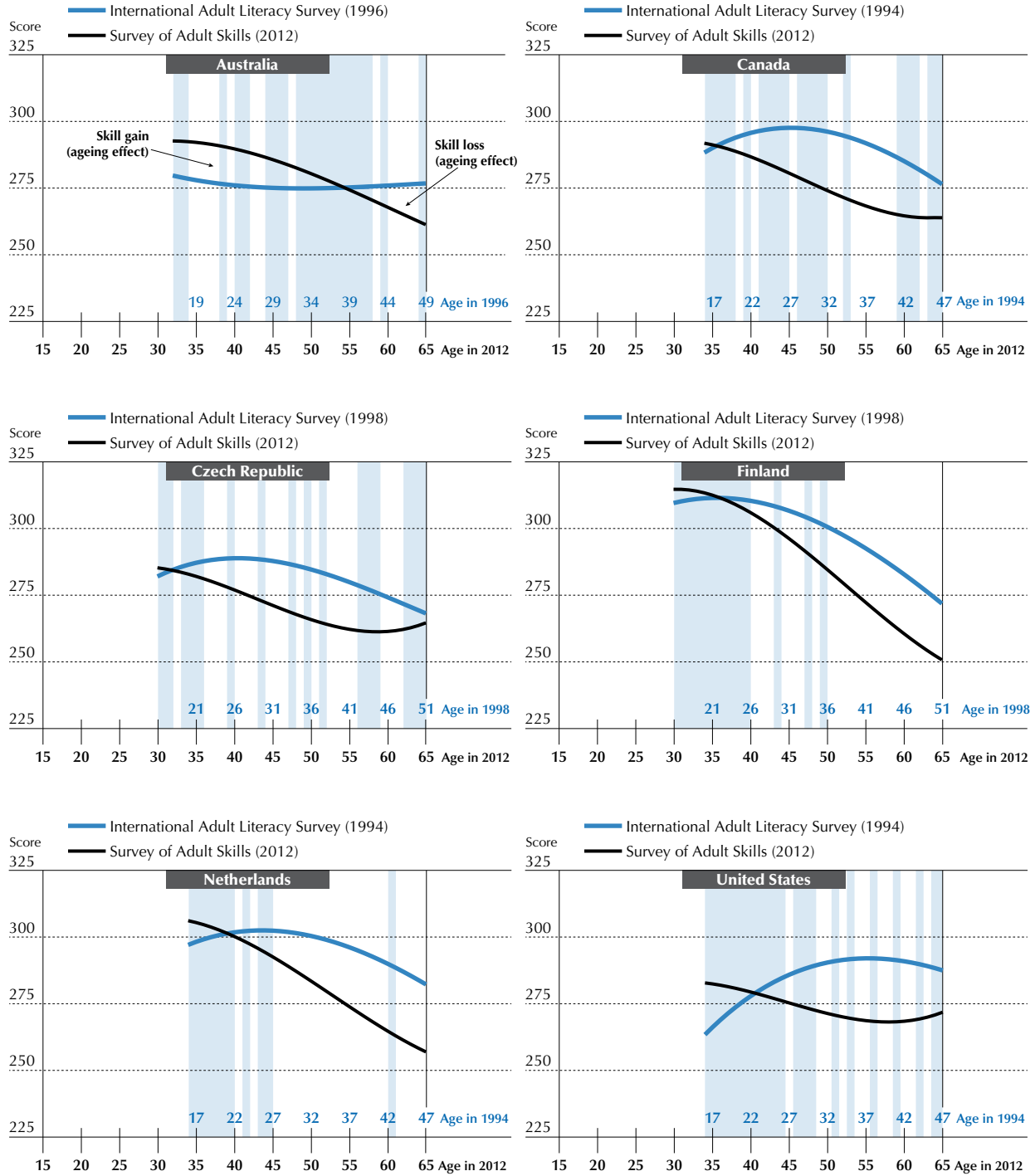
**Source:** International Adult Literacy Survey (1994-1998), and Survey of Adult Skills (PIAAC) (2012), Tables A5.2 (L), A5.4 (L), and Table B5.1 in Annex B.

**StatLink** <http://dx.doi.org/10.1787/888932902056>



Figure 5.4b (L)  
Effect of ageing on literacy proficiency

Trend scores on the literacy scale, by age (ageing effect), for selected countries, foreign-born adults excluded



Notes: Sections of the chart shaded in light blue reveal score differences that are not statistically significant at the 5% level using a one-tailed test. A cubic specification of the trend curves is found to be most accurate in reflecting the distribution of scores by age in most countries. Foreign-born adults are excluded from the analysis. See corresponding table mentioned in the source below for regression parameters and significance estimates.

Only a random sample of countries are shown as an example.

Source: International Adult Literacy Survey (1994-1998), and Survey of Adult Skills (PIAAC) (2012), Tables A5.2 (L), A5.4 (L), and Table B5.2 in Annex B.

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Figure 5.4a (L) compares the average scores of adults of the same age in selected countries at the time of the Survey of Adult Skills and the International Adult Literacy Survey. In doing so, it shows how repeated cross-sectional measures can be used to examine whether specific age cohorts are adding to, or subtracting from, the overall skills base in the selected countries over time. The cohort effects may be due to changes in quality and/or quantity of educational attainment among cohorts but also to other factors. Not all differences depicted are statistically significant (see Figure 5.4a [L]), but there is often sufficient evidence to suggest that both negative and positive cohort effects exist, and that these depend on the age cohort and the country considered. In most countries, higher rates of educational attainment among younger cohorts due to the expansion of participation in education and/or improvements in the quality of education would be expected to yield positive cohort effects. However, this is not always the case. In Canada, a positive cohort effect is observed among adults over 50, but this is only statistically significant for one cohort.

In the same way that individuals may gain or lose skills as they age, age cohorts (i.e. all adults born in 1965, for example) may gain or lose skills, on average, as they age. The Survey of Adult Skills did not track adults of any cohort in the period between 1994-1998 (when the International Adult Literacy Survey was conducted) and 2012, but an overlapping range of age cohorts for which representative samples were drawn participated in both studies. For example, in Canada, adults who were born in 1960 were aged about 34 at the time of the International Adult Literacy Survey and about 51 at the time of the Survey of Adult Skills. Even if the same adults did not participate in both studies, the size of the samples allows for the tracking of a particular age cohort to determine if its members gained or lost skills, on average, as they aged. Some individuals within the cohort may gain skills while others lose them, but a decline in the average for the whole cohort would suggest that the cohort, as a whole, has experienced skills loss. The differences observed between the average proficiency of an age cohort in 1994 and that of the same cohort 17 years later give an idea of the scale of gain or loss in proficiency in information-processing skills linked to ageing.<sup>3</sup>

Figure 5.4b (L) compares the average scores of cohorts aged 16 and over, in selected countries, who participated in the International Adult Literacy Survey and who were not older than 65 in the Survey of Adult Skills (i.e. different sample, but same cohorts 13 to 17 years later, depending on the country). This helps to reveal whether an age cohort has, collectively, gained or lost skills, on average, as it has aged. The chart provides some evidence to suggest that age-related skills loss is widespread. The onset of age-related skills loss ranges from about the age of 33 in the Czech Republic to 42 in the Netherlands and the United States.

### Delaying or avoiding age-related declines in information-processing skills

Some scientists associate “normal ageing” with overall declines in cognitive functioning and have suggested that cognitive decline may begin as early as age 20 and continue into old age, accelerating after the age of 50.<sup>4</sup> This pattern is remarkably consistent with the cross-sectional age-skills profiles found through the Survey of Adult Skills. One explanation for this general pattern is that ageing is associated with neurological decline. The observed trend of age-related cognitive decline is, however, based on average data. Individual trajectories vary and may be linked to a wide range of other factors, including biological, behavioural, environmental and social influences. For example, analysis of within-person growth curves using longitudinal data suggests that individual change in cognitive skills such as literacy and numeracy diverges from overall population change at the cohort level (Reder, 2009a). Some individuals show growth in skills, others show a decline, and others show little change in proficiency. Age-skills profiles, whether based on within-person or between-person comparisons do not do justice to the vast individual differences that are observed. Moreover, there are important country differences in average age-skills profiles, which suggests that social and economic factors, such as the kinds of jobs that are prevalent in an economy, that is, the occupational structure of employment, may also affect the strength of the relationship between age and skills.

It may be possible to delay or even avoid age-related declines in information-processing skills. Research suggests that cognitive skills continue to be malleable during adulthood (OECD, 2007), and that individual behaviours and practices can work against decline. Both theory and evidence suggest that cognitive skills can be developed, maintained or lost over a lifetime, depending on the interplay between the negative effects of ageing (Smith and Marsiske, 1997) and the positive effects of behaviours and practices (Reder, 1994). Research has suggested that about one in three elderly people can be considered “successful agers” – a concept that includes maintaining cognitive and physical functioning into old age (see Depp and Jeste, 2006). From a public policy perspective, it is important to identify the factors and conditions that may relate to successful ageing, including the continued development and maintenance of key information-processing skills.



Learning during childhood and young adulthood, and prior exposure to tasks involving literacy and numeracy, are thought to be important for individuals' evolving skills development trajectory (see meta review of adoption studies by Van Ijzendoorn et al., 2005). Some evidence suggests that educational interventions in adulthood – whether as a complement to initial formal education or a substitute for it – can also help to slow or reverse age-related declines in key information-processing skills (e.g. Willis et. al, 2006). Beyond formal education and training, certain physical, social and, particularly, mental activities can also help adults to maintain their skills (see Desjardins and Wanke, 2012, for a review).

## EDUCATIONAL ATTAINMENT AND ITS RELATIONSHIP TO PROFICIENCY

Formal education and training programmes represent one of the major settings in which skills such as literacy, numeracy and problem solving are developed. However, since the Survey of Adult Skills covers the working-age population, the relationship between formal education, as expressed by educational attainment and proficiency in the skills assessed by the survey, is complex. Educational qualifications do not necessarily reflect the level of an individual's literacy, numeracy or problem-solving skills – even at the point in time at which those qualifications were awarded. For older adults, the relationship between attainment and proficiency is attenuated by the potential influence of occupations that may positively or negatively affect proficiency and by the effects of ageing. In addition, requirements for entry into higher education that are based on exam results favour individuals with higher levels of interest and motivation, meaning that those with greater abilities and proficiency in information-processing skills are more likely to have higher qualifications. Still, most governments aim to ensure that students leave school with adequate proficiency in literacy, numeracy and problem-solving skills; employers and parents expect no less. From this point of view, it is important to know whether education and training systems are successful in inculcating key information-processing skills.

### Upper secondary education and skills proficiency

#### ***Proficiency of recent upper secondary graduates (youths aged 16-19)***

Across countries, the average literacy score for recent upper secondary graduates is 285 points, which corresponds to Level 3. This is significantly higher than the mean for young people aged 16-19 who have yet to attain upper secondary education or who have pursued alternative education or career paths (270 points). Not all recent graduates score at Level 3, however. The average 25th percentile score across countries is 262 points, which corresponds to Level 2. This means that, on average across countries, at least 25% of upper secondary graduates do not attain Level 3 on the literacy scale. In Italy, the United States, England/Northern Ireland (UK) and Ireland, recent upper secondary graduates score, on average, below the OECD mean. For these countries around 50% or more of recent graduates score at Level 2 or below. On average, recent upper secondary graduates in Australia, Japan and the Netherlands score above the OECD mean.

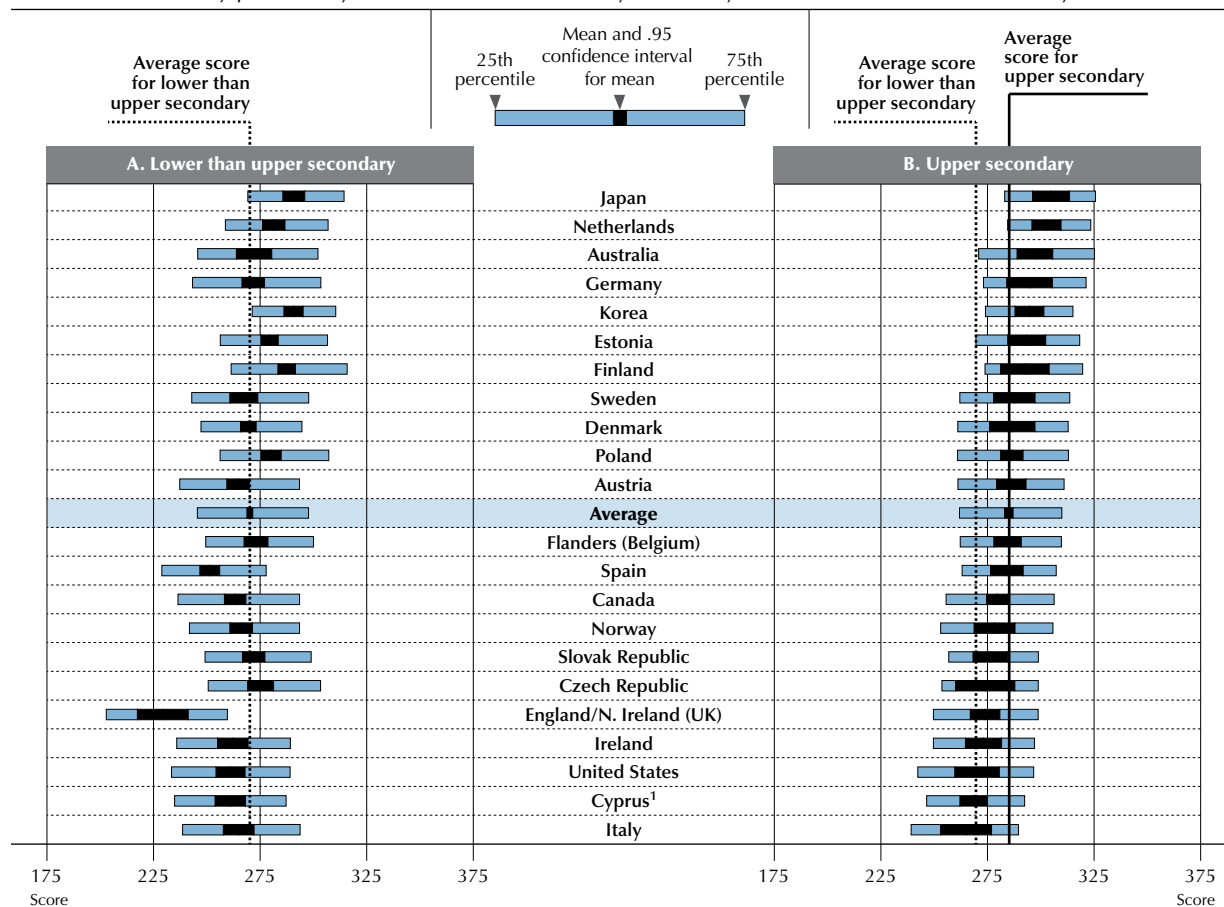
The distribution of literacy skills among recent upper secondary graduates aged 16-19 is shown in the right panel of Figure 5.5a (L). For comparison, the left panel presents the distribution of literacy skills among youth who have not completed upper secondary education but may be in the process of completing an upper secondary qualification, pursuing an alternative, or may simply have left the education system. Figure 5.5e (L) shows a similar comparison among selected countries and allows for within-country comparisons across education levels.

#### ***Proficiency of adults aged 20-65 with upper secondary education as highest attainment***

Results suggest that, across countries, adults over 20 who have not completed upper secondary education tend to score at lower levels of proficiency. For example, in the United States and Canada, they score at or near the bottom of Level 2 on the literacy scale, on average. In nearly every participating country, 25% or more of adults aged 20-65 who did not complete upper secondary education score at Level 1 or below. In contrast, adults who have completed upper secondary education as their highest attainment score closer to Level 3. In Australia, Finland, Japan and the Netherlands, adults with upper secondary education as their highest qualification score at Level 3, on average, and significantly above the OECD mean. In Germany, Italy, Poland, Spain, the United States and a handful of other countries, adults with this profile score below the OECD mean, on average.

The right panel in Figure 5.5b (L) depicts the distribution of literacy skills among adults aged 20-65 whose highest level of educational attainment is upper secondary. The left panel depicts the distribution among adults of the same age who did not complete upper secondary education. Younger adults within this age range have the benefit of more recent schooling; older adults have been away from school for some time. Therefore, these results reflect both the impact of upper secondary schooling and the relationship between qualifications and trajectories through the labour market.

■ Figure 5.5a (L) ■

**Literacy proficiency among young adults with and without upper secondary education***Mean literacy proficiency and distribution of literacy scores, by educational attainment, 16-19 year-olds*

1. See notes at the end of this chapter.

**Notes:** Lower than upper secondary includes International Standard Classification of Education (ISCED) categories 1, 2 and 3C short. Upper secondary includes ISCED 3A-B, 3C long and 4.

*Countries are ranked in descending order of the mean literacy score of young adults aged 16-19 with upper secondary education.*

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.5a (L).

**StatLink** <http://dx.doi.org/10.1787/888932902094>

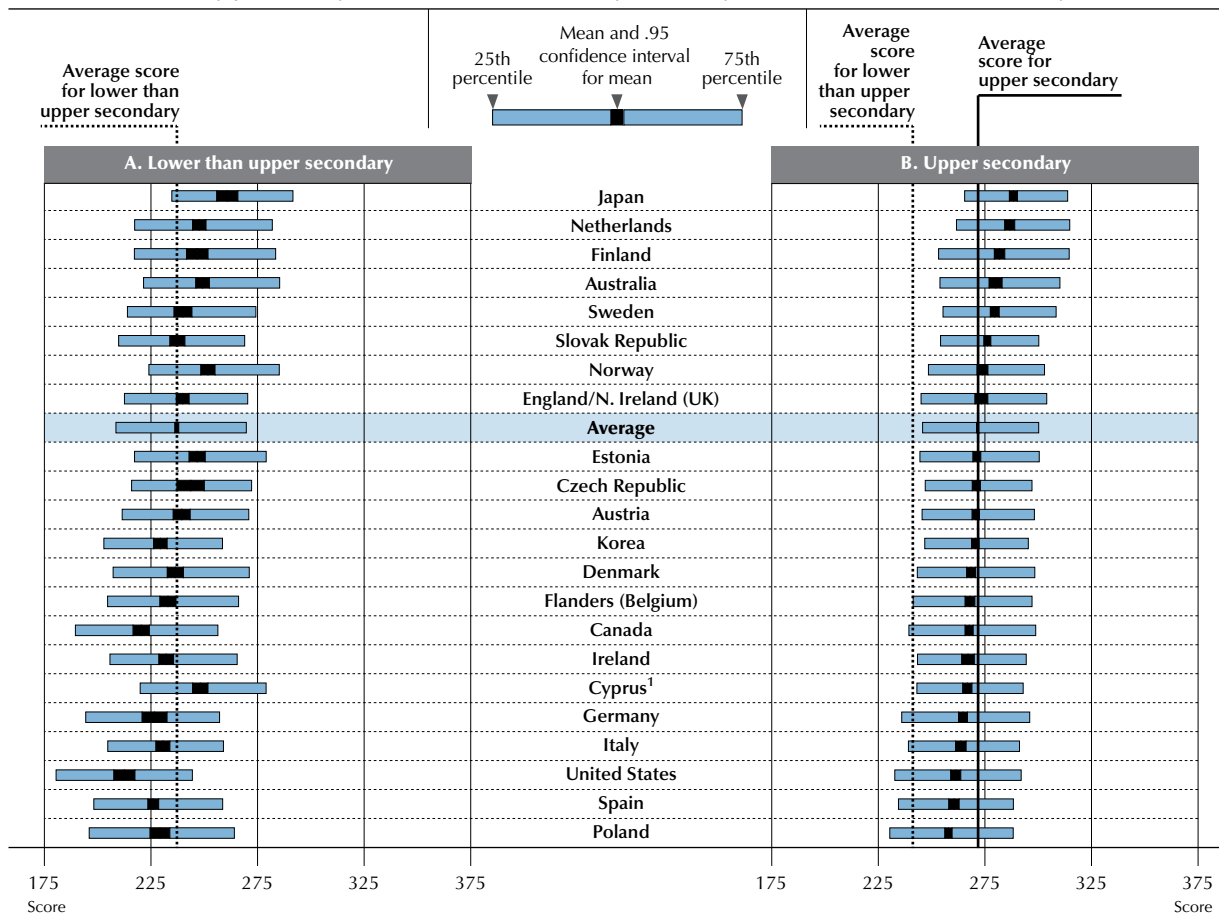
**Proficiency of adults with vocationally oriented upper secondary education as highest attainment**

Young adults aged 16-29 whose highest attainment is general (academically oriented) upper secondary education tend to have higher literacy scores than those with a vocationally oriented upper secondary education. This is to be expected, given that general education tends to foster the kind of generic skills assessed by the Survey of Adult Skills, while vocationally oriented upper secondary education may give greater emphasis to skills that are not measured by this survey. Unsurprisingly, countries with separate vocational and general tracks in upper secondary education tend to show larger differences between the two categories, with the largest differences observed in the Czech Republic, Denmark, Finland, Germany and the Netherlands. Some countries, such as Finland (see Box 5.1) and the Netherlands, also show relatively high literacy scores for graduates of both types of programmes. For other countries, such as Ireland, Poland and Spain, adults with both types of education tend to have relatively low scores.

In contrast, there is no statistically significant difference between the mean scores of adults from vocational or general upper secondary education in Australia, Canada, Japan and the United States. This is not unexpected, as in these countries the vocational category does not correspond to a separate upper secondary track but rather to a range of vocational diplomas and certificates, some of which are at post-secondary, but non-tertiary, level (i.e. ISCED 4). In the United States, both groups score relatively low, while in Australia, both groups score relatively high.



■ Figure 5.5b (L) ■


**Literacy proficiency among adults with and without upper secondary education***Mean literacy proficiency and distribution of literacy scores, by educational attainment, 20-65 year-olds*

1. See notes at the end of this chapter.

**Notes:** Lower than upper secondary includes International Standard Classification of Education (ISCED) categories 1, 2 and 3C short. Upper secondary includes ISCED 3A-B, 3C long and 4.

Countries are ranked in descending order of the mean literacy score of adults aged 20-65 with upper secondary education.

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.5a (L).

**StatLink**  <http://dx.doi.org/10.1787/888932902113>

**Box 5.1. Vocational education and training (VET) for adults in Finland**

More than 1.7 million Finnish adults participate in adult education each year and a growing number of Finnish adults participate in further vocational education and apprenticeship training (Finnish Ministry of Education and Culture, 2010). Vocational adult education and training in Finland aims to maintain and develop the vocational competencies of adults, which, in turn, leads to better employment prospects and a greater capacity among adults to adapt to the labour market (Cedefop, 2006). Individuals can acquire formally recognised VET qualifications by demonstrating an adequate level of vocational skills by taking competence-based tests. While these tests require no preparatory courses, most adults participate in some form of formal programme before seeking certification. Adults over 25 are highly represented in apprenticeship programmes, unlike in other European dual systems: around 80% of apprentices are over 25 and many of the trainees are already employed when they begin an apprenticeship (Finnish National Board of Education, 2010).

The Finnish government allocates a relatively large proportion of its budget for adult education to vocational education and training: of the 12% of the Ministry of Education and Culture's overall budget for adult education, about 40% is allocated to vocational education and apprenticeship training. Most of the programmes are offered free of charge (Finnish Ministry of Education and Culture, 2010).

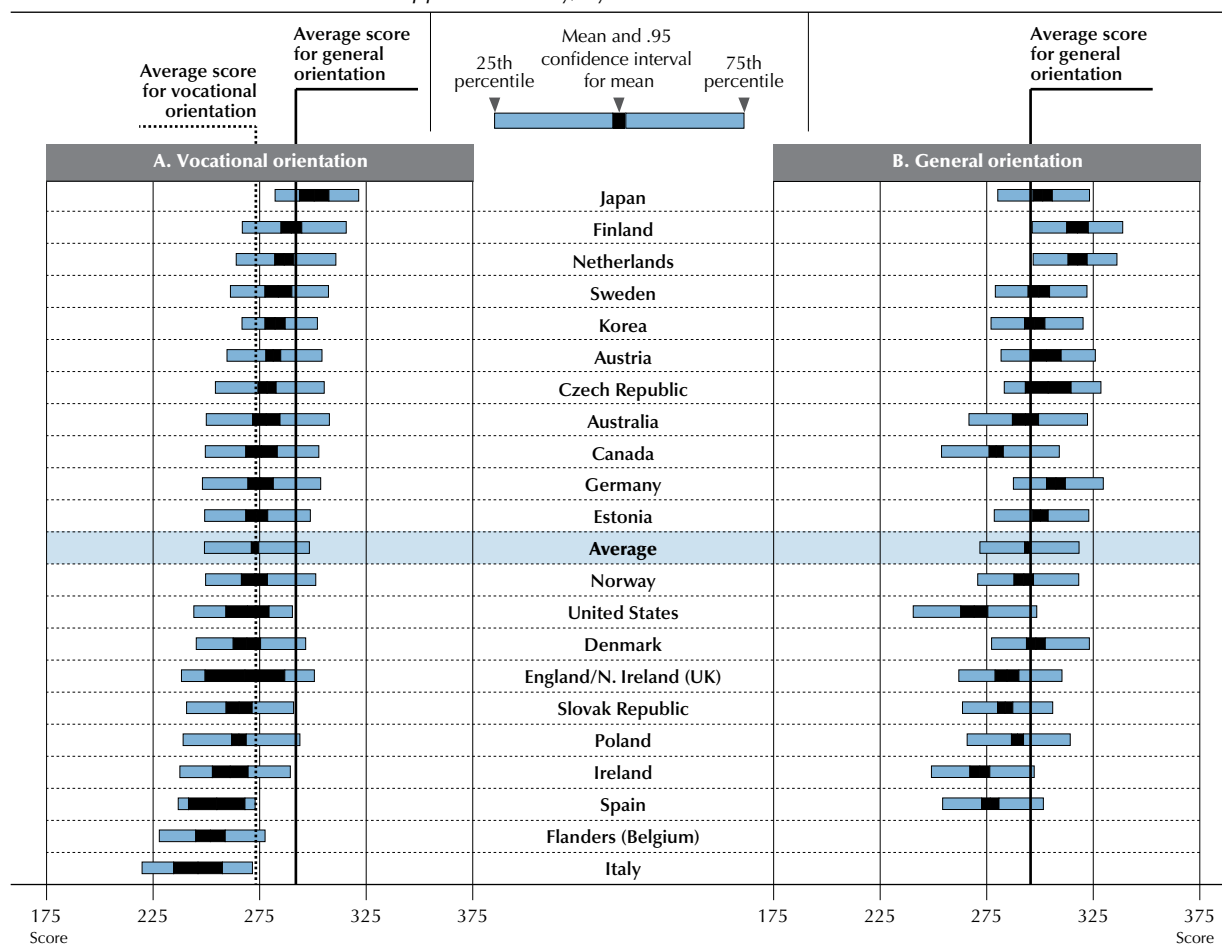
On average across countries, a vocationally oriented upper secondary education is associated with a mean score of 273 points for 16-29 year-olds, which is near the cut-off point between Levels 2 and 3 on the literacy scale. In Finland, Japan and the Netherlands, the mean score for young adults with vocationally oriented upper secondary education corresponds to Level 3 and is significantly above the OECD mean for the same group. Countries significantly below the OECD mean include Flanders (Belgium), Ireland, Italy, Poland, the Slovak Republic and Spain.

Figure 5.5c (L) compares the distribution of literacy skills among adults whose highest level of educational attainment is upper secondary by distinguishing between whether the education was vocational or general. The differences observed between the two groups partly reflect the effectiveness of either type of upper secondary education to impart key information-processing skills, but also other factors, such as selection by ability into different types of education.

■ Figure 5.5c (L) ■

### Literacy proficiency among young adults, by orientation of education

Mean literacy proficiency and distribution of literacy scores for adults aged 16-29 whose highest level of education is upper secondary, by orientation of education



1. See notes at the end of this chapter.

Notes: Estimates based on a sample less than 30 are not shown in Panels A and B.

Countries are ranked in descending order of the mean literacy score of young adults aged 16-29 whose highest level of education is vocationally oriented upper secondary.

Source: Survey of Adult Skills (PIAAC) (2012), Table A5.5b (L).

StatLink <http://dx.doi.org/10.1787/888932902132>

### Tertiary education and skills proficiency

Tertiary-level education strengthens information-processing skills both directly, through the coursework involved, and indirectly, because adults with higher education are more likely to access intellectually demanding jobs that, in turn, help to develop and maintain skills throughout their careers – and throughout their lives.





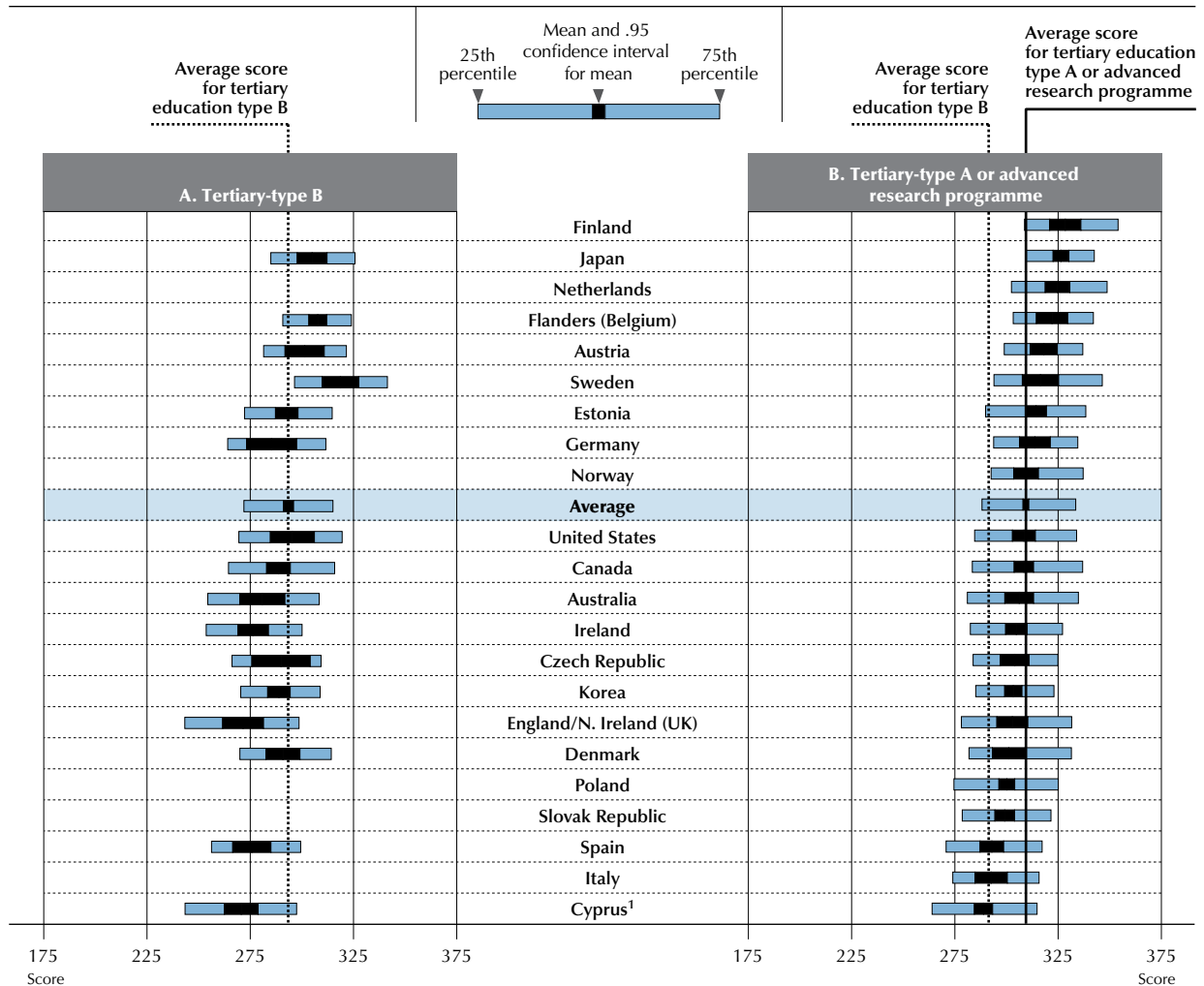
On average across countries, young adults who have attained a university-level education show a mean score of 309 points, which corresponds to well above the mid-point for Level 3; more than 25% of these graduates score at Level 4 or higher. In Finland, Japan and the Netherlands, recent university-level graduates score, on average, well above the corresponding OECD mean: nearly one in two recent graduates scores at Level 4 or higher. Recent graduates in Italy, Poland, the Slovak Republic and Spain score, on average, below the corresponding OECD mean.

Figure 5.5d (L) compares the distribution of literacy skills among adults with tertiary-level qualifications, but distinguishes between tertiary-type B (vocationally oriented) and tertiary-type A (academically oriented) studies. As can be seen in the left panel, young adults who have attained tertiary-type B education score significantly lower, on average, than those who attained university-level qualifications. Covering only the younger and more recent graduates up to the age of 29 offers some insights into the effectiveness of tertiary qualifications vis-a-vis the skills measured in the Survey of Adult Skills.

■ Figure 5.5d (L) ■

**Literacy proficiency among young adults with tertiary education**

Mean literacy proficiency and distribution of literacy scores, by educational attainment, 16-29 year-olds



1. See notes at the end of this chapter.

Notes: Tertiary-type B corresponds to the International Standard Classification of Education (ISCED) category ISCED 5B. Tertiary-type A corresponds to ISCED 5A and advanced research programmes correspond to ISCED 6. Estimates based on a sample less than 30 are not shown in Panels A and B. The estimate for Tertiary-type B for Finland is based on a sample size very close to 30 and is not shown at the country's request.

Countries are ranked in descending order of the mean literacy score of adults aged 16-29 with tertiary-type A or an advanced research programme.

Source: Survey of Adult Skills (PIAAC) (2012), Table A5.5a (L).

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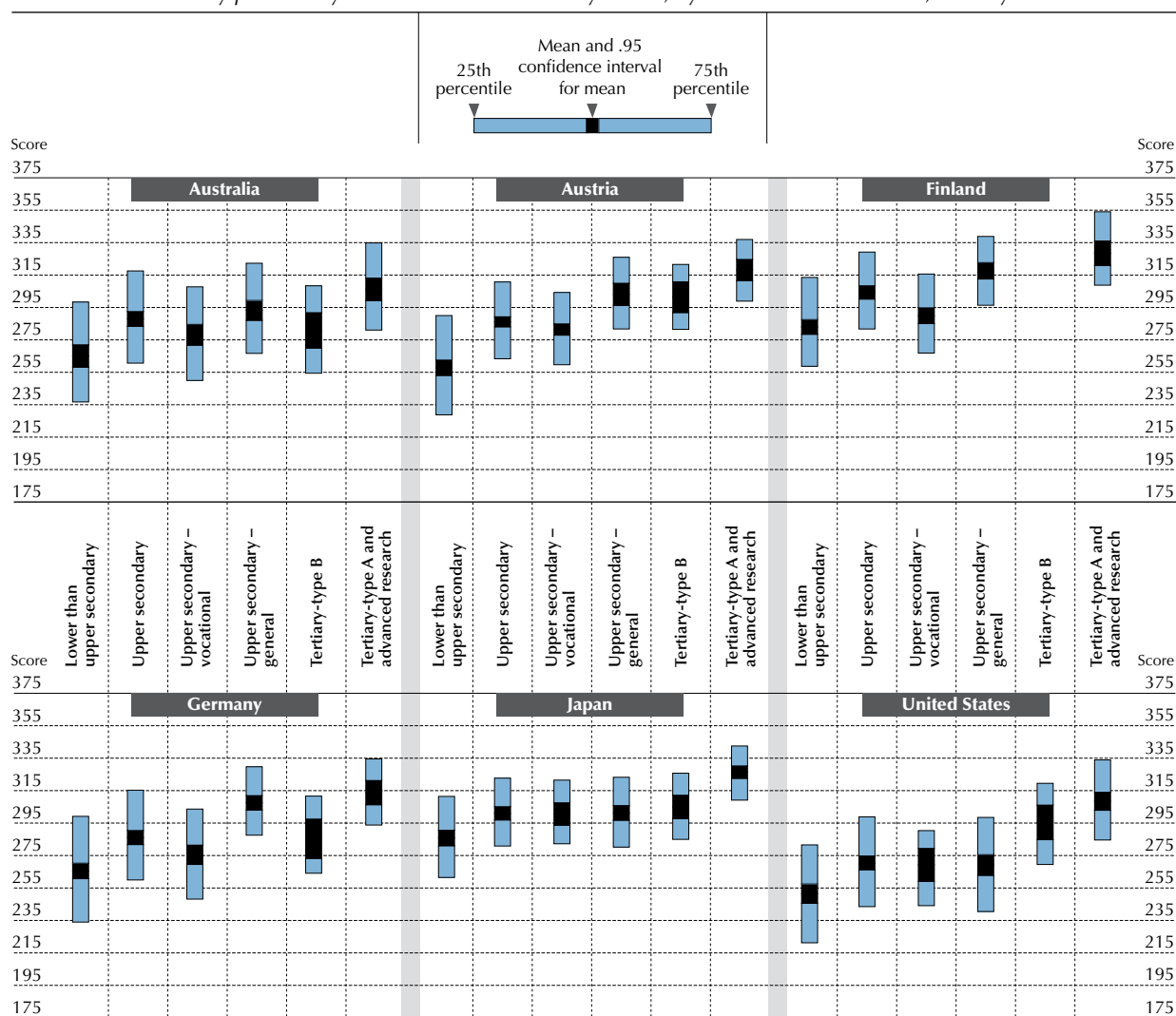
## A comparison of educational attainment levels within and across countries

There is a considerable amount of within-country variation in literacy proficiency related to level of educational attainment. Young adults with tertiary qualifications have the highest average proficiency while adults with lower-than-upper secondary education have the lowest average proficiency. Adults in vocational streams generally show lower proficiency than those in general streams. Nonetheless, there is considerable overlap in the proficiency of young adults at different levels of attainment. Not everyone without an upper secondary qualification scores at lower levels of proficiency; conversely, not everyone with upper secondary or higher education necessarily scores at higher levels of proficiency. The distribution of literacy skills and the extent of overlap by qualification level varies significantly across countries. For example, in Japan and the United States, there is sharp distinction in the distribution of literacy skills between adults aged 16-29 who have a university degree and those who do not. At the same time, in Finland, many adults aged 16-29 who graduated from a general upper secondary programme are about as highly skilled in the literacy domain as university graduates in Austria and Australia.

■ Figure 5.5e (L) ■

### Literacy proficiency among young adults in selected countries, by educational attainment


Mean literacy proficiency and distribution of literacy scores, by educational attainment, 16-29 year-olds



Notes: The estimate for Tertiary-type B for Finland is based on a sample size very close to 30 and is not shown at the country's request.

Only a sample of countries are shown as an example.

Source: Survey of Adult Skills (PIAAC) (2012), Tables A5.5a (L) and A5.5b (L).

StatLink  <http://dx.doi.org/10.1787/888932902170>



Comparing the distribution of literacy skills among young adults who have different types of upper secondary qualifications reveals considerable differences between countries. In Germany, for example, young adults who have completed general upper secondary programmes have broadly similar levels of proficiency as university graduates; but most young adults who completed vocationally oriented upper secondary education are no more skilled in literacy than those who did not complete upper secondary education. The same is true in Finland, although the average score is higher for each type and level of attainment than in Germany, as are the 25th and 75th percentile scores. In Australia, Japan and the United States, the type of upper secondary qualification appears to have little impact on how proficiency is distributed.

The distribution of literacy skills is presented separately for each level of attainment in Figure 5.5a (L) to Figure 5.5d (L) so that differences in the proficiency of adults with a given level of attainment can be compared across countries. Alternatively, Figure 5.5e (L) provides an overview of the distribution of proficiency by level of educational attainment for adults aged 16-29 in selected countries. This age group was chosen to show as clearly as possible the impact of educational attainment on proficiency, since among older adults, ageing and different career trajectories can also influence proficiency.

### **Comparing the development of key skills among different age cohorts that participated in PISA**

Results from PISA provide an insight into the relative effectiveness of participating countries' school systems in developing reading, mathematics and science skills among 15-year-old students. An important question for policy makers is whether the differences in the performance of school systems observed in PISA are reflected in the proficiency in these skills among adults who have recently completed initial education and training. In other words, to what extent does the performance of countries in the rounds of PISA between 2000 and 2009 predict the proficiency of the age cohorts concerned when assessed by the Survey of Adult Skills? Or, to what extent do improvements in proficiency in skills such as reading and mathematics after the age of 15 vary between countries?

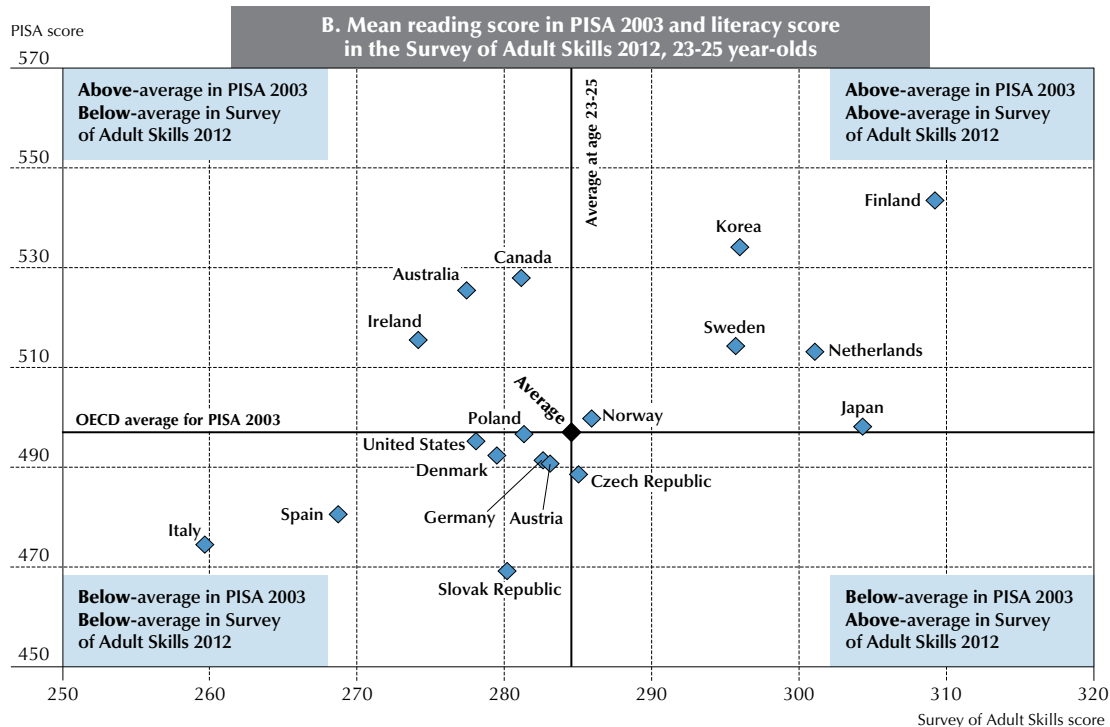
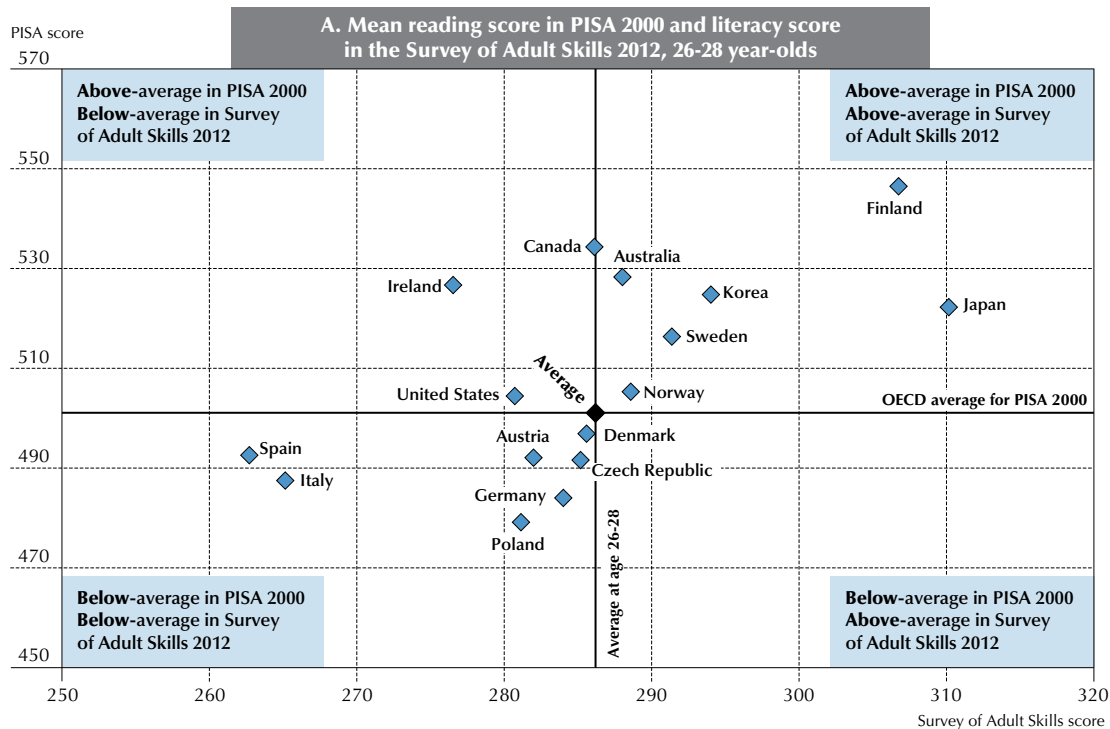
The Survey of Adult Skills can provide some evidence concerning this question. Most adults aged 27 and under in participating countries were members of the cohorts assessed in PISA 2000, 2003, 2006 and 2009, when they were 15 years old. The overlap is not perfect, however: not all adults aged 27 or under were in school at the age of 15; and both emigration and immigration will have changed the composition of each of the PISA cohorts between 2000 and 2009 as they have aged. For example, it may be that the decline in average scores between 2000 and 2011 had more to do with the emigration of educated people from a given country in the wake of the economic crisis than a weakness in the education system. Nonetheless, comparisons of the relationship between mean proficiency scores for literacy/reading and numeracy/mathematics in both studies offer some information regarding the relative growth in proficiency for age cohorts aged 27 years or under from when they were 15.

Some care must be taken in comparing results of the two studies. As mentioned, the overlap between the target populations of the Survey of Adult Skills and PISA is not complete; and while the concepts of literacy in the Survey of Adult Skills and reading literacy in PISA, and the concepts of numeracy in the Survey of Adult Skills and mathematical literacy in PISA are closely related, the measurement scales are not the same (see the *Reader's Companion* to this report for a more detailed comparison of PISA and the Survey of Adult Skills [OECD, 2013]). In addition, the skills of young people aged between 15 and 27 are subject to influences that vary across individuals and countries, including participation in post-secondary and tertiary education and the quality of these programmes, second-chance opportunities for low-skilled young adults, and characteristics of the labour market.

Overall, there is a reasonably close correlation between countries' performance in the different cycles of PISA and the proficiency of the relevant age cohorts in literacy and numeracy in the Survey of Adult Skills. Countries that perform well in PISA in a given year (e.g. 2000) tend to have high performance among the relevant age cohort (e.g. 27-year-olds) in the Survey of Adult Skills and vice versa (see Figures 5.6a [L] and 5.6b [L]). This suggests that, at the country level, the proficiency of an age cohort in reading and mathematics, as measured by PISA, provides a reasonably good predictor of the subsequent performance of the cohort in literacy and numeracy as it moves through post-compulsory education and into the labour market. By implication, much of the difference in the literacy and numeracy proficiency of young adults today is likely related to the effectiveness of the instruction they received in primary and lower secondary school and their educational experiences outside of school as of age 15.


■ Figure 5.6a (L) ■

### Mean literacy proficiency in PISA (2000 and 2003) and in the Survey of Adult Skills



Notes: A three-age band is used in the Survey of Adult Skills to increase size and reliability of estimates. The mix of countries contributing to the average in PISA and the Survey of Adult Skills differs, which may contribute to differences in countries' average scores relative to the overall averages in either study.

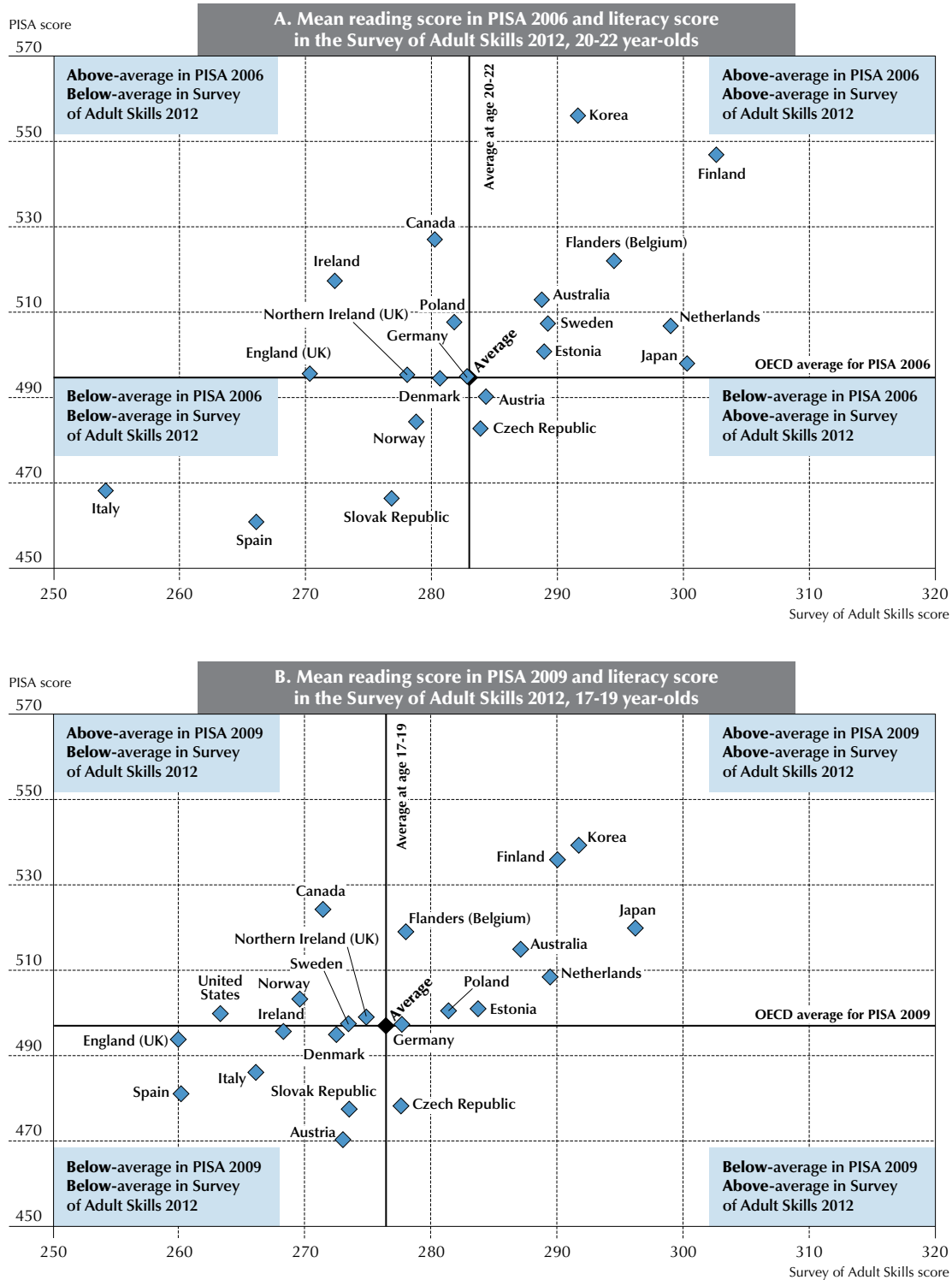
Source: Survey of Adult Skills (PIAAC) (2012) and OECD, PISA 2000-2009 Databases, Table A5.6 (L)

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■ Figure 5.6b (L) ■

**Mean literacy proficiency in PISA (2006 and 2009) and in the Survey of Adult Skills**



Notes: A three-age band is used in the Survey of Adult Skills to increase size and reliability of estimates. The mix of countries contributing to the average in PISA and the Survey of Adult Skills differs, which may contribute to differences in countries' average scores relative to the overall averages in either study.

Source: Survey of Adult Skills (PIAAC) (2012) and OECD, PISA 2009 Databases, Table A5.6 (L).

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## ADULT EDUCATION AND TRAINING AND PROFICIENCY

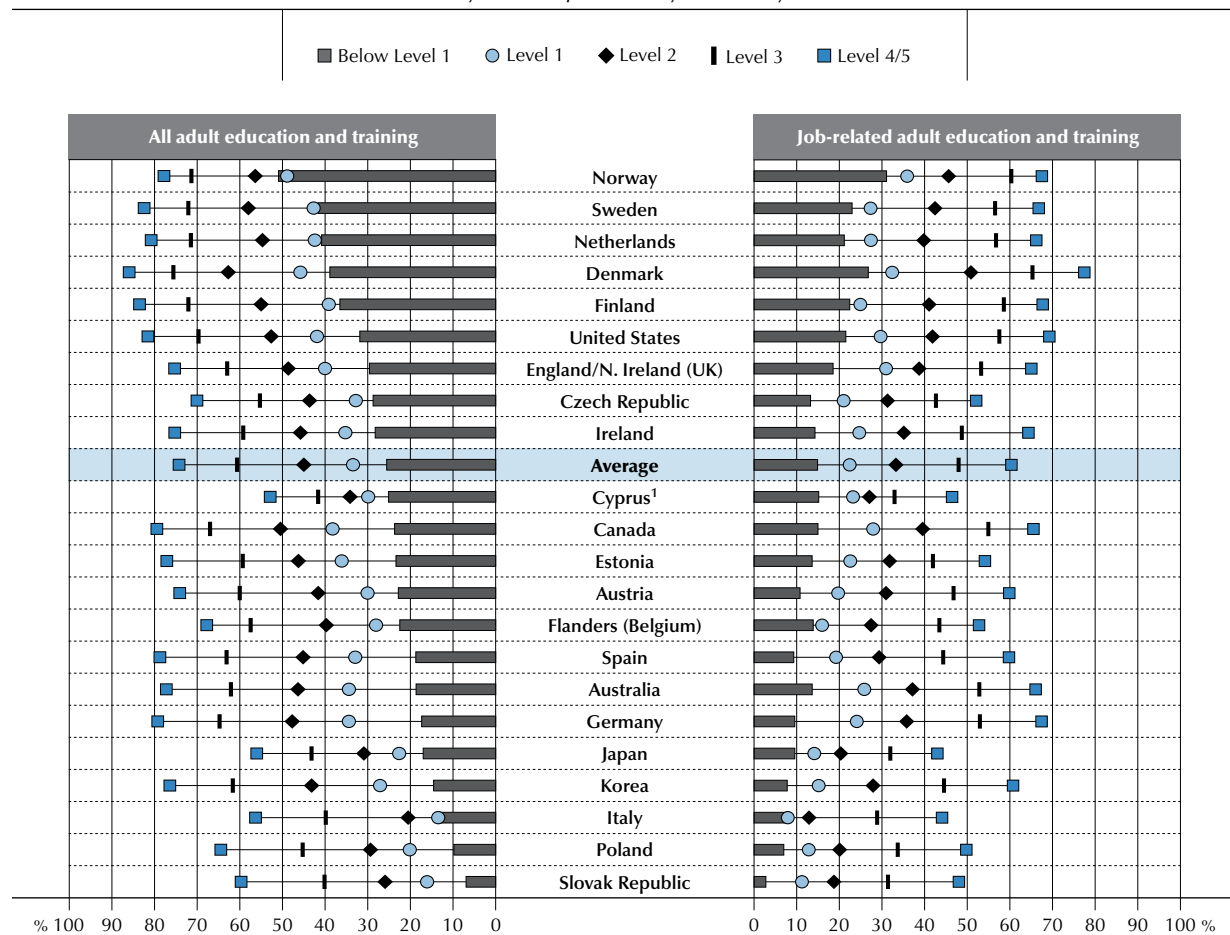
Adult learning can play an important role in helping adults to develop and maintain key information-processing skills, and acquire other knowledge and skills, throughout life. It is crucial to provide, and ensure access to, organised learning opportunities for adults beyond initial formal education, especially for workers who need to adapt to changes throughout their careers. The relevance of continued learning opportunities now extends to workers in both high-skilled and low-skilled occupations. In high-technology sectors, workers need to update their competencies and keep pace with rapidly changing techniques. Workers in low-technology sectors and those performing low-skilled tasks must learn to be adaptable, since they are at higher risk of losing their job, as routine tasks are increasingly performed by machines, and companies may relocate to countries with lower labour costs.

Empirical evidence suggests that adult learning can make a difference. For example, a survey of several European countries found that training increases the probability of re-employment after job loss; and this effect is slightly greater for workers with upper secondary education or less. Participation in adult education and training also increases the probability of being active and reduces the risk of unemployment (OECD, 2004).

■ Figure 5.7 (L) ■

### Participation rate in adult education, by literacy proficiency levels

Percentage of adults who participated in adult education and training during year prior to the survey, by level of proficiency in literacy



1. See notes at the end of this chapter.

Countries are ranked in descending order of the percentage of adults scoring below Level 1 in literacy in adult education and training during year prior to the survey.

Source: Survey of Adult Skills (PIAAC) (2012), Table A5.7 (L).

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### Readiness to learn and key information-processing skills

Participation in adult education and training is now common in many OECD countries but varies considerably. Participation rates reported in this section cover adults aged 16-65 excluding students up to the age of 24, who are deemed to be in their initial cycle of formal education. The data refer to education and training undertaken in the previous year. The results, presented in Figure 5.7 (L), show a strong positive relationship, consistent across countries, between participation in adult education and literacy skills. Adults with already high levels of key information-processing skills participate the most, while those with lower levels of skills participate the least.

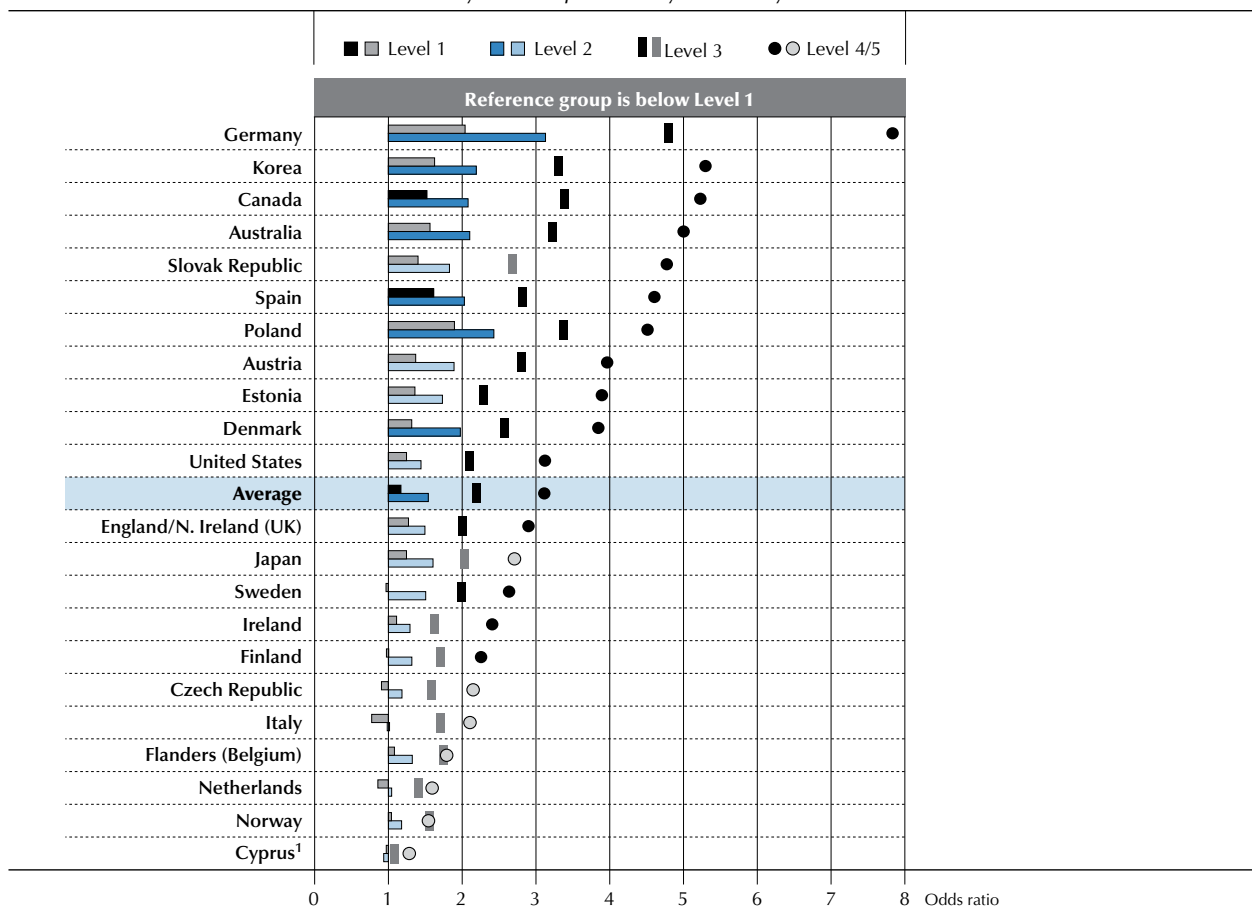
The countries surveyed fall into five groups:

- **Group 1:** Countries with participation rates exceeding 60%: Denmark, Finland, the Netherlands, Norway and Sweden.
- **Group 2:** Countries with participation rates between 50% and 60%: Australia, Canada, England/Northern Ireland (UK), Estonia, Germany, Ireland, Korea and the United States.
- **Group 3:** Countries with participation rates between 40% and 50%: Austria, the Czech Republic, Japan, Spain and Flanders (Belgium).
- **Group 4:** Countries with participation rates between 30% and 40%: Cyprus,<sup>5</sup> Poland and the Slovak Republic.
- **Group 5:** Countries with participation rates below 30%: Italy.

■ Figure 5.8 (L) ■

### Likelihood of participating in adult education and training, by level of literacy proficiency

*Adjusted odds ratios of adults participating in adult education and training during year prior to the survey, by level of proficiency in literacy*



1. See notes at the end of this chapter.

Notes: Statistically significant differences are marked in a darker tone. Odds ratios are adjusted for gender, age, educational attainment and labour force status. Countries are ranked in descending order of the odds of adults scoring at Level 4 or 5.

Source: Survey of Adult Skills (PIAAC) (2012), Table A5.8 (L).

StatLink <http://dx.doi.org/10.1787/888932902265>



Part of the reason for the strong relationship between participation in adult education and proficiency in literacy is the mutually reinforcing link between the skills assessed and continued learning. Demand for training is likely to be higher among individuals with already higher levels of key information-processing skills for a number of reasons. They have the skills that facilitate learning, they are more likely to be in jobs that demand ongoing training, and they have higher levels of education. They may also have other characteristics (e.g. motivation, engagement with work) that encourage individuals to learn and/or their employers to support them. Conversely, participation in adult learning helps to develop and maintain key information-processing skills, especially when the learning programmes require participants to read and write, and confront and solve new problems. In turn, after completing training, workers may be given more demanding tasks with higher skills requirements, which allows them to practice and thus maintain their skills.

These mutually reinforcing aspects create a virtuous cycle for adults with high proficiency and a vicious cycle for those with low proficiency. High-skilled adults will be more likely to participate in learning activities that enhance their skills – which makes these individuals more likely to continue to benefit from learning opportunities (see Figure 5.8 [L]). Conversely, low-skilled adults risk being trapped in a situation in which they rarely benefit from adult learning, and their skills remain weak or deteriorate over time – which makes it even harder for these individuals to participate in learning activities.

The key policy challenge is to help low-skilled adults break this vicious cycle. Many countries offer subsidised adult literacy and numeracy programmes, designed to upgrade the skills of low-skilled adults. In addition, policies may aim specifically to increase the participation of low-skilled adults in adult learning, for example through targeted subsidies (see Box 5.2). Denmark, Finland, the Netherlands, Norway and Sweden are the most successful in extending opportunities for adult learning to those adults who score at Level 1 or below (see Figure 5.7 [L]).

#### Box 5.2. **Adult education for adults with low skills**

Adults with low levels of education or in low-skilled occupations are less likely to participate in or have opportunities to participate in adult learning programmes (OECD, 2003). Providing learning opportunities to this group of adults is therefore an important policy issue in many OECD countries.

The Basic Competence in Working Life Programme (BKA) in Norway, Adult Education Initiative in Sweden, and WeGebAU programme in Germany are three examples of learning programmes for adults who have not attained upper secondary education (Albrecht et al., 2004; Ericson, 2005).

In 2006, the Norwegian government launched the BKA programme, which is now administered through Vox, the Norwegian Agency for Lifelong Learning. It aims to strengthen basic skills in reading, writing, numeracy and information and communication technologies (ICT). Courses are aligned to competence goals under a Framework for Basic Skills, developed by Vox, and are adapted to the needs of participants. BKA learning activities are often linked with work and other job-related practices. More than 30 000 adults have participated in the programme so far (European Commission, 2011).

The Swedish Adult Education Initiative was implemented in all municipalities in 1997 and ran until 2002 when it became the basis for a municipal adult education and training reform. The programme focused on providing general basic skills, such as Swedish, English and mathematics, at upper secondary level. More than 10% of the overall labour force participated in this programme between 1997 and 2000. Participation in courses provided by the initiative was free of charge. Unemployed participants received supplementary “special education support”, equivalent to unemployment insurance payments for a maximum of one year. Some studies found that young men participating in this initiative had better chances of returning to the labour market compared to those who did not take part in the programme (Albrecht et al., 2004; Ericson, 2005).

The German WeGebAU programme was implemented in 2006 to provide educational support for workers without certified vocational qualifications, those with low skills proficiency and older workers to improve their employability. The Federal Employment Agency covers the cost of training courses, travel and lodging. In addition, participants can receive extra unemployment compensation if they are not able to work while they are taking the courses. At the end of the programme, participants received a recognised vocational qualification or partial qualification. Some 340 000 adults have participated in the programme since 2006 (Federal Institute for Vocational Education and Training, 2013).





Figure 5.9 (L)

**Participation in adult education and training, by average literacy proficiency**

*Distribution of literacy proficiency scores, and percentage of adults participating in adult education and training during year prior to the survey*



1. See notes at the end of this chapter.

**Notes:** Students aged 16-24 who are considered to still be in their first formal cycle of studies are excluded from the analysis. However, youths aged 16-19 who recently completed or are still in a short duration ISCED 3C or below are included as adult learners. Similarly, youths aged 20-24 who recently completed or are still in ISCED 3A, B, C or below are included as adult learners.

**Source:** Survey of Adults Skills (PIAAC) (2012), Table A5.9 (L).

**StatLink** <http://dx.doi.org/10.1787/888932902284>



## Participation rates in organised adult learning at the country level and average proficiency

Results of the Survey of Adult Skills show a clear relationship between the extent of participation in organised adult learning and the average level of key information-processing skills in a given country (Figure 5.9 [L]). The large variation among countries at similar levels of economic development suggests major differences in learning cultures, learning opportunities at work, and adult-education structures. This could be interpreted to suggest that the supply of adult training programmes is a function of demand (proxied by literacy skills); but the chart also shows that differences in participation rates seems to have an impact not only on scores near the top or at the average but also near the bottom of the skills distribution.

### WORK-RELATED PRACTICES THAT OPTIMISE THE USE AND DEVELOPMENT OF SKILLS

The best way to develop and maintain skills is to use them (see Reder, 2009a; 2009b). Indeed, there is a two-way relationship between proficiency in information-processing skills and the practices that require using those skills: practice reinforces proficiency, and proficiency facilitates practice. For example, adults with already-high levels of skills are more likely to gain access to jobs that require still higher levels of skills. In turn, holding a job that requires regular use of literacy, numeracy and problem-solving skills helps to develop and maintain these skills. Several studies have found a link between occupations requiring the performance of complex tasks and the level of cognitive skills, even after controlling for education (e.g. Andel et al., 2005; Finkel et al., 2009). There are some indications that job complexity has an effect on the growth rate of skills (see Schooler, Mulatu and Oates, 1999; Baldivia, Andrade and Bueno, 2008; Potter, Helms and Plassman, 2008); and some research suggests that retirement can lead to cognitive decline (e.g. Bonsang, Adam and Perelman, 2010; Mazzonna and Peracchi, 2009). Remaining outside the labour market for long periods can also lead to a loss of skills.

Thus, workers who do not have the opportunity to perform complex tasks involving key information-processing skills may be at risk of losing these kinds of skills more rapidly as they age. From a policy perspective, developing and maintaining the skills supply is not only a goal of education and training systems, but should also be an aim of workplaces. The use of various cognitive and other generic skills at work is considered in more detail in Chapter 4.

### Skills proficiency and the use of skills at work

Results from the Survey of Adult Skills show a positive relationship between average literacy proficiency and the extent of engagement in reading practices at work (Figure 5.10). Adults who engage more in reading at work tend to score at higher levels of literacy proficiency. It is not possible to determine whether practices lead to the acquisition of skills or whether adults engage in these tasks because they already have greater proficiency. However, adjusting for educational attainment and language status reveals that the positive relationship between practice and proficiency is strong. That is, adults who practice their literacy skills nearly every day tend to score higher, regardless of their level of education. This suggests that there might be practice effects independent of education effects that influence proficiency. Without controlling for educational attainment, the relationship is much stronger since there are complementary effects between education and practice effects.

In nearly all cases, adults who engage the least in reading at work (i.e. the two lowest quintiles of distribution) tend to score at Level 2 or below. Figures 5.11 and 5.12 show a similar pattern between average numeracy proficiency and the extent of engagement in numeracy practices at work, and between average literacy proficiency and ICT use at work, respectively.

### Occupational structure at the country level and average proficiency

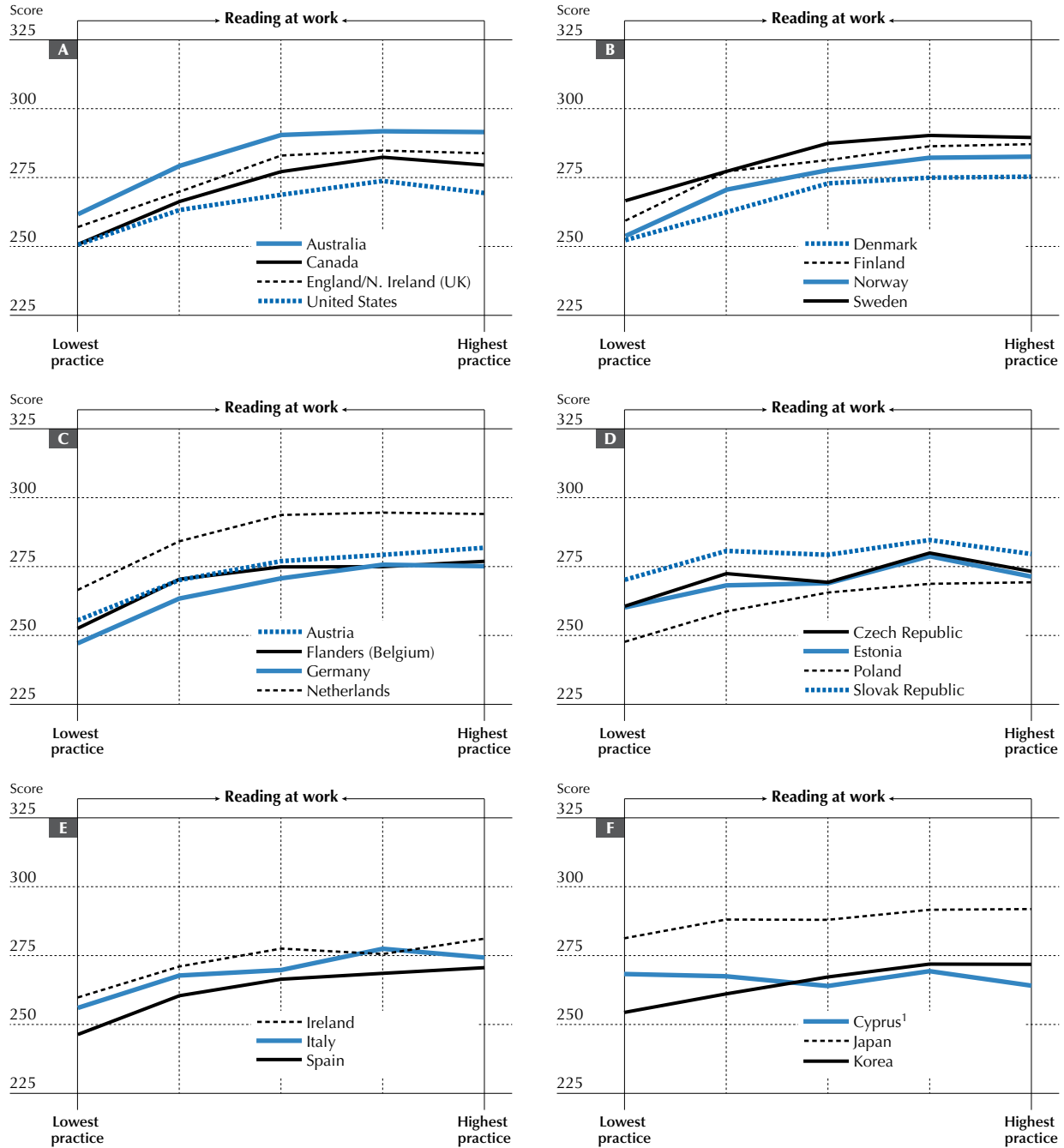
A country's occupational structure is significantly related to the underlying level and distribution of key information-processing skills in that country. Results show that about 21% of the cross-national variation in average proficiency in literacy skills is associated with the proportion of adults who work in professional, managerial and technical occupations (Figure 5.13 [L]). While this is merely an association and may reflect selection of the most able workers into highly skilled occupations, there is good reason to believe that what happens beyond initial formal education, including the choice of occupation and the nature of work to which an individual is exposed, has a significant impact on the development and maintenance of literacy skills over a lifetime. It can also suggest that an economy with more people in high-skilled jobs simply has a more highly skilled workforce that also has greater proficiency in literacy.



Figure 5.10

**Reading at work and literacy proficiency**

Relationship between literacy proficiency scores and level of engagement in reading at work, adults aged 30-65 employed during year prior to survey



1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with each quintile of a reading at work index. No practice of reading is combined with the lowest quintile of practice, which generally reflects reading at work rarely or less than once a month, whereas highest practice reflects reading multiple types of texts daily or weekly.

Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

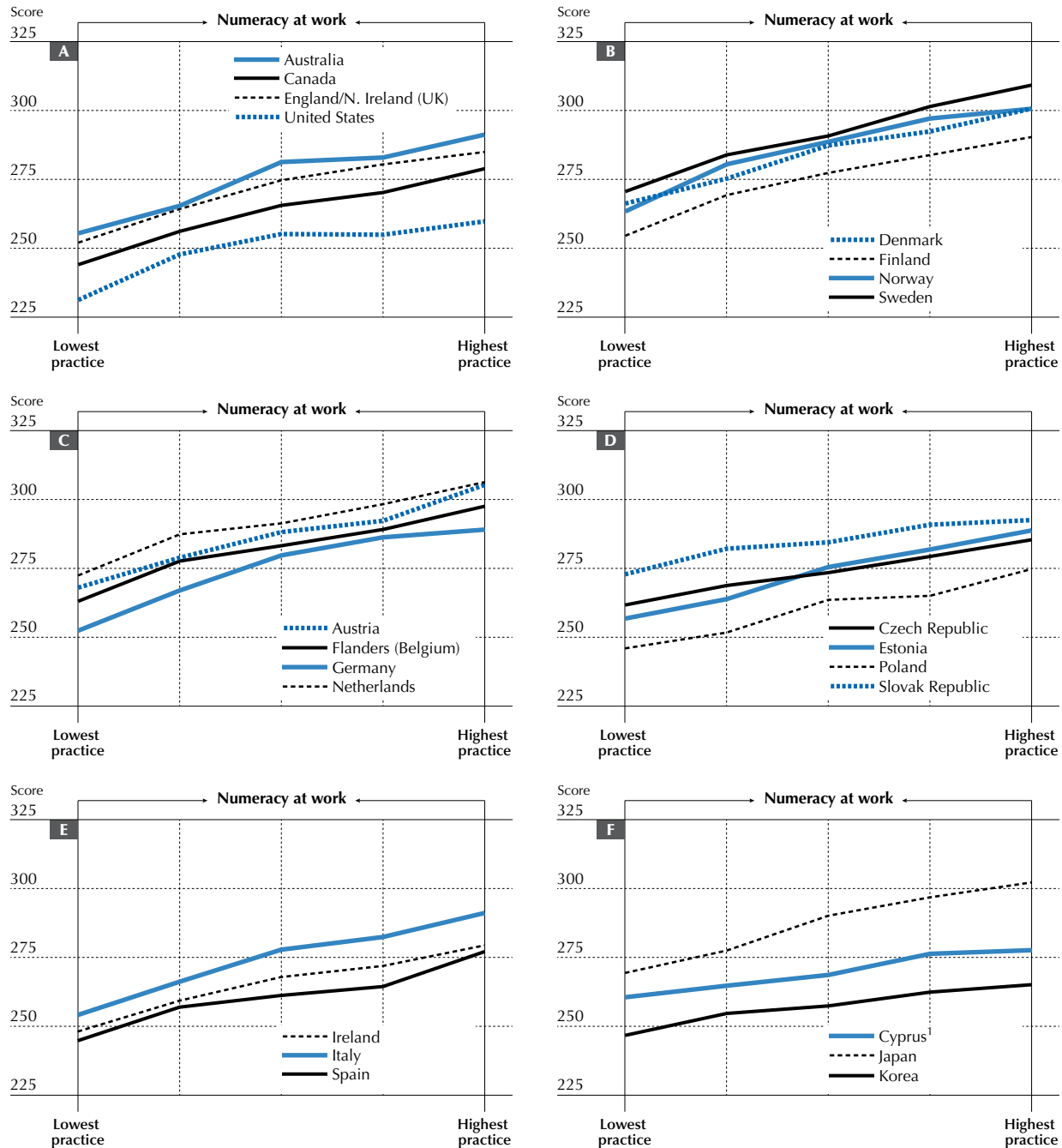
Source: Survey of Adult Skills (PIAAC) (2012), Table A5.10.

StatLink <http://dx.doi.org/10.1787/888932902303>

■ Figure 5.11 ■

**Numeracy practice at work and numeracy proficiency**

*Relationship between numeracy proficiency scores and level of engagement in numeracy-related practices at work, adults aged 30-65 employed during year prior to survey*




1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born, and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with each quintile of a numeracy practice at work index. No practice of numeracy is combined with the lowest quintile of practice, which generally reflects numeracy practice at work rarely or less than once a month, whereas highest practice reflects engagement in multiple types of numeracy-related activities daily or weekly.

*Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.*

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.11.

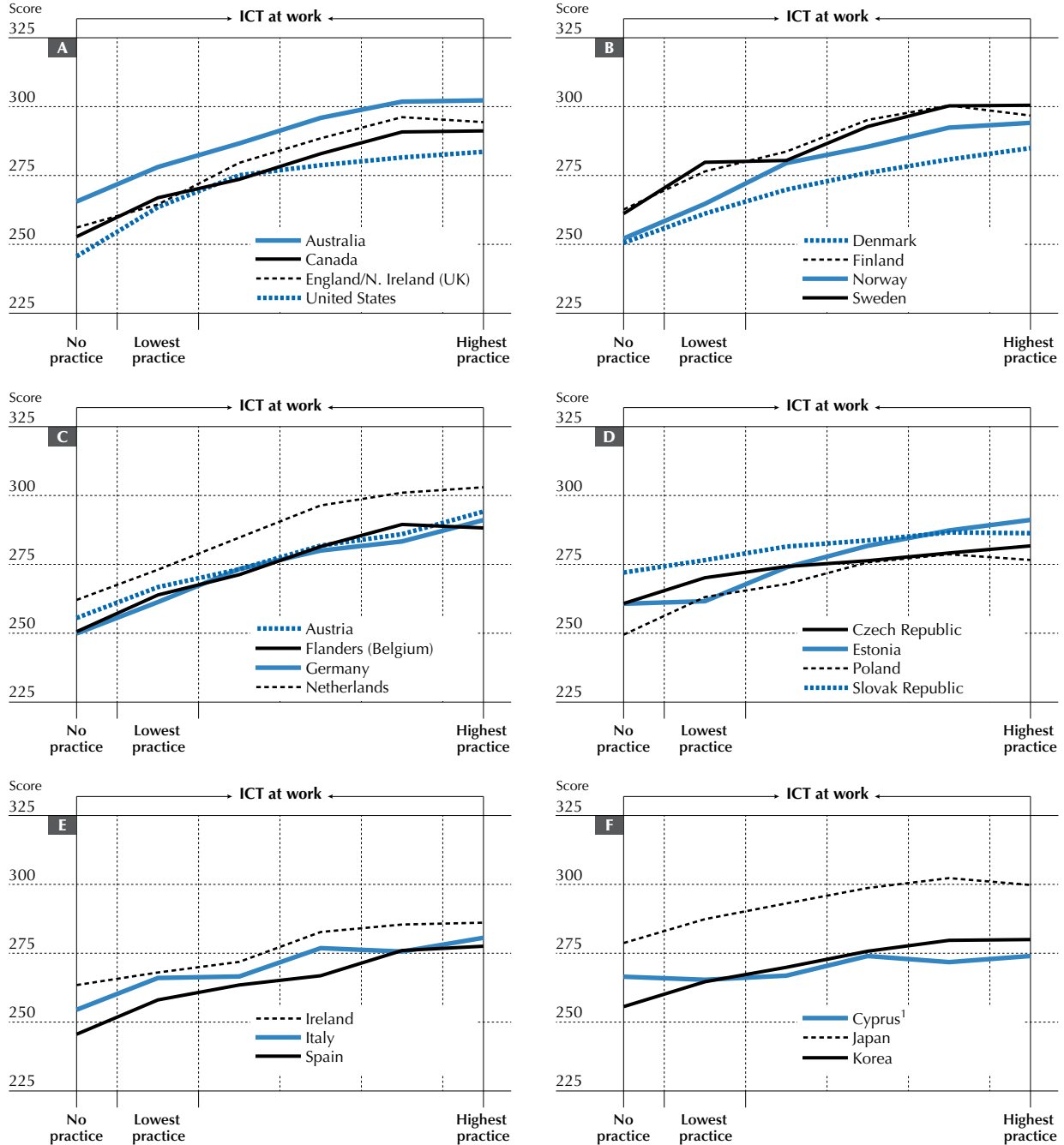
**StatLink**  <http://dx.doi.org/10.1787/888932902322>



■ Figure 5.12 ■

**ICT use at work and literacy proficiency**

*Relationship between literacy proficiency scores and level of engagement in ICT-related practices at work, adults aged 30-65 employed during year prior to survey*



1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born, and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with no use and each quintile of a ICT use at work index. The lowest quintile of use generally reflects use of ICTs at work rarely or less than once a month, whereas highest practice reflects engagement in multiple types of ICT-related activities daily or weekly.

Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

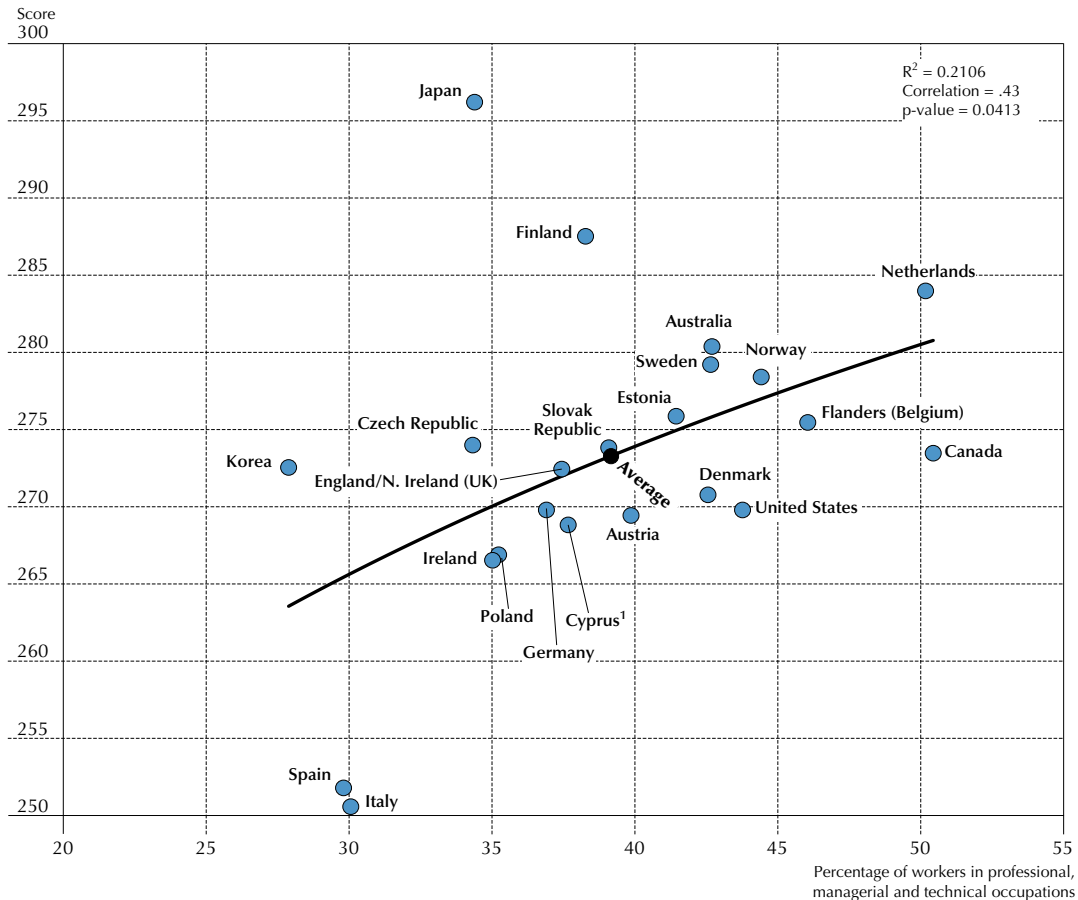
**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.12.

**StatLink** <http://dx.doi.org/10.1787/888932902341>

■ Figure 5.13 (L) ■


**Occupational structure at the country level, by average literacy proficiency**

Percentage of workers in professional, managerial and technical occupations during previous five years, by mean literacy proficiency scores



1. See notes at the end of this chapter.

Source: Survey of Adults Skills (PIAAC) (2012), Table A5.13 (L).

StatLink  <http://dx.doi.org/10.1787/888932902360>

## SOCIAL, CULTURAL AND OTHER DAILY PRACTICES THAT HELP TO DEVELOP AND MAINTAIN SKILLS

Practicing skills outside of the work environment may also affect the development and maintenance of key information-processing skills over a lifetime. For example, reading outside of work, whether on paper or through the use of ICTs, affects the development of literacy skills, and numeracy practices outside of work affect the development of numeracy skills. Engaging with a wide variety of text-based content also has an impact on skills development and maintenance (Smith, 1996). The indices of reading and numeracy practices used for this analysis incorporate both frequency and variety of engagement in corresponding activities.

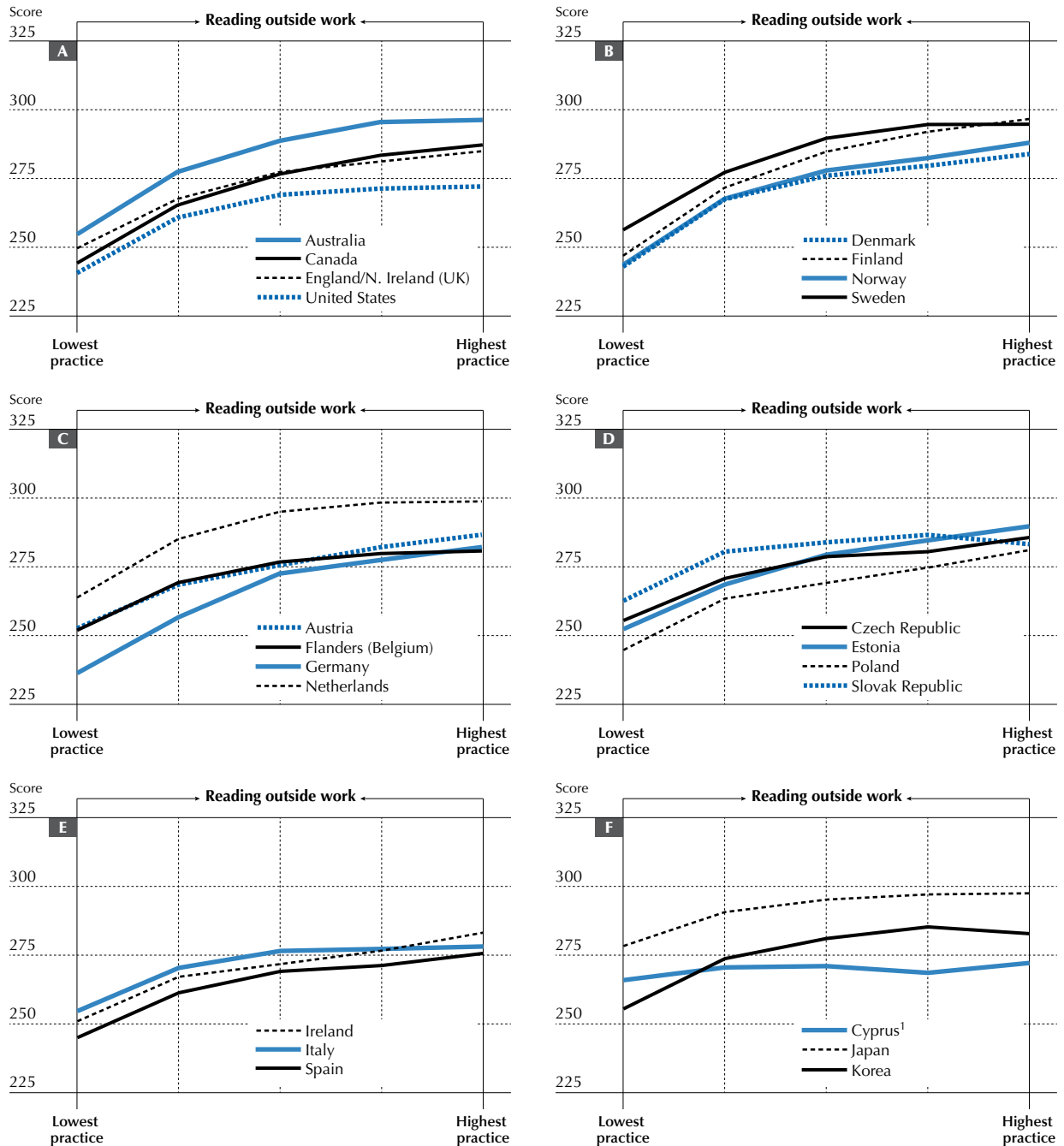
Results, presented in Figures 5.14 and 5.16 for literacy and Figure 5.15 for numeracy, suggest that, outside of work, adults who engage more frequently in a variety of practices that are relevant to the skills assessed score higher on average than those who engage less frequently. As for the previous set of findings, adjustments are made to account for the relationship between these types of practices and educational attainment. The results suggest that these activities practiced outside of work have an even stronger relationship with the skills assessed than the corresponding activities that are practiced at work. In particular, adults who engage very little in reading or in activities involving numeracy outside of work score very low in the domains assessed.



Figure 5.14

### Reading outside work and literacy proficiency

Relationship between literacy proficiency scores and level of engagement in reading outside work



1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born, and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with each quintile of a reading outside work index. No practice of reading is combined with the lowest quintile of practice, which generally reflects reading outside work rarely or less than once a month, whereas highest practice reflects reading multiple types of texts daily or weekly.

Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

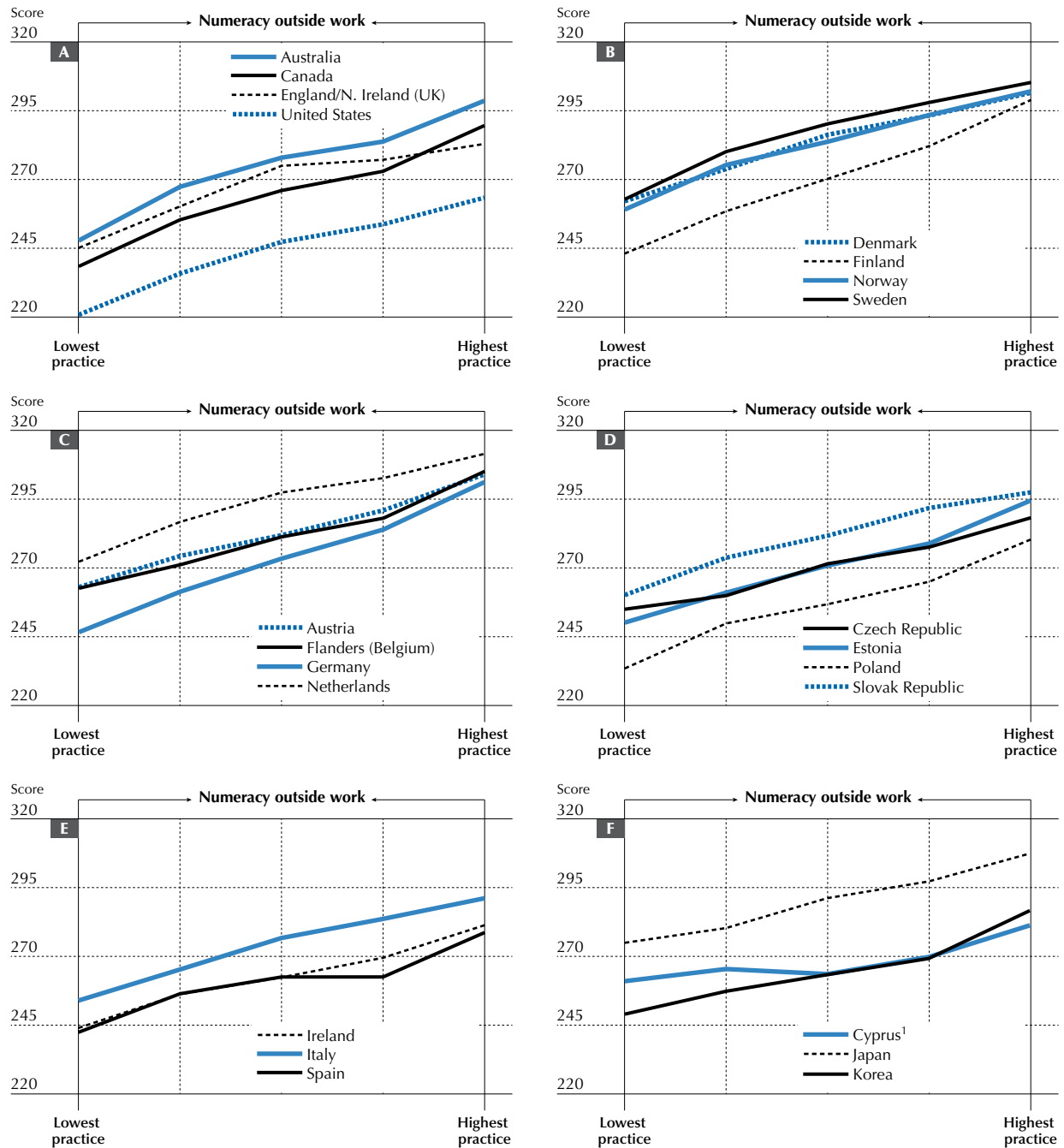
**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.14.

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Figure 5.15

### Numeracy practice outside work and numeracy proficiency

Relationship between numeracy proficiency scores and level of engagement in numeracy-related practices outside work



1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born, and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with each quintile of a numeracy practice outside work index. No practice of numeracy is combined with the lowest quintile of practice, which generally reflects numeracy practice outside work rarely or less than once a month, whereas highest practice reflects engagement in multiple types of numeracy-related activities daily or weekly.

Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.15.

**StatLink** <http://dx.doi.org/10.1787/888932902398>

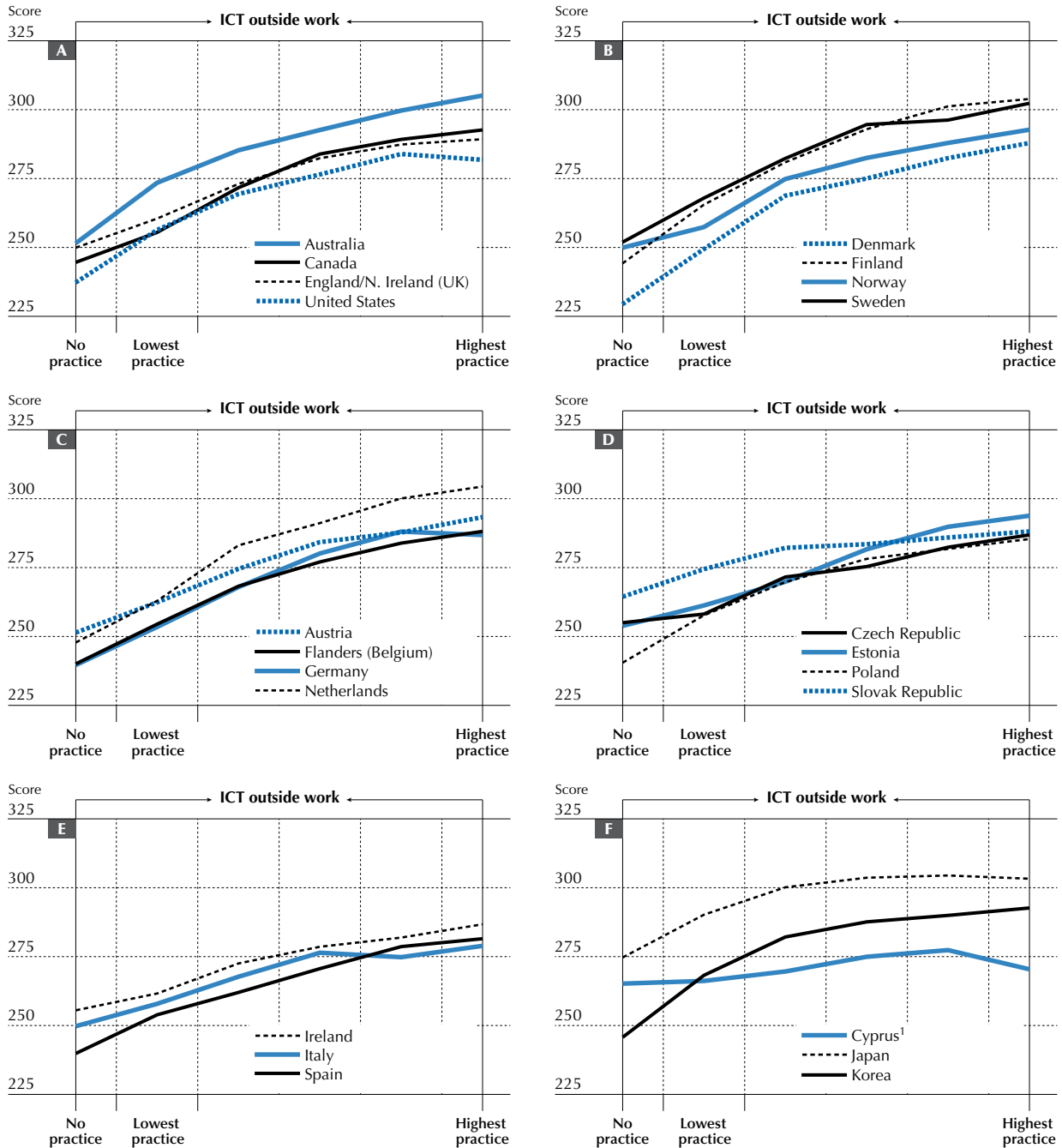




■ Figure 5.16 ■

**ICT use outside work and literacy proficiency**

*Relationship between literacy proficiency scores and level of engagement in ICT-related practices outside work*



1. See notes at the end of this chapter.

**Notes:** Results are adjusted for educational attainment and immigrant and language background. The reference group for which the curves are drawn is adults who have attained upper secondary education, are native-born, and whose first or second language learned as a child is the same as the language of the assessment. The curves reflect means scores associated with no use and each quintile of an ICT use outside work index. The lowest quintile of use generally reflects use of ICTs outside work rarely or less than once a month, whereas highest practice reflects engagement in multiple types of ICT-related activities daily or weekly.

Countries in Panel A-D are grouped according to regional or language considerations with the remainder grouped in Panel E-F.

**Source:** Survey of Adult Skills (PIAAC) (2012), Table A5.16.

**StatLink** <http://dx.doi.org/10.1787/888932902417>

## SUMMARY

While formal education is found to be the single most important factor related to proficiency, results from the Survey of Adult Skills also suggest that there are large variations in proficiency related to the type and level of an individual's qualifications, and this varies by country. This is partly due to differences in the quality of education concerning the skills measured in the Survey of Adult Skills. It is also due to the fact that literacy, numeracy and problem solving in technology-rich environments can be developed outside of formal education. Indeed, learning does not stop at the end of initial schooling. As individuals age and spend more time out of education, a range of other factors, such as participation in adult learning activities, the tasks they perform at work, and engagement in activities involving the use of literacy, numeracy and problem-solving skills outside of work, become increasingly important for enhancing and maintaining these skills.

Patterns of participation in education and training over a lifetime, providing training for adults, and the nature of job tasks are, themselves, a function of different policy decisions relating to how education and training systems and the workplace are organised. Understanding the potential role of these various factors in developing and maintaining proficiency in information-processing skills and how they function at different stages in life is important, given that most advanced countries are confronting the dual challenge of ageing populations and ongoing structural change.

In addition to the learning that occurs in formal education, reading, whether on a screen or on paper, is found to be closely linked to proficiency: adults who read more are likely to be better readers, and better readers are also likely to read more. Nevertheless, the findings suggest that access to digital technologies, in the workplace or elsewhere, the organisation of work, and the allocation of work tasks make a difference in whether information-processing skills are developed and maintained. This implies that policies aimed at improving literacy and numeracy skills among adults must ensure that the skills inculcated in education and training programmes are put to use in the workplace.

## Notes

1. A separate report is planned for 2014 to provide additional detailed analyses of results on the problem solving in technology-rich environments scale.
2. The Report of the Taskforce on the Aging of the American Workforce (2008) estimated that between 2004 and 2014, the labour force participation rate in the US is projected to increase by 42.3% for people aged 55-64, and by 74% for people aged 65 and older.
3. Period effects are also a possibility, but generally cannot be identified with any certainty (see Winship and Harding, 2010). Period effects are similar to cohort effects, but the term is often reserved for effects that could have affected everyone at the time of the assessment. Such occasion-specific influences may include economic conditions such as a recession or crisis.
4. A negative relationship between cognitive skills, such as reasoning, episodic memory, vocabulary or processing speed, and age as well as literacy, numeracy and problem solving has been consistently found in a wide range of studies conducted from different disciplinary perspectives (e.g. cognitive scientists, gerontologists, medical doctors, educationalists) and based on different methods (e.g. cross-sectional designs, longitudinal designs) (see Desjardins and Warnke, 2012). Such relationships have been observed since the 1930s (Jones and Conrad, 1933).
5. See notes below.

### Notes regarding Cyprus

**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".

**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.



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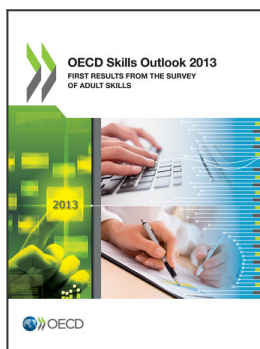
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