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Numeracy practices and numeracy skills among adults

Nicolas Jonas

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NUMERACY PRACTICES AND NUMERACY SKILLS AMONG ADULTS

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By Nicolas Jonas, OECD

This working paper has been authorised by Andreas Schleicher, Director of the Directorate for Education and Skills, OECD.

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Abstract

We assess the relationship between numeracy skills and numeracy practices among adults in everyday life and at work from the Survey of Adult Skills, a product of the Programme for the International Assessment of Adult Competencies (PIAAC), an international survey of about 250 000 adults aged 16-65 years old conducted by the OECD in 33 countries/economies.

The level of proficiency and the intensity of engagement in numeracy practices are two embedded aspects of numeracy. Proficient adults use numeracy frequently and adults who regularly engage in numeracy practices improve their performance.

Individual and contextual factors influence, in different ways across countries, the strength of these links. The intensity of the use of numeracy in everyday life decreases as the lapse of time since a person's studies increases. Moreover, employed people engage in mathematical activities less in the private setting if they do not do so intensively in the workplace.

Résumé

Nous étudions les liens entre les compétences et les pratiques des adultes en numératie dans leur vie de tous les jours et au travail en analysant les données de l'enquête internationale sur les adultes, un produit du Programme pour l'évaluation internationale des compétences des adultes (PIAAC), portant sur 250 000 adultes âgés de 16 à 65 ans et menée par l'OCDE dans 33 pays et régions.

La maîtrise des compétences et l'intensité d'engagement dans les pratiques sont deux aspects liés de la numératie. Les adultes compétents en numératie y ont recours plus fréquemment, et ceux qui pratiquent régulièrement la numératie améliorent leurs performances.

Plusieurs facteurs jouent sur la force de ces liens, mais différemment selon les pays. L'intensité de pratique au quotidien diminue avec l'éloignement des études. Par ailleurs, les actifs occupés pratiquent moins la numératie dans le cadre privé s'ils n'y ont pas intensivement recours dans leur travail.

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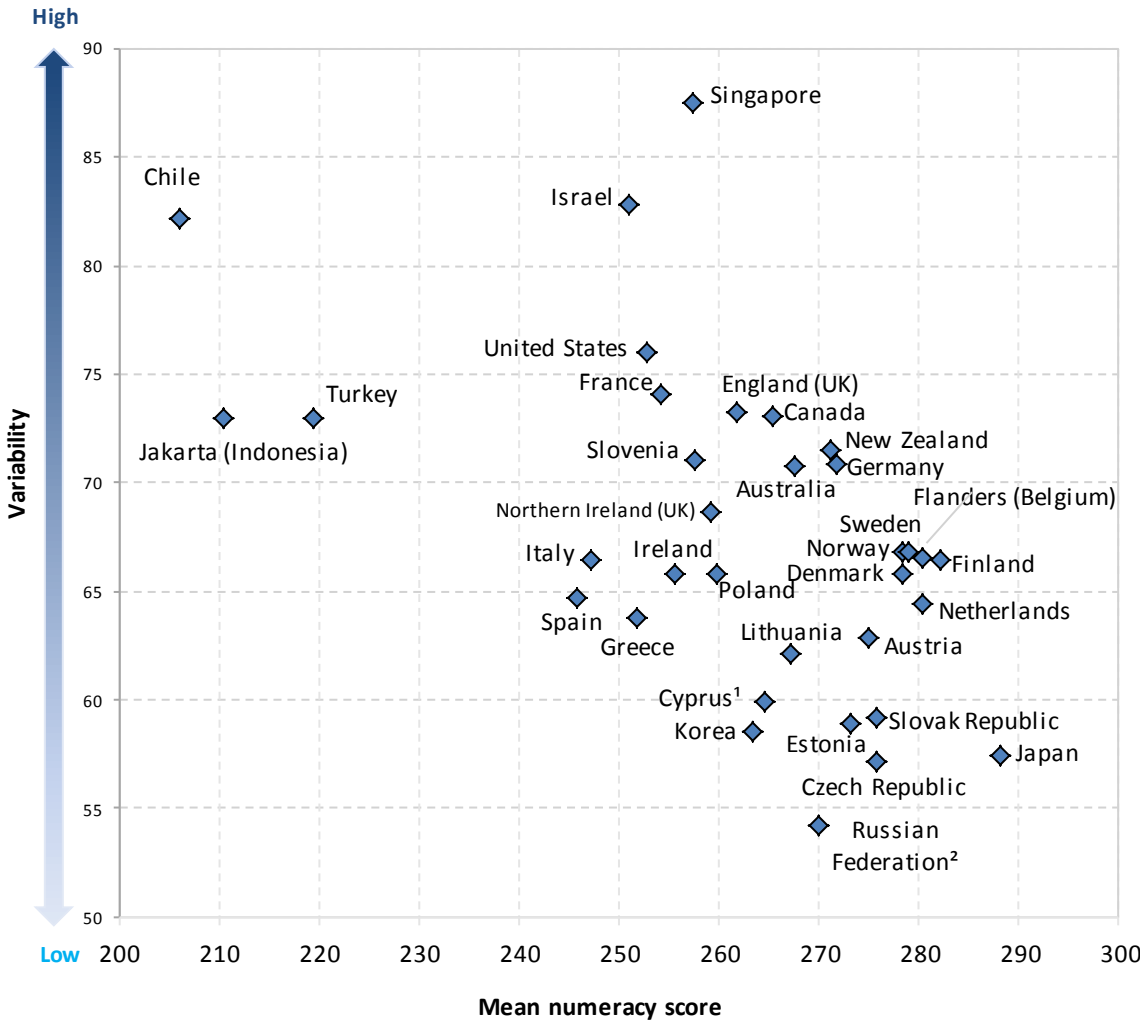
1. Introduction

The OECD's Programme for the International Assessment of Adult Competencies (PIAAC), following on from the International Adult Literacy Survey (IALS) and the Adult Literacy and Life Skills Survey (ALL), has highlighted the important role of cognitive skills, including numeracy skills, in individuals' active participation in modern society. Adults must be able to use a wide range of mathematical skills in many everyday situations – for example when making decisions, dealing with numerical information, or trying to assess the relevance of figures. Recent changes in the world of work, such as the digital revolution and the growth of jobs in the service and information sector, also mean that workers need good numeracy skills to complete properly the tasks they are set in the normal course of their employment.

However, not all individuals have the ability to understand numbers and use them properly. Recent OECD reports have highlighted the existence of significant inequalities in numeracy proficiency between countries and within adult populations in PIAAC participating countries (Figure 1.1). The observed discrepancies have detrimental effects for the least proficient individuals, since numeracy skills are one of the aspects of human capital that is valued in the labour market. In addition, the mastery of these skills is linked to other important aspects of individual well-being, including health, political efficacy, trust in others and participation in voluntary or associative activities (OECD, 2016[1]).

Figure 1.1. Average and variability of numeracy scores

Relationship between mean numeracy proficiency score and variability



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Throughout this report, including in boxes and annexes, a * symbol is shown where Cyprus is mentioned, inviting readers to refer to the notes above.
2. The sample for the Russian Federation does not include the population of the Moscow municipal area.
Note: The indicator used for variability is the interquartile range (the difference between the third and first quartiles).
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.5, http://dx.doi.org/10.1787/888933366458.

Improving the average numeracy level of adults, whether or not they are attached to the labour market, therefore seems a legitimate goal of public action. Achieving this goal

requires among other things a better understanding of the factors that influence people's familiarity with the use of mathematical operations in everyday life or at work.

There are a number of reasons why this is so. First, engaging in activities involving calculations is one of the important dimensions of numeracy. From this point of view, it is as important to understand the factors associated with varying intensity in the use of numeracy as it is to understand the factors associated with varying proficiency in numeracy. Second, given that more or less regular use is a mechanism by which skills develop over the long-term (Reder and Bynner, 2009[2]), it is useful to identify the personal and contextual factors that affect the intensity of individual numeracy practices and their development. Finally, by examining the factors that determine practice, it is possible to assess what is measured by the questions about numeracy activities in PIAAC, in order to improve our understanding of the scope and limitations of these data.

In this context, the first objective of this report is to present the factors that may account for the frequency and intensity of the everyday and work-related practices in the field of numeracy that are covered by the PIAAC questionnaire. Particular emphasis is placed on individual characteristics such as the level of numeracy proficiency, sex or age, but also on the environment (working, every day or educational) in which adults engage in calculation and mathematical reasoning activities, as factors affecting the intensity of their numeracy practices. There has been little exploration of these questions using data from PIAAC or previous surveys such as IALS and ALL. Some analysis can be found in Chapter 4 of OECD (2016), and in the work of Quintini (2011[3]), Ryan and Sinning (2011[4]) and McGowan and Andrews (2015[5]), which focus exclusively on numeracy in work-related contexts. In the literature, analyses of the uses of numeracy also tend to be secondary to analyses of literacy practices and are generally reserved for work on skills mismatch in the labour market or, less commonly, on training needs. To our knowledge, no analysis of the factors influencing adult numeracy practices, taking account of the context in which these activities occur, has previously been conducted using PIAAC data.

1.1. Presentation of PIAAC

PIAAC is an international survey that directly measures the information-processing skills of adults aged 16 to 65 years. Thirty-three countries participated in the first edition of the survey (24 in the first round and 9 in the second round). Respondents completed a biographical questionnaire and then underwent a literacy assessment, a numeracy assessment and, for 28 of the participating countries, an assessment of problem-solving in technology-rich environments. Respondents completed the assessments on a laptop or on paper if their computer skills did not enable them to use a laptop properly. The sample size in most countries was around 5 000 adults. All the technical specifications of the survey can be found in the reader manuals (OECD, 2016[6]; OECD, 2013[7]) and in the survey's technical report (OECD, 2016[8]). The PIAAC programme provides information about two dimensions of adult numeracy skills in particular. It offers a measure of *proficiency level*, based on a standardised numeracy assessment, and a measure of intensity of adults' *use of numeracy*, based on self-reported questions about the frequency of a whole series of activities involving the use of numeracy-related skills and/or reasoning.

The analyses in this report are based on data from 30 of the 33 countries/economies that participated in one of the first two rounds of the survey[1].

1.2. The structure of the report

This report is organised into four chapters.

Chapter 1, which looks at the numeracy practices of adults in everyday life, first seeks to define an acceptable way of measuring the phenomenon. Then, distinguishing between students and the rest of the population aged 16-65, the second part of the chapter is devoted to identifying the factors in these practices by considering the main demographic, social and educational information available.

Chapter 2 describes the use of numeracy in the workplace. The main challenge is first to understand what individual and contextual characteristics determine the level of workers' engagement in numeracy practices. Next, the influence of intensity of engagement on numeracy practices at work on adults' level of competency in numeracy is examined through its links with everyday practices and through its influence on the take-up of professional training ("use it or lose it").

Chapter 3 examines the specific consequences of numeracy (skills and use) for adults active in the labour market by analysing its links with access to the labour market, salary level and the ability to use the computer tools needed in modern economies.

Chapter 4 is dedicated to a broader and more exploratory question to which the PIAAC data only offer a partial answer, that of the links between individual well-being and numeracy. An extensive literature has shown that familiarity with numeracy (proficiency and practices) influences adults' understanding of the world around them. After recalling the main conclusions of these studies, we outline some points of analysis relating to two specific areas of application of this hypothesis: financial literacy and so-called health literacy.

The conclusion of this report summarises the links between skills and practices in the field of numeracy and the importance of these links for adult populations. The limitations encountered in compiling the report are indicated here, and the opportunity is taken to suggest some modifications for the next PIAAC cycle.

[1] Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Lithuania, the Netherlands, New Zealand, Norway, Poland, Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United Kingdom (England and Northern Ireland) and the United States. Cyprus*, Jakarta (Indonesia) and the Russian Federation are not included in this report. Cyprus* is omitted because the proportion of missing answers due to language problems was too high, Jakarta because the assessment was carried out exclusively on paper and the Russian Federation because of incomplete coverage of the Russian population.

2. Practices in everyday life

2.1. Measuring adults' numeracy skills

Numeracy, defined as "the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life" (OECD, 2016, p. 49[1]), is one of the three key information-processing skills assessed in PIAAC. Built around the consideration of real-life situations, this definition emphasises the usefulness of numeracy in many everyday situations in which adults need to manage information and solve problems by responding to mathematical content, ideas or reasoning presented in various forms. For this reason, the concept of numeracy as defined in PIAAC has five facets which describe its various dimensions: contexts (the situations in which adults use numeracy-related behaviour), responses (the types of responses expected depending on the nature of the mathematical demands), content (the set of mathematical information and ideas that adults use and on the basis of which they must act), representations (the forms in which mathematical information is presented and contextualised) and cognitive and non-cognitive processes (the types of cognitive operations and attitudes deployed when engaging in numeracy-related behaviour) (OECD, 2012, pp. 35-39[9]).

Numeracy skills are measured by a test administered directly to respondents. The test questions are constructed so as to fully cover the five facets describing the dimensions of numeracy. The results are presented on a scale from 0 to 500 points. To facilitate the interpretation of the scores obtained, the proficiency scale is divided into "proficiency levels". Descriptors have been developed to summarise the types of tasks that adults are likely to be able to complete who have obtained a given score on the proficiency scale. They indicate what adults are able to do when they reach a certain level of proficiency. There are six levels of numeracy proficiency (Levels 1 to 5 plus below Level 1). The composition of the six proficiency levels and the descriptors associated with these levels are presented in Chapter 4 of the *Reader's Companion* (OECD, 2016[6]).

2.2. Adults' numeracy practices at work and in everyday life

Adults' use of numeracy at work and in everyday life is a research topic which has a long history (Sewell, 1981[10]; Payne, 2002[11]) and has been the subject of attempted assessments in large-scale surveys such as the Adult Learners' Lives project of Barton, Ivanic, Appleby, Hodge and Tusting (Barton et al., 2004[12]) and the ALL survey of the OECD and Statistics Canada.

In addition to measuring numeracy skills, the PIAAC questionnaire also collects information on the frequency with which adults engage in a number of numeracy-related activities in everyday life and at work. The frequency scale used to record responses consists of five categories ranging from "never" to "every day". Respondents are questioned about six activities related to numeracy in the strict sense, such as activities involving calculations and the use of mathematical formulas, for instance to calculate

prices, costs or budgets, the use of a calculator, the preparation of charts, tables or graphs, or the use of advanced maths or statistics. Two of the eight questions that normally fall under the category of reading activities have been added to the analyses in this report, as they involve accessing numerical and mathematical information and representations that have a mathematical dimension. These are the questions about the reading of bills, invoices, bank statements or other financial statements, and about reading diagrams, maps or schematics. These activities can be seen as falling within the definition of numeracy used in PIAAC, as they involve mathematical content (quantities or relationships) and representations of mathematical information in the form of numbers, texts, diagrams or maps.

Before returning in more detail to the description of the questions, it should be noted that, in the case of employed adults, the questionnaire makes a clear distinction between mathematical activities undertaken at work and those undertaken in everyday life, i.e. away from the work setting. By contrast, in the case of students, no distinction is made between mathematical activities carried out in everyday life and those carried out in connection with their studies. This means that for respondents who are not employed, the uses in "everyday life" cover all mathematical activities, including those required by the nature of their course, whereas for employed respondents, the uses in "everyday life" cover all mathematical activities engaged in outside work.

2.3. Frequency and intensity of numeracy practices in everyday life

To provide a detailed idea of the intensity with which adults use numeracy in their daily lives, the questions were introduced by the phrase "Outside your work" (or "In everyday life" if the person is not in employment), "how often do you usually...". The results of the descriptive statistics concerning the responses are summarised in Table 2.1. The most commonly cited activities are "reading bills, invoices, bank statements or other financial statements", "using a calculator (hand-held or computer-based)", and "calculating prices, costs or budgets", which around 40% of adults say they engage in at least once a week. At the other end of the spectrum, "preparing charts, graphs or tables" and especially "using advanced maths or statistics" are the most infrequently reported uses of numeracy, with more than 70% of adults engaging in them less than once a month.

Table 2.1. Descriptive statistics on numeracy practices in everyday life (OECD mean)

Numeracy practices	% Missing	% Never	Mean	Standard-deviation
Reading bills, invoices or bank statements	1.3	14.2	3.085	1.110
Calculating prices, costs or budgets	1.4	23.7	2.845	1.335
Using a calculator	1.3	22.3	2.807	1.288
Using or calculating fractions, decimals or percentages	1.4	43.4	2.242	1.318
Using simple algebra or formulas	1.4	56.5	1.985	1.247
Reading diagrams, maps, or schematics	1.3	49.2	1.937	1.104
Preparing charts, graphs or tables	1.3	74.0	1.425	0.853
Using advanced maths or statistics	1.3	86.2	1.249	0.746

Note: Response format: 1 = "Never", 2 = "Less than once a month", 3 = "Less than once a week but at least once a month", 4 = "At least once a week but not every day", 5 = "Every day"; For each question: Min = 1, Max = 5.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Box 2.1. Constructing an index of intensity of engagement in numeracy practices

The PIAAC background questionnaire asks adults about the frequency with which they undertake eight groups of tasks involving numeracy skills. As shown in the following table, the eight selected practices attempt to reflect the wide variety of possible applications of numeracy skills. Two questions concern the interpretation of numerical information. Three questions relate to purely mathematical (or conceptual) knowledge. The last three questions describe contextualised technical skills that require some familiarity with maths. However, they do not cover all areas of numeracy. In particular, tasks related to the management of risk or uncertainty are absent from the list. Moreover, the practices about which information is sought are not mutually exclusive: for example, a calculator may be used to calculate prices or budgets. Finally, some of the practices described require additional skills in literacy (reading a bill) or computers (constructing graphs).

Table 2.2. Use of numeracy skills

Question	Wording	Domain
H_Q01g	Read bills, invoices, bank statements or other financial statements?	Interpretation
H_Q01h	Read diagrams, maps, or schematics?	Interpretation
H_Q03b	Calculate prices, costs or budgets?	Use
H_Q03c	Use or calculate fractions, decimals or percentages?	Concept
H_Q03d	Use a calculator - either hand-held or computer based?	Use
H_Q03f	Prepare charts, graphs or tables?	Use
H_Q03g	Use simple algebra or formulas?	Concept
H_Q03h	Use more advanced maths or statistics such as calculus, complex algebra, trigonometry or use of regression techniques?	Concept

Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The response categories employ a five-point Likert scale based on the frequency of use reported by the respondent. This coding method does not provide any information about the time needed to complete the task referred to by the question. For example, the responses do not make it possible to distinguish between someone who takes one day a week to prepare his or her budget and someone who calculates discounts while doing the weekly shopping. To make it easier to calculate averages, each response category is given a value from 1 to 5.

Table 2.3. Response categories

Response categories	Coding
Never	1
Less than once a month	2
Less than once a week but at least once a month	3
At least once a week but not every day	4
Every day	5

To analyse the overall use of practices involving adults' numeracy skills, the most immediate solution would have been to average the eight responses for each individual. However, the result obtained in this way is hard to interpret, as this method treats the different practices indiscriminately, regardless of their rarity and

relative difficulty, and leads to confusion between the number of practices and their frequency of use. For example, an individual reporting varied but infrequent uses of numeracy would obtain the same average as someone engaging very regularly in a small number of these practices.

The most common statistical approach to constructing an index from a series of questions with multiple response modes is to estimate a dimension (or latent trait) that ranks individuals by their response profile. On the specific subject of numeracy practices, some studies have for example opted for a latent class analysis method to distinguish groups of individuals with very marked response profiles (Duchhardt, Jordan and Ehmke, 2017[13]). In this report, the low number of practices identified and the clear ranking in the technical difficulty of these practices ruled out this method. The choice therefore fell on a two-parameter item response theory model (IRT).

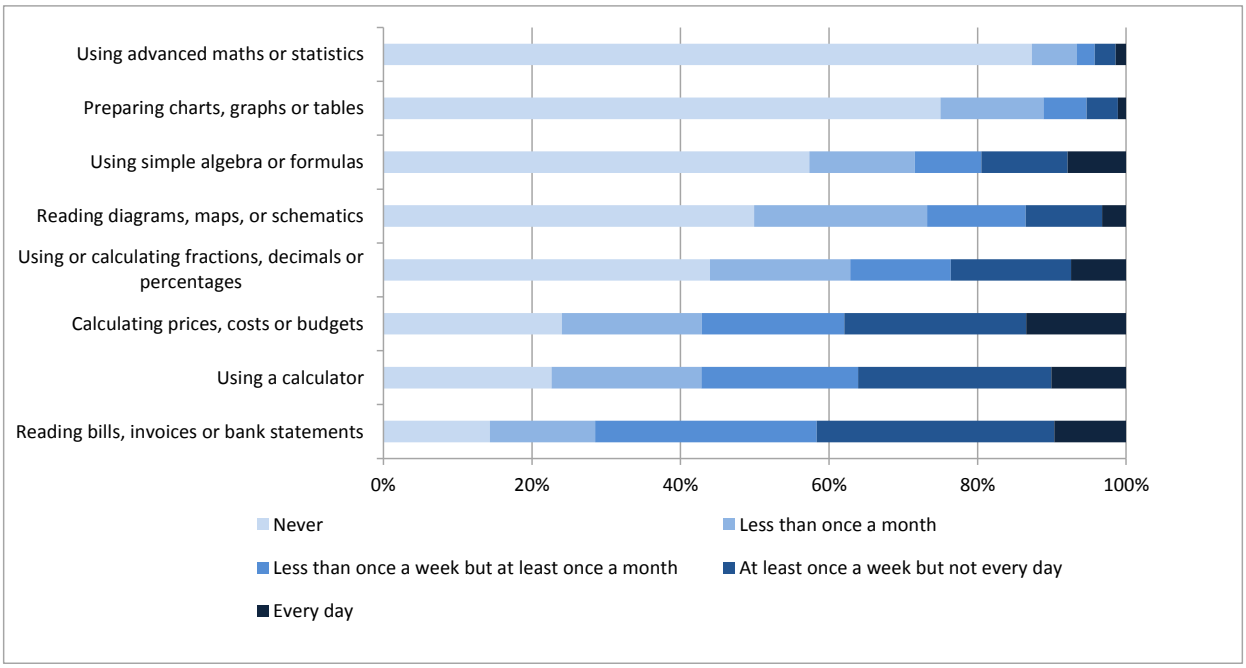
The variable estimated from the sample of all countries participating in PIAAC models the behaviour of each individual with regard to numeracy practices by assigning him or her a score between -3 and 3. To facilitate the reading of the results, this score has been transformed into a variable between 0 and 1, the value of which depends on the percentile in the score distribution to which a given individual belongs. For example, a value of 0.12 means that the individual has a score in the 12th percentile of the distribution. By combining data on frequency of use of practices and data on number of practices used, this measure could be seen as an approximation of the intensity of adults' engagement in numeracy practices.

The division of this index into three groups reflecting the level of engagement in the use of mathematics (limited, median, intensive) is based on the structure of the item responses. Some items only have a reported frequency of other than zero if the value of responses to the other items is high. For example, responses greater than 1 to the two most rarely mentioned items fairly clearly characterise people in the intensive group, whereas people in the “median” group tend to give responses greater than 1 only to the six most frequent items, and those in the last group only to the three most frequent items.

The occurrence of “never” as a response varies greatly from question to question (Figure 2.1). The more a practice requires expert mathematical formalisation (equations, statistics) or some technical knowledge (graph preparation), the higher the percentage of adults saying that they never engage in it, reaching 86% for the last question (use of advanced statistics or maths).

The overall proportion of adults who say they never undertake any of the listed numeracy activities in everyday life is around 6%. However, this figure is difficult to interpret. It does not necessarily mean that more than 1 in 20 adults never use numeracy in everyday life. Other fields in which numeracy is used are not included in the list in the questionnaire, even though they may be used relatively frequently. In particular, this could include measuring weights and distances – something that, according to other sources, more than 50% of the adult population in Germany report doing at least once a week, for example (Duchhardt, Jordan and Ehmke, 2017[13]).

Figure 2.1. Distribution of responses to the eight questions on numeracy practices in everyday life



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The distribution varies greatly by country. More than a quarter of adults in Italy, Japan and Korea never use numeracy in everyday life, whereas the proportion rises to more than a third in Chile, Lithuania and Turkey. Conversely, in Norway only 4% of 16-65 year-olds report that this is the case. The question that met with the most varied responses between countries is definitely that concerning the use of "algebra or formulas". The average answer to this question ranges from 1.36 in Japan to 3.68 in the Czech Republic, with an OECD average of 1.98. This heterogeneity may be due in part to the translation of this item: the technical complexity of the practice covered by the question varies depending on the respondent's language and country.

Table 2.4. Country mean: Numeracy practices in everyday life

Countries and economies	Reading bills, invoices or bank statements	Calculating prices, costs or budgets	Using a calculator	Using or calculating fractions, decimals or percentages	Using simple algebra or formulas	Reading diagrams, maps, or schematics	Preparing charts, graphs or tables	Using advanced maths or statistics
Australia	3.6	3.2	2.9	2.5	1.7	2.4	1.5	1.3
Austria	3.4	2.6	2.7	2.3	2.5	1.7	1.4	1.2
Canada	3.4	3.1	3.0	2.6	1.8	2.2	1.5	1.3
Chile	2.4	2.8	2.7	2.1	1.7	1.7	1.5	1.3
Czech Republic	2.8	2.8	3.0	2.3	3.7	1.9	1.5	1.3
Denmark	3.2	2.5	3.0	2.3	2.0	1.9	1.5	1.3
England (UK)	3.5	3.2	2.7	2.2	1.4	2.1	1.3	1.2
Estonia	2.8	3.1	3.1	2.3	2.3	1.8	1.5	1.3
Finland	3.3	3.1	3.0	2.7	3.1	2.4	1.6	1.4
Flanders (Belgium)	3.4	2.3	2.6	1.9	1.7	1.7	1.3	1.2
France	3.3	2.8	2.9	2.0	1.6	1.8	1.4	1.2
Germany	3.5	2.9	2.8	2.4	2.0	2.1	1.5	1.3
Greece	2.8	3.2	2.7	2.1	2.1	1.5	1.2	1.1
Ireland	3.4	3.1	2.6	2.1	1.5	1.9	1.4	1.2
Israel	2.8	2.8	2.7	2.4	1.8	1.6	1.5	1.3
Italy	2.6	2.5	2.3	1.8	1.5	1.5	1.3	1.2
Japan	2.4	2.2	2.8	1.6	1.4	2.0	1.3	1.1
Korea	2.7	3.1	3.0	2.1	1.8	2.4	1.4	1.3
Lithuania	2.1	2.9	2.8	1.8	2.5	1.6	1.2	1.1
Netherlands	3.4	2.2	2.5	2.0	1.7	1.9	1.5	1.2
New Zealand	3.6	3.4	3.1	2.7	1.8	2.5	1.5	1.3
Norway	3.5	2.5	3.0	2.4	1.8	2.2	1.5	1.3
OECD mean	**3.1**	**2.8**	**2.8**	**2.2**	**2.0**	**1.9**	**1.4**	**1.2**
Poland	2.7	3.0	2.8	2.1	2.6	1.8	1.4	1.3
Singapore	2.9	3.0	3.1	2.4	1.7	2.0	1.4	1.3
Slovak Republic	2.8	3.0	3.0	2.3	2.3	1.7	1.3	1.1
Slovenia	3.0	3.0	2.9	2.4	2.4	2.1	1.4	1.2
Spain	3.2	2.9	2.5	2.1	1.6	1.7	1.5	1.3
Sweden	3.2	2.6	3.0	2.5	1.9	2.3	1.4	1.3
Turkey	2.2	2.4	2.0	1.7	1.8	1.2	1.2	1.1
United States	3.6	3.5	3.2	2.9	2.1	2.2	1.6	1.4

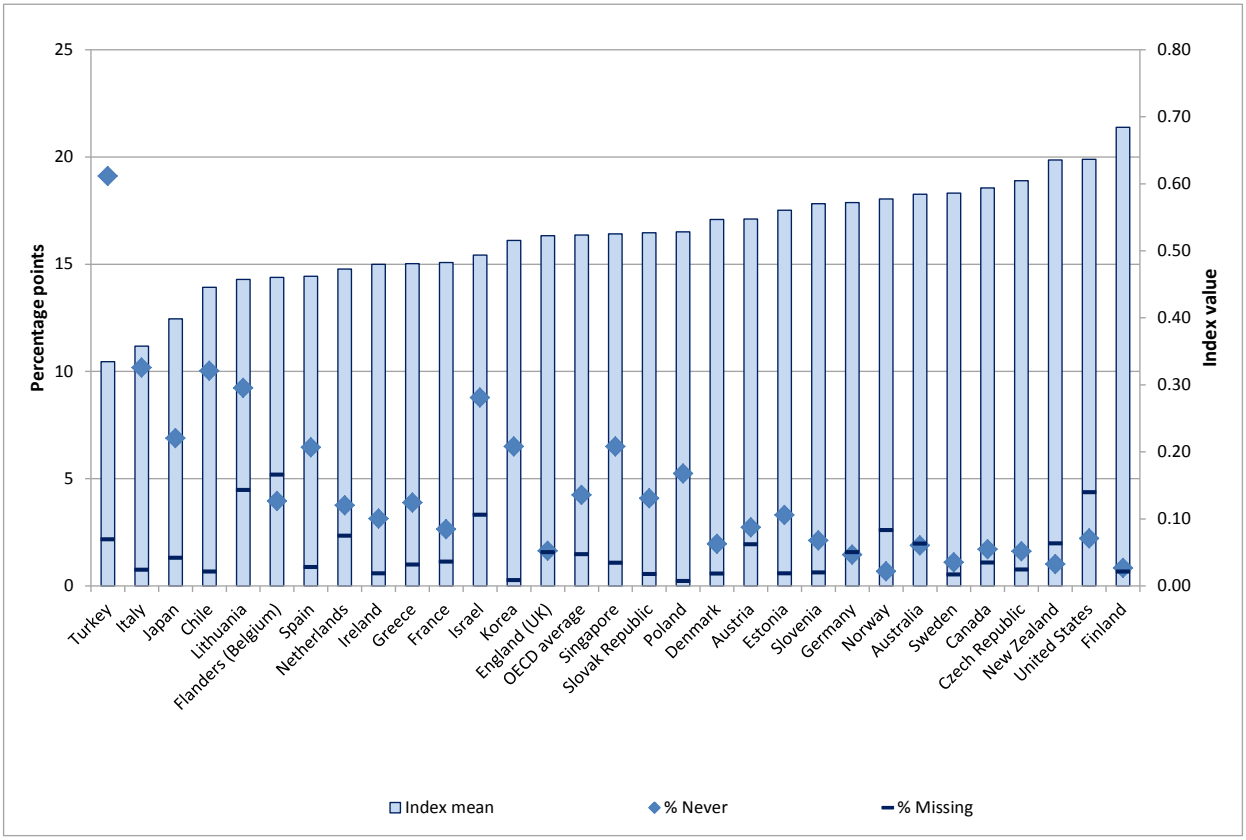
Source: Survey of Adult skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

To gain an idea of the overall intensity of engagement in numeracy practices, it would be possible to calculate the average reported frequency for all the questions studied. However, this average would be unsatisfactory, as it would indiscriminately aggregate the numeracy practices (whatever their difficulty) and the frequency of those practices. It was decided to synthesise the data using an item response model based on the eight ordinal variables represented by the eight questions on numeracy practices (Box 2.1). For the sake of clarity, the resulting variable was then transformed to take values between 0 (for respondents never engaging in any of the activities mentioned) and 1 (for those engaging in all practices every day) according to the percentile in the distribution to which each respondent belonged.

The national averages on this engagement intensity index all lie between 0.33 and 0.70. Three countries have an index score averaging well below 0.45 (Italy, Japan and Turkey),

and three others have an average above 0.60 (Finland, the United States and New Zealand). It should be noted that the index average is only imperfectly correlated with the share of the population never engaging in any activity (Figure 2.2). For example, the averages obtained in the United Kingdom and Korea are similar and very close to the OECD average (0.52), whereas the percentage of adults who engage in no numeracy activity is very high in the first country and very low in the second.

Figure 2.2. Index of intensity of engagement in numeracy practices in everyday life and the quality of responses, by country

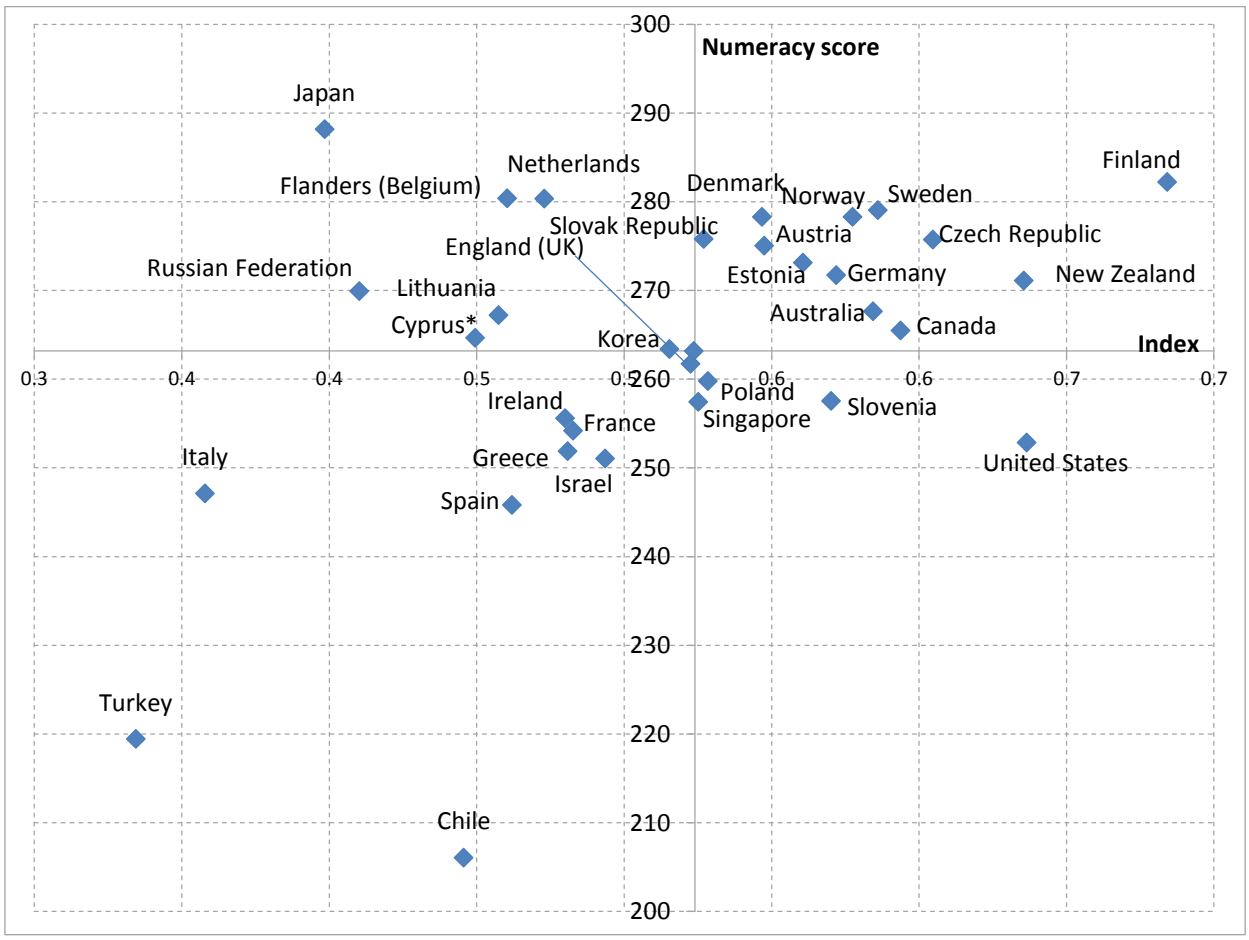


Note: Axis 1: Percentages of respondents answering "Never" (% Never) and giving no answer (% Missing) to all eight questions in the index. Axis 2: Engagement index value (Min = 0 and Max = 1).
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

One essential question regarding the use of skills is whether use simply reflects a mastery of those skills. In other words, to what extent does the index of intensity of engagement in numeracy practices in everyday life correlate with the level of numeracy proficiency achieved by adults? Figure 2.3 confirms that there is a positive relationship between these two variables. In general, the higher the national average of the index, the higher the national average numeracy score. However, there are two notable exceptions to this trend: the United States and Japan. In the first case, the population's average numeracy score is 252, 11 points below the OECD average, while the average index of intensity of engagement in everyday uses of numeracy is the second highest of any participating country. Conversely, in the second case, Japan has the highest numeracy score of any participating country, but one of the lowest average engagement indices.

The fact that countries/economies rank differently on these two dimensions suggests that mastery of skills and their use, though related to some extent, are two separate concepts. This could result from the different way in which skills are measured in the direct assessment and in the background questionnaire. However, it is more likely to indicate that other factors (such as educational background or employment situation) lead to more or less frequent use of skills by adults in their daily lives.

Figure 2.3. Countries means of index engagement intensity in numeracy practices in everyday life and of numeracy score



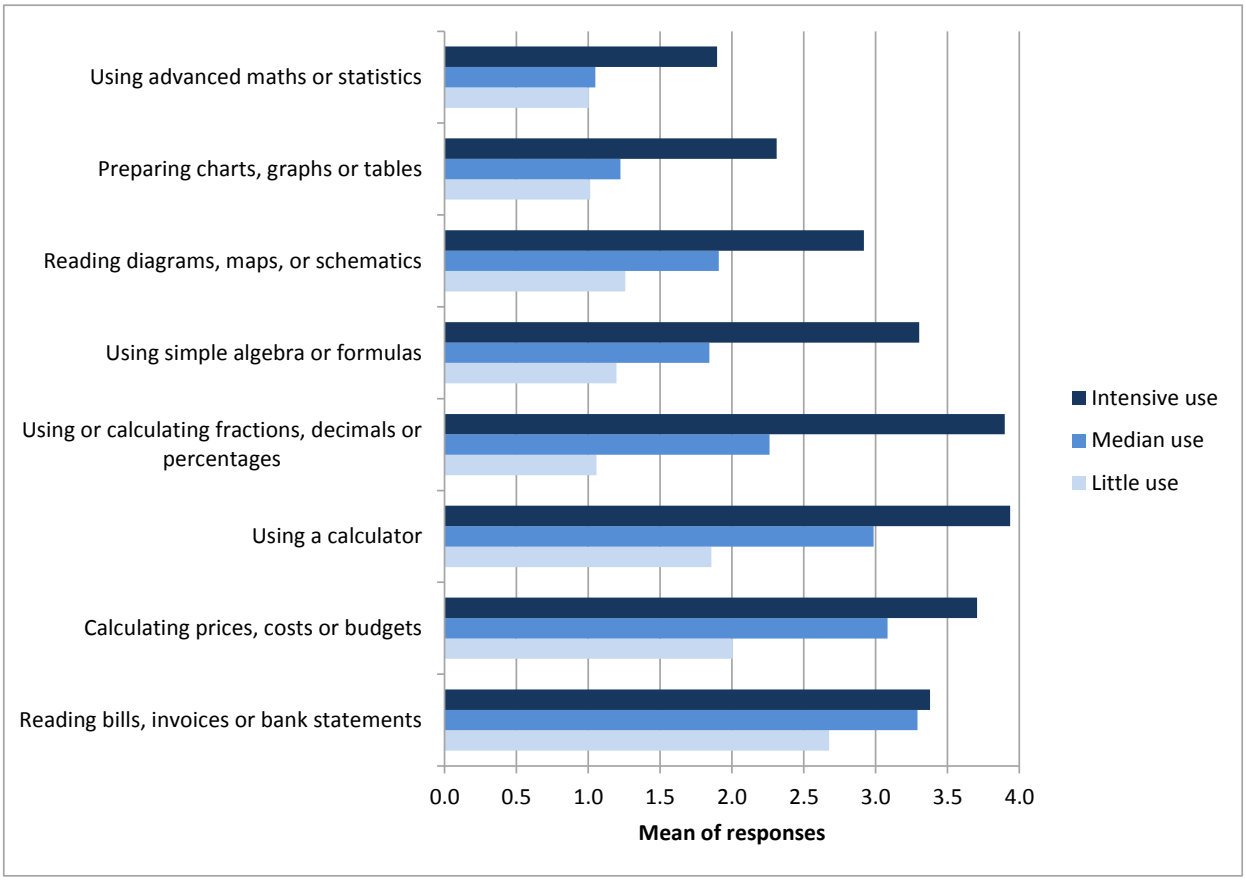
Note: The sample for the Russian Federation does not include the population of the Moscow municipal area.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

2.4. Low, average and intensive use of numeracy in everyday life

To facilitate the interpretation of the index, two exogenous thresholds have been defined that distinguish three levels of engagement in numeracy practices. Membership of the first group, covering the first 40 percentiles, reflects limited use of numeracy in everyday life. This group consists of adults who report infrequent use (or no use at all) of a very small number of practices, usually the most commonly cited ones. The last group includes the 25% of adults who claim to engage intensively in a large number of numeracy practices in everyday life, and in particular those requiring advanced proficiency in maths. Finally, the middle group is made up of the 35% of adults who make average use

of numeracy. Like those in the first group, they very rarely report the most technically demanding practices, but unlike them, they frequently engage in a number of practices requiring basic or intermediate mathematical knowledge.

Figure 2.4. Means of responses to the eight questions on numeracy practices in everyday life, by level of engagement in numeracy practices



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The average score for the eight questions of the adults in each of the three groups illustrates the differences in the nature and difficulty of the practices described in the questionnaire (Figure 2.4). The three most frequently cited practices in which individuals engage most regularly are those for which people in the "limited use" group score well above 1. For the three intermediate practices, the average use of the "limited use" group peaks at around 1, while that of the "average use" group is close to 2. Finally, the two most demanding practices are engaged in more than once a year almost exclusively by adults in the "intensive use" group.

Applying these thresholds to distributions of countries/economies, it can be noted that the proportion of adults making limited use of numeracy ranges from 12.5% in Finland to 64% in Italy. Conversely, only 10% of people make intensive use of numeracy in Turkey, compared with almost 45% in Finland. This presentation also brings out certain points that comparison of the index averages tended to confuse. For example, Sweden and Canada, which have a similar average index (0.58), have dissimilar distributions of

practice. The percentage of people who engage intensively in numeracy is much higher in the first of these countries (33.3%) than in the second (27.7%).

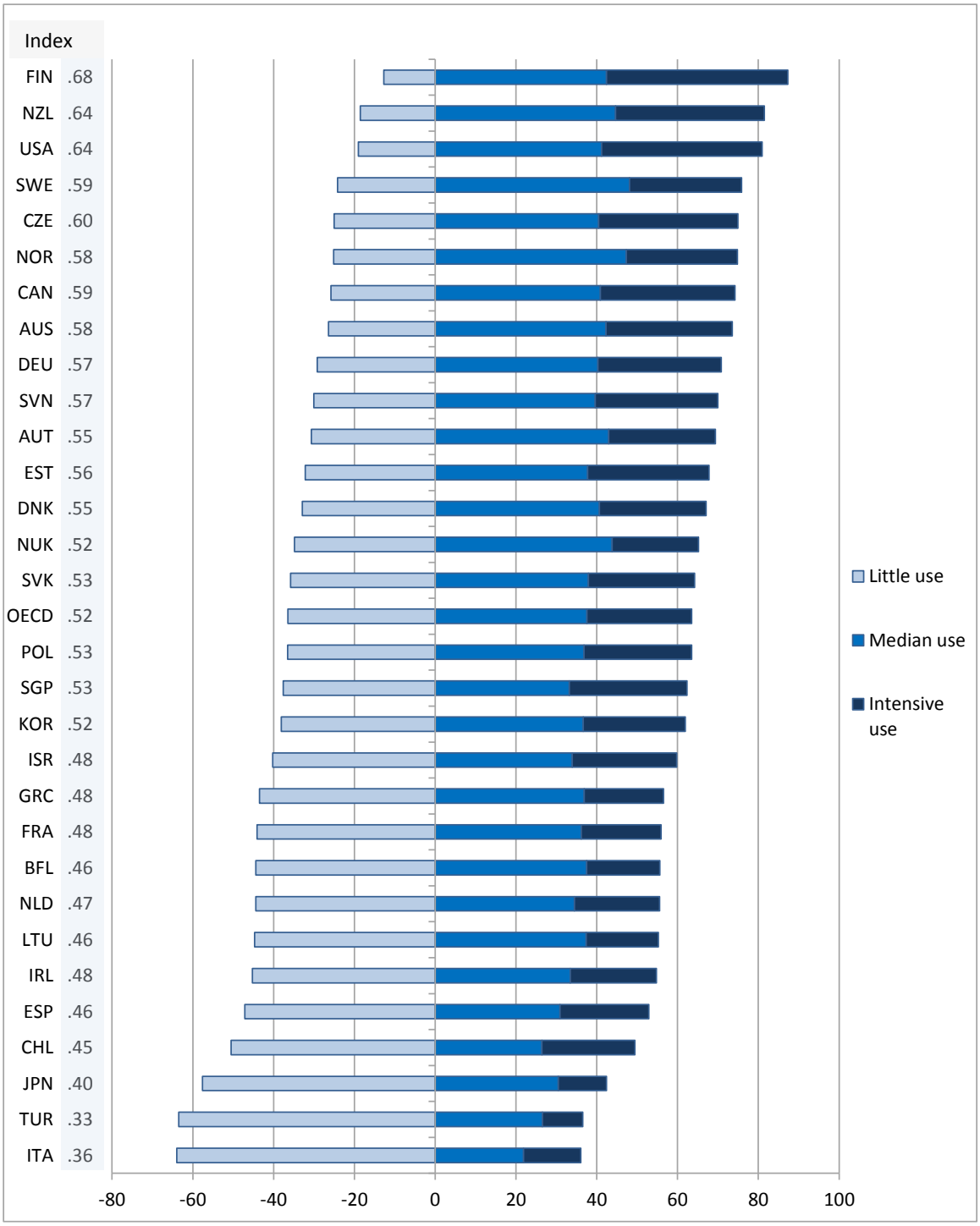
Analysis of the socio-demographic characteristics of adults according to their level of engagement also highlights pronounced differences relating to gender and age. Men are over-represented among adults making intensive use of numeracy: 29.8% of men belong to this group compared with 22.1% of women. Young adults aged between 16 and 25 are three times more likely than adults aged 56 to 65 to make intensive use of numeracy in everyday life. This difference in intensity of engagement is probably due mainly to the fact that most young adults are still in their initial education, so that their practices in everyday life partly reflect their practices in connection with their studies. If this age group is disregarded, the age-related engagement gradient, while still observable, is far less pronounced. For example, adults aged 26 to 35 and adults aged 36 to 45 do not report very significant differences in level of engagement.

The level of education mainly affects the probability of belonging to the group of adults making limited use of numeracy. Thus 49% of those with few or no educational qualifications make very limited use of their numeracy skills in everyday life, compared with 23% of graduates. Unsurprisingly, the influence of adults' proficiency in maths shows the same trend, albeit more markedly. Thus the proportion of respondents at Level 1 or less in numeracy who engage very rarely in numeracy practices is 46.6 percentage points higher than that of highly proficient respondents (Levels 4 or 5). The extent of the differences in the level of engagement according to literacy skills is only slightly less marked, highlighting the correlation already observed (OECD, 2016[1]) between literacy level and numeracy level.

This finding does not provide an unambiguous answer to the question of whether intensity of practice is simply a reflection of adults' level of proficiency. At the very least, a low level of mathematical competence acts as a barrier that can limit adults' propensity to engage in a number of mathematical activities in everyday life. However, the fact that people with a median level of engagement do not have socio-demographic characteristics that distinguish them from the other groups suggests that unobserved factors are involved, such as the respondents' tastes, personal and family constraints or habits resulting from work practices.

To better identify the factors that influence the level of engagement in numeracy practices, the student population will be distinguished from the rest of the adult population in the remainder of the report. This distinction will, moreover, partly eliminate the problems relating to the definition of "everyday life" in the PIAAC background questionnaire.

Figure 2.5. Percentage of adults scoring at each engagement level, by country



Note: Countries/economies are ranked in ascending order of size of the "limited use" group.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Table 2.5. Composition of the three groups of intensity of engagement in numeracy practices in everyday life (OECD average)

	Little use	Median use	Intensive use
Gender			
Female	38.6	39.3	22.1
Male	34.4	35.8	29.8
Age group			
16-25	26.2	28.4	45.5
26-35	32.7	40.6	26.7
36-45	34.4	41.1	24.6
46-55	40.3	39.2	20.5
56-65	47.4	36.8	15.8
Education			
Primary or below	49.2	27.7	23.1
Secondary	37.9	38.2	23.9
Tertiary	23.3	42.3	34.4
Numeracy proficiency			
Level 1 and below 1	59.2	29.0	11.8
Level 2	40.9	37.7	21.4
Level 3	25.1	40.8	34.1
Level 4 and 5	12.6	39.0	48.4
Literacy proficiency			
Level 1 and below 1	59.3	28.7	12.0
Level 2	42.2	36.6	21.2
Level 3	26.3	40.5	33.2
Level 4 and 5	14.7	40.2	45.1

Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

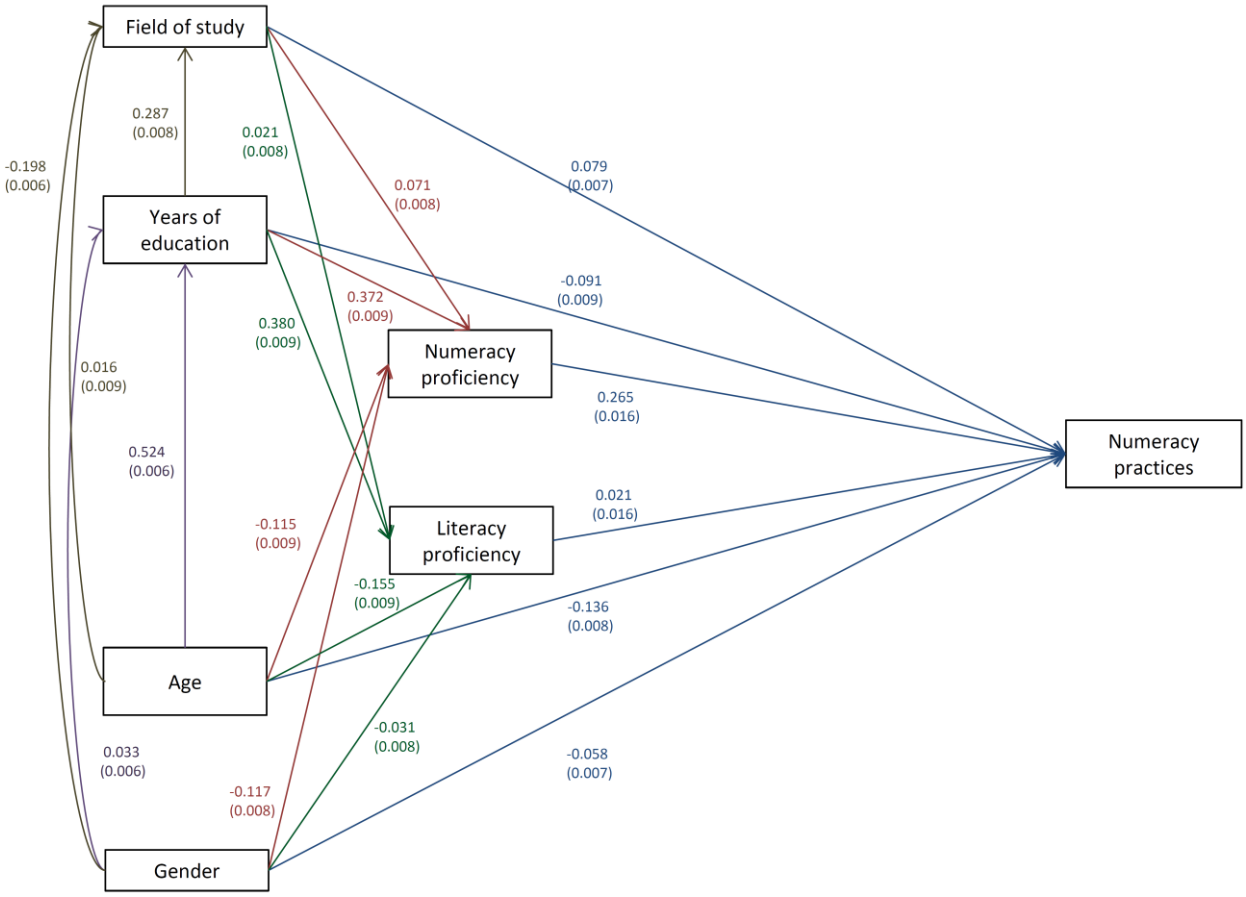
2.5. Determinants of students' numeracy practices

Studying the determinants of students' intensity of use of numeracy in everyday life mainly involves examining the influence of their educational attainment and area of specialisation on their reported practices, regardless of their level of proficiency in information-processing skills. To this end, their intensity of engagement in calculation practices has been modelled as a function of their personal characteristics, numeracy and literacy proficiency, and educational background. Structural equation modelling (also called causal path analysis) has been chosen to take account of the covariances between each pair of variables, in order to isolate the individual effect of each variable of interest on the intensity of practices.

The variable to be explained is the engagement intensity group, consisting of three modalities. The explanatory variables consist of a number of continuous variables – the numeracy and literacy scores, the number of years of education (corresponding to the number of years required to complete the highest educational qualification obtained) and

age (expressed in years) – as well as sex (male or female), and subject[2] of educational course (strong mathematical element or not). The results of the statistical analyses[3] are presented in the form of a diagram in the section below. The numbers in brackets represent the standard errors for each coefficient. All the coefficients are significative (p>.05). The details of the model are presented in Table A A.1 and Table A A.2.

Figure 2.6. Causal path analysis of the students' intensity of engagement in numeracy practices in everyday life



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

[2] The module devoted to educational background distinguishes just nine main fields of study. The identification of courses with a strong mathematical component is therefore very imprecise. Among the nine fields identified in the PIAAC database, "mathematics, science and computer science" and "engineering, industrial processing and production" have been classified as fields with a strong mathematical component (coded 1). "General programmes", "teaching and education", "arts and literature", "social sciences, business and law", "agriculture and veterinary science", "health and social welfare" and "services" are classified as having lesser mathematical content (coded 0).

[3] For all the regressions performed in this report, the coefficients displayed represent the average of the countries' coefficients.

With regard to individual characteristics, age seems to have a particularly strong negative impact (-0.136). This coefficient is explained by the correlation of this variable with the duration of education: at an equal level of education, a one-year increase in a student's age reflects a delay of one year in the normal completion of a study cycle compared to the reference group. It is therefore understandable that, all other things being equal, older students perform less well in literacy and numeracy and engage less in the common uses of mathematical operations. Being a woman also has a negative net impact on intensity of numeracy practices, although to a lesser extent. Finally, all other things being equal, proficiency in numeracy has a strong positive effect on degree of engagement in numeracy practices. However, the main question concerning the student population remains that of the influence of the subject of study on calculation practices.

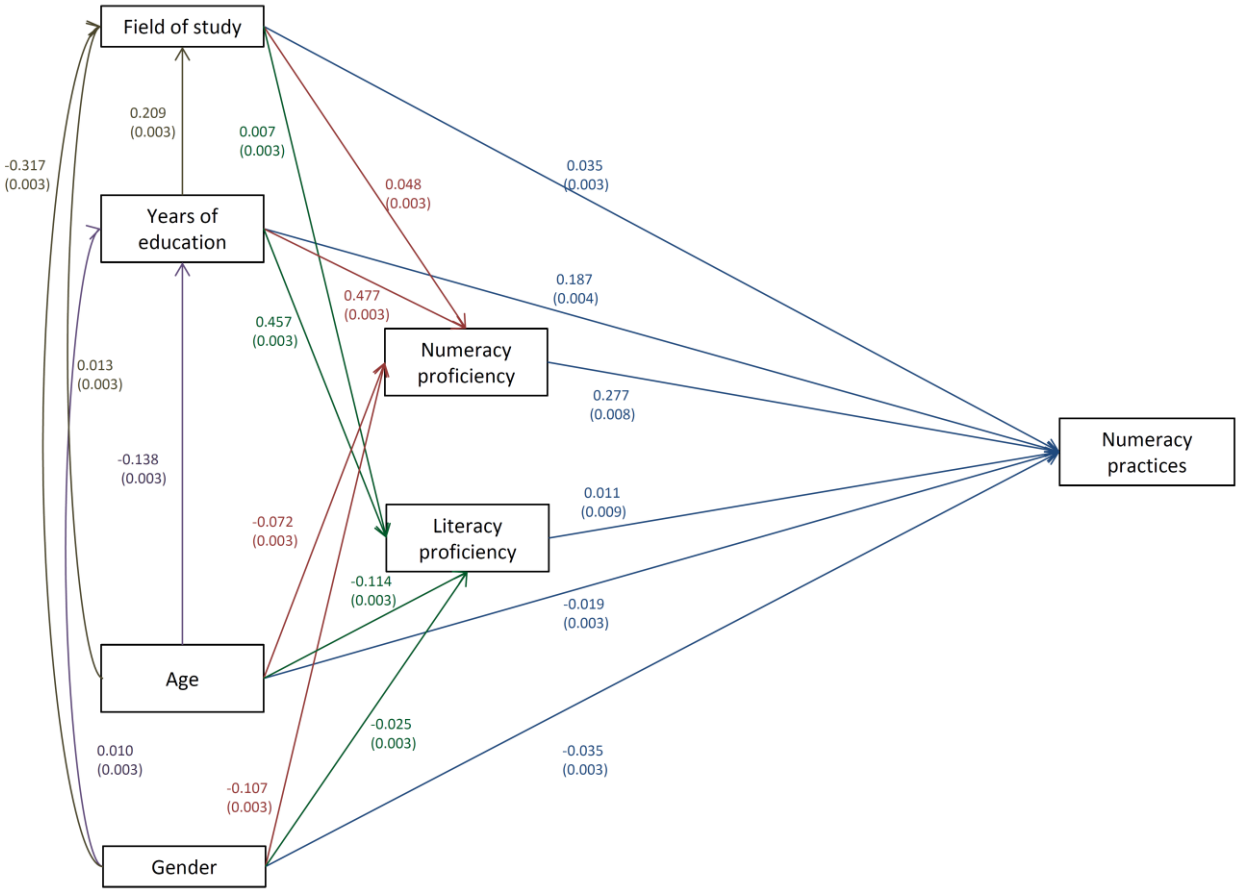
Field of study has a positive but relatively weak effect on numeracy practices, whereas educational attainment (estimated by the number of years of education corresponding to the highest qualification obtained) has a negative effect. Given that highly specialised mathematics and science courses are associated with higher education rather than secondary education, which tends to be more general in nature, these results may seem contradictory. However, the very specific nature of the practice of numeracy in schooling is undoubtedly one of the main reasons why the intensity of calculation practices is negatively correlated with the number of years of study in the student population, but positively correlated with the field of study. This is because, while the level of numeracy required in courses with a significant mathematical content increases with the level of education, average participation in such courses decreases considerably as students progress from secondary to higher education. As a result, the average intensity of numeracy practice is lower among students with a longer educational career (reaching tertiary level) than among those who have attained or are still engaged in a lower level of education (secondary level).

2.6. Determinants of numeracy practices in adults other than students

The results are significantly different for adults who have completed their initial education. The intensity of calculation practices of this other group is modelled as the function of the same explanatory variables as those used for the student population. The dependent variable and explanatory variables are the same, apart from the educational field variable, which refers to the field of the highest qualification obtained.

The relationships between the intensity of mathematical practice and the explanatory variables follow very different trends from those identified in the previous section. This time, while gender has no significant effect on calculation practices, age has a relatively strong negative effect, all other things being equal. The fact that age is negatively correlated with intensity of use of numeracy could be explained here in several ways. The effects of ageing, for example, may hinder adults' ability to apply numeracy skills in everyday life. Again, work-related limitations and habits may eventually have an influence on behaviour and everyday practices, for example by limiting the time available to engage in these practices.

Figure 2.7. Causal path analysis of the intensity of engagement in numeracy practices in everyday life of non-student adults



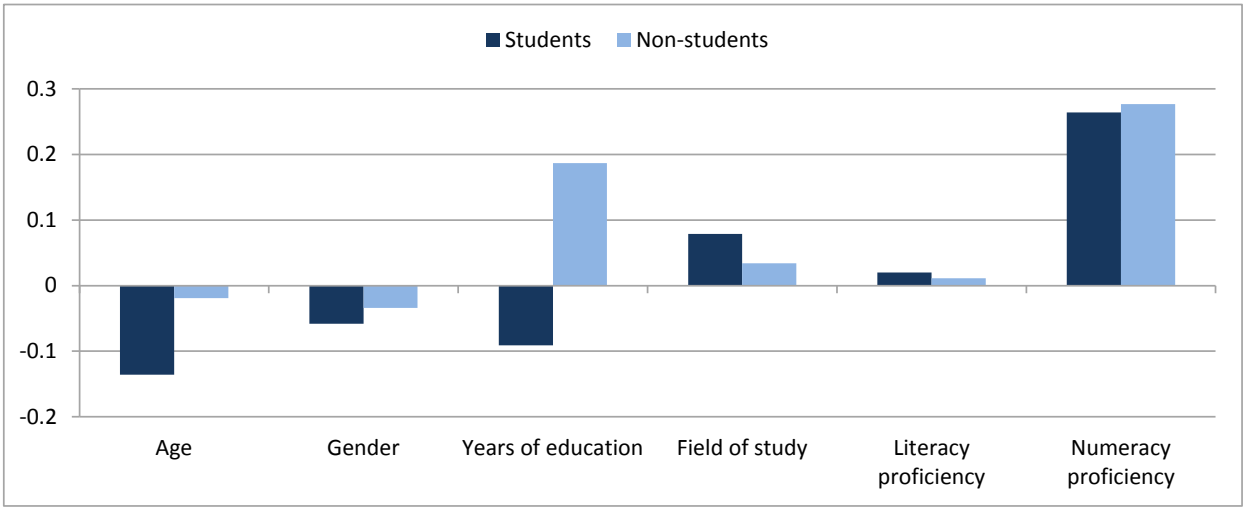
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The most interesting result is undoubtedly the importance of the impact of the length of education on the numeracy practices of adults who are no longer students. Remarkably, even when literacy and numeracy skills are taken into account, engagement in education is the variable with the second highest predictive power in the regression model ($ß_{length}$=0.187). This result could be due either to a direct effect of education or to an indirect effect. In the first hypothesis, the explanation would be that, as they progressed through their schooling, individuals had to learn to use more and more different calculation practices of increasing difficulty. Thus the longer their schooling lasted, the more they acquired the habit and/or ability to engage in varied uses of numeracy in their adult lives. In the second hypothesis, it would be argued instead that the respondents with the highest educational qualifications are most likely to obtain skilled jobs that are characterised by more intense professional numeracy practices than other jobs. They thus benefit from a working environment that encourages or supports the use of their numeracy skills, which may in turn affect their everyday practices. To decide between these two hypotheses, it is necessary to examine the relationships between the intensity of numeracy practices in everyday life and the intensity of numeracy practices at work.

2.7. Conclusions: Comparison between students and non-students

Comparison of the determinants of the use of numeracy in everyday life between students and non-students highlights some of the limitations of the data collection method, especially for the student population. Given that some of the practices listed by the questionnaire do not require any particular equipment and can be performed very quickly in a very large number of everyday situations (reading a recipe, shopping, checking a timetable, planning a trip, etc.), it is possible that the respondents do not necessarily think of mentioning them to the interviewer. This could be especially true of students, who may tend to think first of practices related to the requirements of the course in which they are enrolled at the time of the survey.

Figure 2.8. Comparison of the determinants of the students' and non-students' engagement intensity in numeracy practices in everyday life



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

This comparison exercise also reveals a number of points about the characteristics of education systems. First, they tend to accentuate gender inequalities slightly: not only are female students slightly less proficient in numeracy than male students (OECD, 2016[1]), but in addition, at the same level of proficiency, they tend to engage a little less intensively in numeracy practices in their everyday lives. Second, level of numeracy has a much stronger impact on calculation practices than level of literacy. This result was expected but the difference in impact is particularly pronounced. It suggests that, although the engagement indicator is composed of at least two questions relating to practices requiring reading activity in order to be performed correctly, numeracy skills are used in very different practices from literacy skills in everyday life. This makes it all the more important to study the determinants specific to the use of numeracy by adults.

Moreover, the fact that the educational variables have different explanatory power between the model used for students and the model used for the rest of the adult population suggests that other factors come into play after the end of the initial studies, especially at the point of entry into the labour market. We therefore now need to analyse the impact of work-related factors on everyday practices, starting by examining calculation practices in the workplace.

3. Numeracy practices at work

Focusing on the employed labour force, this chapter aims to describe numeracy practices in the workplace and to analyse the influence of the job characteristics and workers' individual characteristics on the intensity of engagement in these practices.

3.1. Frequency and intensity of numeracy practices at work

The Survey of Adult Skills uses the same eight questions discussed in the previous chapter to describe the spectrum of mathematical activities in the working environment. Overall, the proportion of employed persons who say they do not practice any of the eight activities mentioned is 15%. Only two of these eight activities are reported more often as professional practices than as everyday practices. These are those that require a more advanced level of mathematical proficiency and whose application in everyday life is less obvious: "preparing charts, graphs or tables" and "using advanced maths or statistics". However, they are still rare: only 40.3% and 14.2% respectively of workers use them in their working environment.

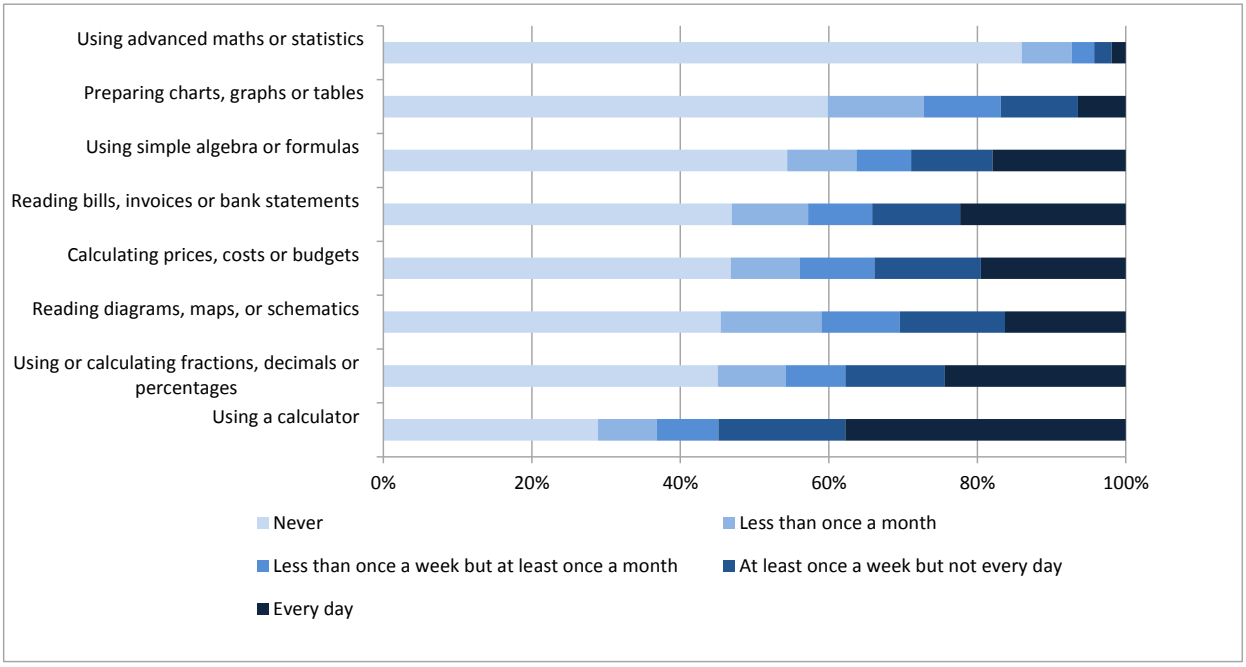
Table 3.1. Descriptive statistics on numeracy practices at work (OECD mean)

Numeracy practices	% Missing	% Never	Mean	Standard-deviation
Reading bills, invoices or bank statements	0.2	46.7	2.505	1.611
Calculating prices, costs or budgets	0.2	46.8	2.523	1.644
Using a calculator	0.2	28.8	3.270	1.665
Using or calculating fractions, decimals or percentages	0.2	44.9	2.629	1.666
Using simple algebra or formulas	0.2	54.3	2.288	1.538
Reading diagrams, maps, or schematics	0.2	45.3	2.423	1.515
Preparing charts, graphs or tables	0.2	59.7	1.906	1.285
Using advanced maths or statistics	0.2	85.8	1.275	0.785

Note: Response format: 0 = "Never", 1 = "Less than once a month", 2 = "Less than once a week but at least once a month", 3 = "At least once a week but not every day", 4 = "Every day". For each question: Min = 0, Max = 4.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The use of a calculator is the only practice that stands out as being commonly undertaken at work by a large majority of the work force. Only 28.8% of workers have never engaged in this activity, and more than 50% do so at least once a week in the context of work. Only about half of working adults (between 45% and 55%) report undertaking most of the other numeracy related activities covered in the questionnaire, often rather infrequently.

Figure 3.1. Distribution of responses given to questions on numeracy practices at work

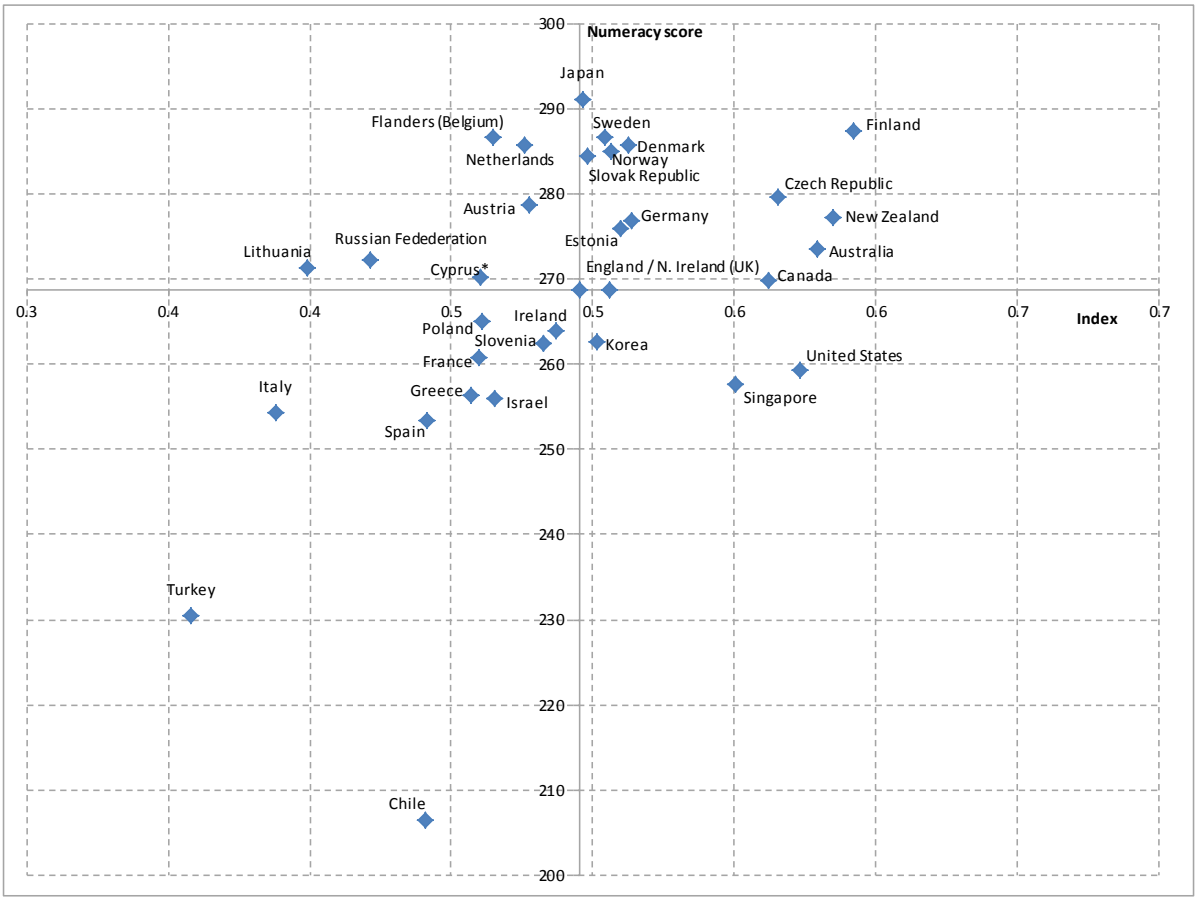


Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

An overall index of intensity of engagement in numeracy practices at work was calculated on the same model as that for everyday life, then standardised to be expressed in values from 0 to 1 according to each individual's percentile in the distribution. The averages of this index obtained by the participating countries are relatively close to each other, all lying between 0.36 and 0.59. Only two countries have an engagement index below 0.4: Turkey (0.36) and Italy (0.39).

The correlation of numeracy performance with intensity of numeracy practices at work is greater than that with intensity of numeracy practices in everyday life. Countries therefore deviate less from the trend line. For example, Japan is this time in a much more median position on the axis of calculation practices at work. On the other hand, the United States retains its unique situation: the labour force has a rather low average numeracy score but a very high level of engagement in numeracy practices. To a certain extent, the Singaporean labour force shares this characteristic.

Figure 3.2. Country mean: Index of intensity of engagement in numeracy practices at work and numeracy score

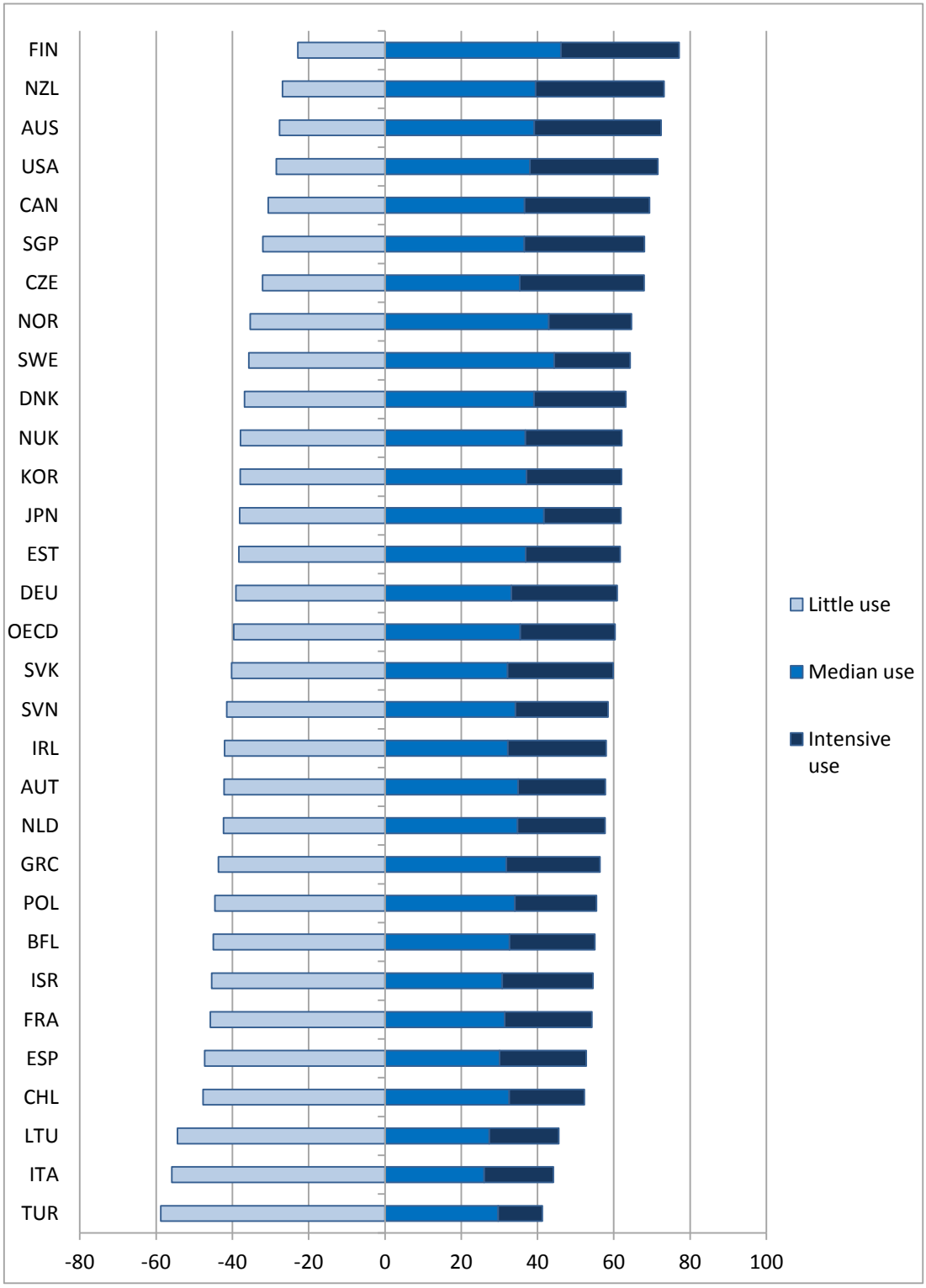


Note: Field: employed labour force. The sample for the Russian Federation does not include the population of the Moscow municipal area.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

As in the previous chapter, respondents were divided into three groups according to the intensity of their use of numeracy in working life. The thresholds used to delineate the three levels of engagement were defined according to the distribution of the index relating to practices at work. This means, for example, that an average level of engagement at work does not have the same meaning as an average level of engagement in everyday life.

Interestingly, the distribution of the values for the index of intensity of engagement by labour force status reveals very marked disparities in some countries. In Sweden, for example, whose average numeracy intensity index is very high (9th out of 32), only 19% of workers engage intensively in calculation practices – the fifth-lowest total. The relative share of each of the three groups of usage intensity differs greatly from country to country. In the Czech Republic, for example, 32% of employed people belong to the maximum engagement group, compared with just 11% in Turkey. At the other end of the spectrum, 68% of Turkish workers never or hardly ever use numeracy at work, compared with just 22% in Finland.

Figure 3.3. Percentage of employed working by level of engagement, by country



Note: Countries/economies are ranked in ascending order of size of the "limited use" group.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The socio-demographic characteristics of the workers in these three groups are shown in Table 3.2. As can be seen, the differences between men and women are comparable in their magnitude to those observed for everyday practices, the former being over-represented in the group making intensive use of numeracy and under-represented in the group making very moderate use of numeracy. On the other hand, the distribution by age group is very different this time, with the youngest being the cohort least engaged in the use of numeracy. This could be due to the fact that some young adults aged 16 to 25 who are already in the labour market will have left the school system early. Less educated and less proficient, they are less likely to be inclined to engage in maths, as well as being more likely to be employed in low-skilled jobs requiring fewer information-processing skills.

Table 3.2. Composition of the three groups of intensity of engagement in numeracy practices at work (OECD average)

	Little use	Median use	Intensive use
Gender			
Female	44.4	35.1	20.5
Male	35.8	35.6	28.6
Age group			
16-25 years	50.3	32.6	17.1
26-35 years	35.8	36.7	27.5
36-45 years	35.1	37.0	28.0
46-55 years	40.8	34.8	24.3
56-65 years	45.8	34.1	20.1
Education			
Primary or below	63.6	26.2	10.2
Secondary	43.4	34.8	21.8
Tertiary	23.1	40.5	36.4
Numeracy proficiency			
Level 1 and below 1	64.4	25.3	10.3
Level 2	45.9	34.3	19.8
Level 3	29.0	40.0	31.0
Level 4 and 5	15.1	40.5	44.4
Literacy proficiency			
Level 1 and below 1	62.4	25.5	12.1
Level 2	45.8	33.6	20.7
Level 3	30.3	39.2	30.5
Level 4 and 5	18.9	42.3	38.8

Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Proficiency in literacy and numeracy has a strong association with the intensity of engagement in numeracy practices at work. However, compared with everyday practices, the difference between the percentage of highly proficient adults and the percentage of those with low levels of proficiency in the group making intensive use of numeracy at work is higher in numeracy (34 percentage points) than in literacy (26 percentage points).

3.2. Working environment and numeracy practices at work

The socio-demographic differences between the adults in the three engagement groups raise the question of whether numeracy practices at work are due to personal characteristics or the nature of their jobs. In other words, are there noticeable differences

in the intensity of mathematical practice according to the working environment and job characteristics of the respondents?

Unsurprisingly, the intensity of practices varies with the sector of activity. Finance, insurance and real estate employees are more likely to use numeracy intensively in their work, as well as, to a lesser extent, the information and communication sector and the business support sector. On the other hand, public sector employees are over-represented among adults making limited use of numeracy in their work.

Table 3.3. Composition of the three engagement groups by job characteristics

	Little use	Median use	Intensive use
Industry			
Agriculture, forestry and fishing	44.5	41.1	14.4
Manufacturing and other industry	40.9	31.9	27.2
Construction	37.5	36.5	26.1
Trade, transport and hotels, etc.	37.0	34.3	28.7
Information and communication	19.5	44.4	36.1
Financial and insurance and real estate	13.7	33.5	52.7
Business services	32.7	33.0	34.3
Public admin; education, human health and social work	46.5	38.0	15.5
Other services	45.3	40.4	14.3
Type of contract			
Permanent contract	39.4	34.5	26.2
Fixed term contract	52.3	30.8	16.9
Self-employed	59.5	26.5	14.1
Other	60	26.7	13.3
Firm size			
10 and below	45.1	33.7	21.2
11 to 50	43.7	32.9	23.4
51 to 250	42.9	32.9	24.2
More than 250	40.3	32.7	27.0
Occupation			
Skilled occupations	21.5	40.8	37.7
Semi-skilled white-collar occupations	43.5	34.1	22.4
Semi-skilled blue-collar occupations	52.4	34.5	13.1
Elementary occupations	81.8	14.4	3.8
Supervision of employees			
Yes	22.7	39.3	38.1
No	52.0	30.6	17.4
Tasks discretion (percentiles)			
Bottom 25th	39.4	34.5	26.2
25th-50th	52.3	30.8	16.9
50th-75th	59.5	26.5	14.1
Top 75th	60.0	26.7	13.3

Note: task flexibility is measured by calculating the average of the answers to the four questions concerning the degree to which workers can modify or choose: "the order of their tasks", "their way of working", "their work pace" and "their working hours". For each question, the response scale was: 1 = Not at all; 2 = Very little; 3 = Moderately; 4 = To a high extent; 5 = To a very high extent. The higher an individual's percentile in the distribution of this average, the greater the degree of flexibility with which he or she can complete his or her tasks.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The specific characteristics of the job – the type of occupation, the nature of the employment contract, the degree of flexibility in the organisation of tasks and the managerial position – also lead to differences in the intensity of use of a very wide range of mathematical skills. Workers in the jobs which are most stable and skilled and which involve the most autonomy are most likely to be classified in the "intensive use" group. Yet while these preliminary analyses highlight the profile of numeracy use by adults in the labour market according to certain characteristics of the job, they do not allow us to identify the factors that determine this level of practice or the actual importance of these factors.

To identify these factors, two sets of regression models were tested, each consisting of one model valid for the entire population, one model specific to the male employed labour force, and one model specific to the female employed labour force. The value of the index of intensity of engagement in numeracy practices is defined as the dependent variable. In the first set of models, the explanatory variables are as follows:

- Individual characteristics: gender (male/female), age (five age groups), level of education (three categories of qualification), level of proficiency in information-processing (numeracy and literacy scores);
- Working environment: activity sector (nine aggregated sectors) and size of enterprise (four categories);
- Nature of position held: type of contract (fixed-term or open-ended, self-employed, other), professional classification of the job (four categories), managerial nature of the job and degree of flexibility in the organisation of the work [expressed in four degrees, according to the value of the "task discretion" index defined in the international report (OECD, 2016[1])].

In the second set of models, the intensity of engagement in the practice of maths in everyday life was added to the explanatory variables.

Analysis of the determinants confirms the idea that the intensity of practice is primarily a consequence of the job's requirements. For example, having a skilled job improves a worker's position by more than 28 percentiles in the distribution of the index of maths use in the workplace compared with that of a worker in a non-skilled job. On the other hand, all other things being equal, the working environment plays a far more variable role than the previous table suggests. For example, controlling for the skill level of jobs, the banking sector turns out not to be particularly demanding in terms of the use of numeracy.

The degree of flexibility in task organisation is another important factor in the intensity of engagement in numeracy practices: a difference of 10 percentiles can be observed between workers with more autonomy and those with less autonomy in this respect. However, this indicator is ambivalent since it could equally reflect a superior professional position with heavy demands in terms of use of numeracy or a position in which individual preferences have the greatest chance of finding expression.

Box 3.1. Highly proficient workers who make little use of numeracy at work

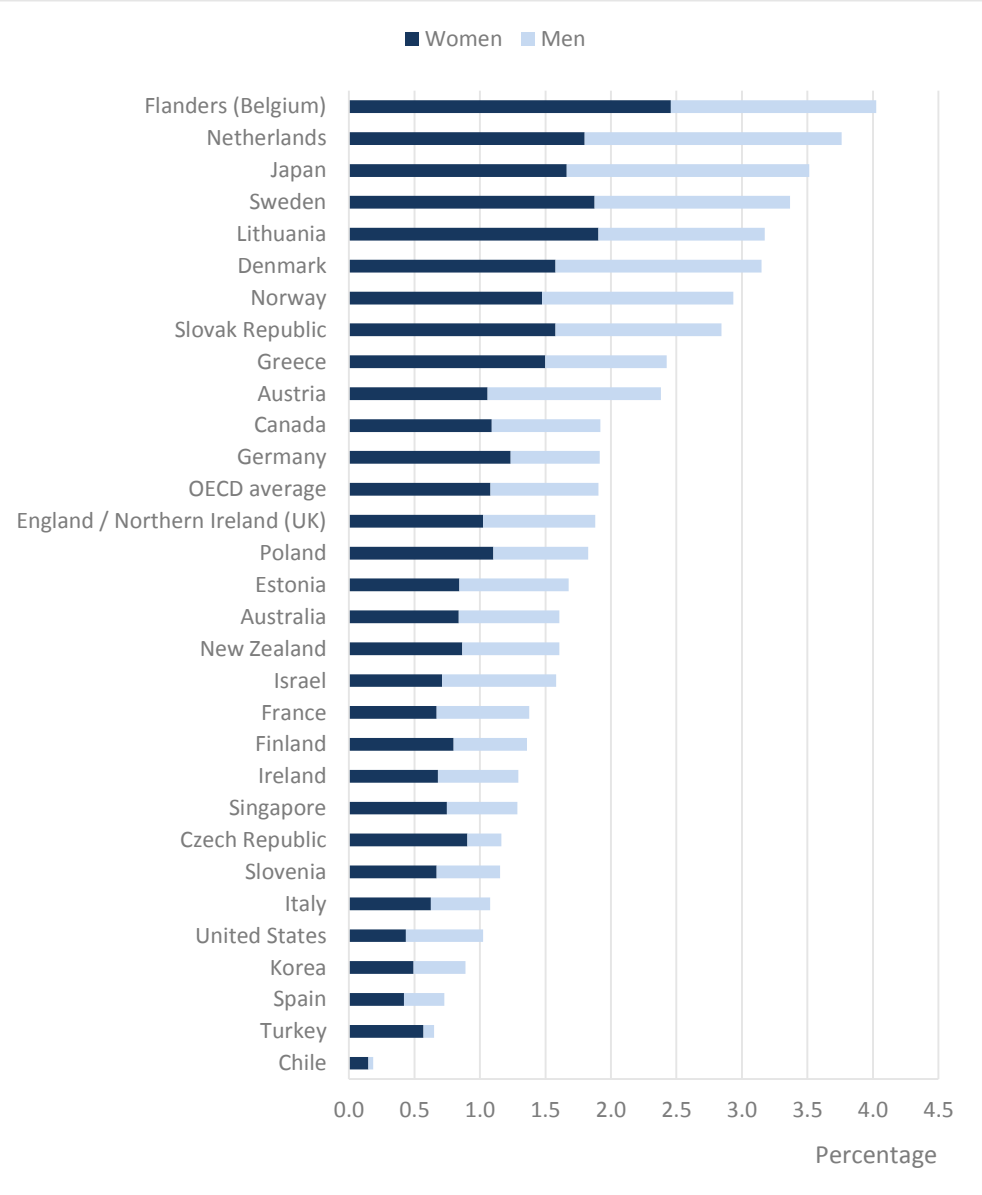
Much of the literature on the match between workers' skills and the nature of their work takes the view that workers with a certain level of competence in a particular field must necessarily perform professional tasks using skills in that field, and that the number and frequency of use of these skills must correspond to the level of proficiency in that competence. In the particular case of numeracy, however, it is clear that a significant proportion of the employed labour force has the dual characteristic of demonstrating both very strong numeracy skills (Level 4 or 5), yet making very limited use of numeracy in their job. While these particular situations may in some cases be analysed in terms of a mismatch on the labour market, they are more likely to result from other dynamics, as an examination of the characteristics of these workers reveals.

It should be emphasised that situations vary greatly from country to country. Thus, this group represents just 0.2% of the labour force in Chile but 4% of that of the Flemish Community in Belgium, with an average of about 1.9% for the OECD countries participating in the survey. With the exception of the Austria, France, Israel, Japan, the Netherlands and the United States, women make up the majority of this group of workers. They represent nearly two-thirds of this group in Germany (64%) and more than three-quarters in the Czech Republic (77%).

Workers with very strong skills in numeracy who make little use of numeracy at work are mostly (40% on average) found in the public service and in the social sector. In the majority of cases, they do not occupy a management position: only 20% of them are required to supervise employees at work.

This group is well integrated in the labour market. The vast majority of workers who make it up have an open-ended contract (71%) and work as professionals (44%) or skilled white-collar workers (25%). These last results suggest that they occupy positions for which it is necessary to demonstrate strong skills in order to do the job properly. The apparent mismatch between their numeracy potential and their actual practices may therefore derive from the fact that these workers also have a high degree of proficiency in other skills are that are valued in the labour market. It may also be explained by personal preferences: workers may wish to move to jobs that allow them to express other facets of their potential or that allow them to achieve a better work/life balance. Incidentally, 25-45 year-olds are the most strongly represented age group among these highly skilled workers who make little use of numeracy at work.

Figure 3.4. Share of highly skilled workers in numeracy with low level of engagement in numeracy practices, by gender



Note: Countries are ranked in descending order of the proportion of the group of highly skilled workers making little use of numeracy at work.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Table A B.2 detailing the socio-demographic characteristics and working environment of these workers is included in Annex B.

Table 3.4. Determinants of intensity of engagement in numeracy practices at work

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Overall	Men	Women	Overall	Men	Women
Gender						
Female	3.26			2.02		
Male	Ref.			Ref.		
Age group						
16-25 years	-0.16	0.43	-0.76	0.24	0.39	-0.04
26-35 years	0.44	0.78	0.26	0.58	0.59	0.60
36-45 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
46-55 years	-1.52	-1.98	-0.89	-1.20	-1.55	-0.77
56-65 years	-3.24	-3.57	-3.45	-2.25	-2.58	-2.46
Education						
Primary or below	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Secondary	5.18	5.07	5.58	3.91	3.47	4.69
Tertiary	10.60	11.37	10.50	7.51	7.61	8.10
Numeracy proficiency						
Level 1 and below 1	-4.55	-5.06	-4.04	-3.23	-3.55	-2.81
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	5.02	5.35	4.58	3.22	3.26	3.17
Level 4 and 5	9.74	10.18	8.59	5.87	5.98	5.40
Literacy proficiency						
Level 1 and below 1	-1.22	-0.79	-1.30	-0.76	-0.33	-1.02
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	0.84	0.60	0.94	0.22	-0.21	0.51
Level 4 and 5	0.28	0.05	0.27	-0.83	-1.20	-0.59
Industry						
Agriculture, forestry and fishing	-4.63	-4.98	-5.51	-4.76	-5.04	-5.94
Manufacturing and other industry	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Construction	0.98	0.12	4.21	1.08	0.22	3.64
Trade, transport and hotels, etc.	-0.36	0.89	-3.09	-0.06	1.01	-2.75
Information and communication	-6.79	-7.16	-8.12	-7.12	-7.47	-8.32
Financial and insurance and real estate	5.70	5.01	4.14	5.75	5.34	3.99
Business services	-3.88	-4.10	-4.94	-4.04	-4.37	-5.15
Public admin; education, human health and social work	-15.79	-11.88	-19.55	-15.50	-11.99	-19.18
Other services	-12.42	-12.87	-13.88	-11.85	-11.88	-13.40
Numeracy practices in everyday life						
Little use				Ref.	Ref.	Ref.
Median use				11.42	12.72	9.99
Intensive use				23.40	24.34	22.04
Type of contract						
Permanent contract	3.31	2.76	3.84	3.52	3.07	4.04
Fixed term contract	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Self-employed	-1.14	-0.74	-1.70	-0.93	-0.22	-1.33
Other	-1.23	-1.29	-0.25	-1.41	-1.65	-0.36
Firm size						
10 and below	1.09	0.85	1.07	1.07	0.92	1.00
11 to 50	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
51 to 250	-0.53	-0.88	-0.17	-0.77	-1.07	-0.46
More than 250	-0.33	-1.17	0.49	-0.80	-1.60	0.04
Occupation						
Skilled occupations	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Semi-skilled white-collar occupations	-7.18	-10.79	-5.34	-6.73	-9.70	-5.11

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Overall	Men	Women	Overall	Men	Women
Semi-skilled blue-collar occupations	-20.53	-19.31	-25.24	-19.23	-17.93	-24.26
Elementary occupations	-28.21	-26.77	-29.75	-26.84	-25.01	-28.45
Supervision of employees						
Yes	9.20	9.55	9.02	8.43	8.72	8.37
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Tasks discretion (percentiles)						
Bottom 25th	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25th-50th	4.97	5.84	3.91	4.40	4.98	3.57
50th-75th	8.25	9.63	6.54	7.47	8.49	6.06
Top 75th	10.16	12.08	7.77	9.36	10.88	7.39

Note: Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The joint impact of the characteristics of the job and engagement intensity in everyday numeracy practices on the intensity of numeracy practices at work is explored in the second set of models. This is because, in order to interpret the observed relationship between job characteristics and intensity of numeracy practices at work, it is essential to know whether the effects of the job should be considered purely as the consequence of its specific constraints (for example, basic jobs have fewer requirements in terms of numeracy practices than skilled jobs), or whether they also reflect the preferences of the workers who tend to occupy certain types of job (for example, workers in basic jobs are workers who, regardless of the characteristics of their jobs and their individual characteristics, tend to engage less in mathematical activities than workers in skilled jobs).

A comparison of the direction and strength of the links between the characteristics of the work environment and the intensity of numeracy practices at work, according to whether or not the intensity of numeracy practices in everyday life is taken into consideration, provides a few pointers here. For example, one might have expected that, if workers' personal preferences had been the main reason for the differences in professional practices observed between workers in jobs with very different characteristics, the coefficients of the variables characterising job type, controlling for the impact of other factors, would be much lower in the second set of models. In fact, they remain largely unchanged. Yet at the same time, the coefficients reflecting the links between the intensity of practices in everyday life and the intensity of practices in working life are very high – comparable in magnitude to the coefficients characterising the qualification level of the position.

It is impossible to be absolutely certain that these effects, controlling for the sector of activity, level of training and level of proficiency, can be attributed solely to the demands of the job. The influence of everyday practices on professional practices suggests that certain individual characteristics associated with interest in maths and the ability to engage in numeracy practices intensively also determine workers' professional practices. This means that workers with jobs in which numeracy practices are largely absent may simply be adults with little interest in numeracy practices, even after controlling for other factors. However, the explanation that the intensity of engagement in numeracy practices at work depends equally on the demands of the job and on workers' preferences is not completely certain: it is also possible that the fact of having a job with certain characteristics also has effects on numeracy practices in everyday life, for example by

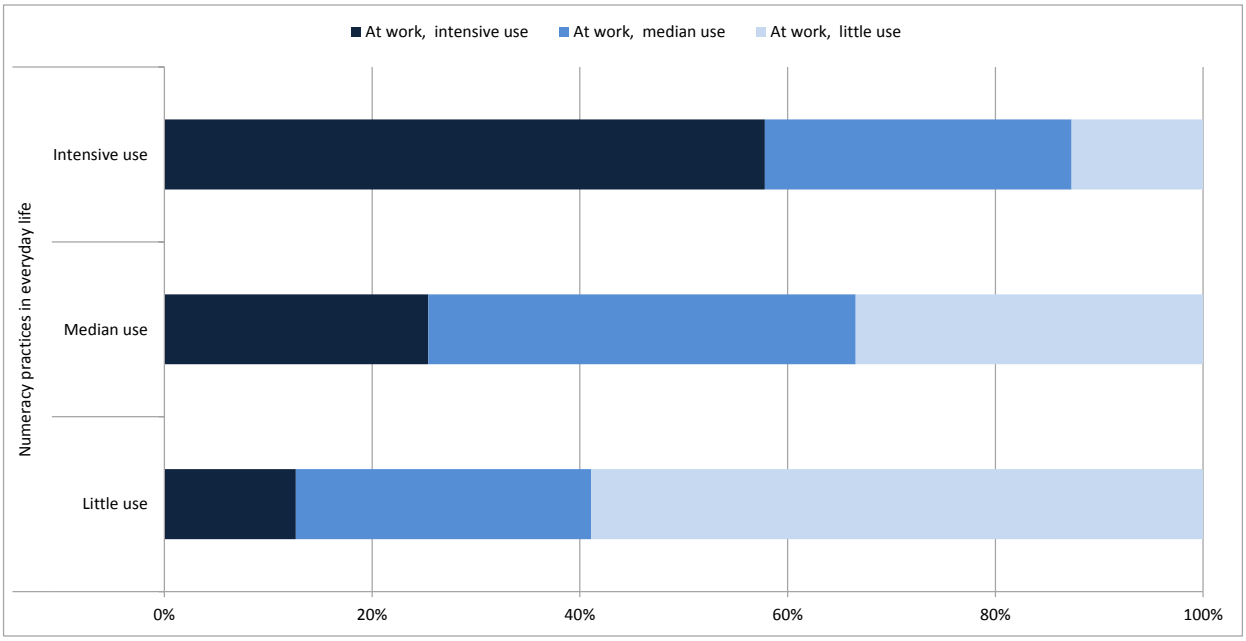
reinforcing certain related behaviours or habits. To better quantify these two sets of explanations, we must therefore analyse the causalities linking working practices and practices in everyday life in a little more depth.

3.3. The "Use it or lose it" hypothesis: Influences of the level of practice of numeracy at work

The impact of the intensity of engagement in numeracy practices in everyday life on the level of engagement in numeracy practices at work also needs to be examined to assess the extent to which adults who use numeracy intensively in one of these contexts also do so in the other. In other words, are the individuals who make intensive use of numeracy at work the same as those who, all other things being equal, make intensive use of numeracy in everyday life, and vice versa?

As Figure 3.5 shows, 57% of employed people who use numeracy extensively in their working lives also do so in their daily lives, compared with just 12% who make very little use of it. On the other hand, 9 out of 10 adults who make little use of numeracy skills at work also make little or only moderate use of them in everyday life. These results, without giving any indication of the direction of causality, highlight the existence of a strong, though not unequivocal, link between the intensity of numeracy practices at work and in everyday life. The existence can certainly be conjectured of a virtuous circle between working practices and everyday practices.

Figure 3.5. Engagement intensity in numeracy practices at work, by engagement intensity in numeracy practices in everyday life

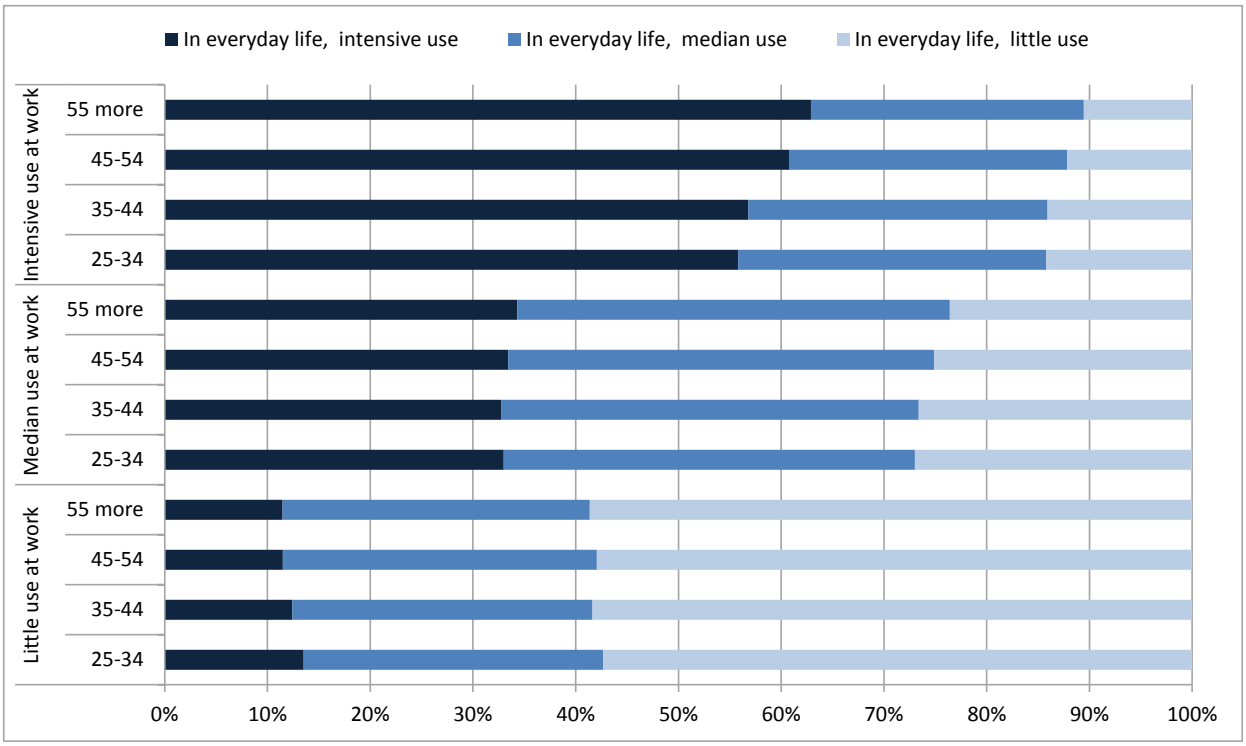


Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

One way to gain further information about the direction of causality might be to look at the influence of age on the correlation between the intensity of numeracy practices in the two environments. Among workers who make little or no use of numeracy at work, the oldest are the least likely to use numeracy intensively in everyday life. Age has a

similarly clear effect on the probability of engaging intensively in numeracy practices in everyday life when workers already make intensive use of numeracy at work. This result suggests that not being obliged to use one's skills at work leads to a gradual decrease in intensity of use in everyday life and, conversely, being obliged to do so gradually reinforces the tendency to use numeracy intensively in everyday life. This result could also be one of the explanations for the decline in skills observed after the age of 50 (OECD, 2016[1]) and the greater dispersion of numeracy scores among the 54-65 age group (Paccagnella, 2016[14]), regardless of any cognitive decline. This hypothesis also has the merit of explaining why age is a significant explanatory variable of intensity of use in everyday life but much less so in working life.

Figure 3.6. Intensity of numeracy practices at work and in everyday life, by age



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

While we have seen that the use of skills at work and their use in everyday life exhibit multiple and changing causal links with age, the question of what impact these intensities of use have on adults' proficiency level in numeracy remains unanswered. In other words, does the extent of engagement in numeracy practices improve or adversely affect numeracy skills?

To answer this question, the numeracy score is modelled as a function of the following explanatory variables:

- Model 1: personal characteristics (age, sex, place of birth, literacy score) and social characteristics (level of education, parents' level of education) of employed adults.
- Model 2: Model 1 variables plus intensity of engagement in numeracy practices in everyday life.

- Model 3: Model 1 variables plus intensity of engagement in numeracy practices at work.
- Model 4: Model 1 variables plus intensity of engagement in numeracy practices at work and in everyday life.

Table 3.5. Influence of numeracy practices at work and in everyday life on numeracy proficiency

	Model 1	Model 2	Model 3	Model 4
Gender				
Female	-11.17	-10.15	-9.44	-9.44
Male	Ref.	Ref.	Ref.	Ref.
Age group				
16-25 years	-5.42	-4.75	-4.02	-4.02
26-35 years	-1.65	-1.36	-1.18	-1.18
36-45 years	Ref.	Ref.	Ref.	Ref.
46-55 years	0.29	0.35	0.42	0.42
56-65 years	-2.34	-1.82	-1.66	-1.66
Education				
Primary or below	Ref.	Ref.	Ref.	Ref.
Secondary	11.92	10.85	10.02	10.02
Tertiary	22.01	19.47	17.76	17.76
Highest of mother's or father's level of education				
Neither parent has attained upper secondary	Ref.	Ref.	Ref.	Ref.
At least one parent has attained secondary and post-secondary, non-tertiary	2.67	2.19	1.88	1.88
At least one parent has attained tertiary	5.64	4.81	4.39	4.39
Foreign born				
Yes	-8.21	-8.21	-7.71	-7.71
No	Ref.	Ref.	Ref.	Ref.
Numeracy proficiency				
Level 1 and below 1	-50.14	-49.16	-48.63	-48.63
Level 2	Ref.	Ref.	Ref.	Ref.
Level 3	36.72	35.53	35.08	35.08
Level 4 and 5	72.23	69.95	69.31	69.31
Numeracy practices in everyday life				
Little use		Ref.		Ref.
Median use		7.51		5.81
Intensive use		13.47		10.19
Numeracy practices at work				
Little use			Ref.	Ref.
Median use			5.78	5.78
Intensive use			9.34	9.34
Explained variance (R2)		0.65	0.66	0.67

Note: Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The results of the Survey of Adult Skills show a positive correlation between average numeracy skills and the extent of numeracy practice in the workplace (Model 3). Adults who practice calculation activities more intensively tend to have a higher level of numeracy proficiency. All other things being equal, people who use numeracy intensively

score an average of 9.3 points more on the numeracy proficiency scale. It is very difficult to determine whether professional activities lead to the acquisition of some of these skills, or whether adults who use these skills already have a high degree of proficiency in these skills.

However, two points seem to confirm the hypothesis that practices influence the proficiency level. First, when the level of education is controlled for, the existence of a strong positive correlation between intensity of use and proficiency is found. In other words, adults who practice their numeracy skills almost every day tend to score higher regardless of their level of education. This suggests the existence of practice-related effects, independent of education-related effects that influence proficiency. Second, the introduction of practices in everyday life (model 4) leaves the coefficients of all explanatory variables unchanged and increases the explanatory quality of the model. This suggests that, regardless of the environment (private or professional), practices do impact the level of proficiency in the particular case of numeracy.

Encouraging more frequent and diversified professional use of mathematical techniques and reasoning through targeted training could therefore be an effective lever for enhancing the numeracy level of the employed labour force. Studies have already shown the impact of professional training on the maintenance and/or improvement of adults' information-processing skills (Carpentieri, Lister and Frumkin, 2009[15]). However, several countries have had difficulties in increasing the participation rate in these training courses, which remains low or very uneven from sector to sector. It is therefore important to identify the factors likely to influence the tendency to participate in professional training.

In order to provide some pointers here, participation in training is transformed into a binary variable with the value 1 if the person has participated in formal or non-formal training for work reasons during the last 12 months, and 0 if not. Marginal effects are estimated for the entire employed labour force, and then separately for men and women. The explanatory variables are the same as those used in previous models. It should be noted that the use of numeracy at work and in everyday life has also been introduced into the model in order to analyse the extent to which the degree of intensity of use promotes the propensity to learn about new numeracy practices in training, thus encouraging the emergence of a virtuous circle.

Table 3.6. Marginal effects of individual and job characteristics on the likelihood of participating in training (formal and non-formal)

	Overall	Men	Women
Gender			
Female	0.90%		
Male	Ref.		
Age group			
16-25 years	9.00%	8.70%	7.70%
26-35 years	1.10%	2.70%	-1.00%
36-45 years	Ref.	Ref.	Ref.
46-55 years	-0.50%	-1.50%	0.80%
56-65 years	-6.40%	-6.90%	-5.70%
Education			
Primary or below	Ref.	Ref.	Ref.
Secondary	5.70%	4.70%	5.40%
Tertiary	12.80%	9.90%	14.80%
Numeracy proficiency			
Level 1 and below 1	-0.80%	-1.70%	-0.20%
Level 2	Ref.	Ref.	Ref.
Level 3	1.80%	2.50%	1.10%
Level 4 and 5	2.40%	3.40%	1.60%
Literacy proficiency			
Level 1 and below 1	-2.40%	-2.20%	-2.60%
Level 2	Ref.	Ref.	Ref.
Level 3	1.50%	0.90%	2.10%
Level 4 and 5	2.20%	1.90%	3.50%
Industry			
Agriculture, forestry and fishing	-2.90%	-4.00%	1.20%
Manufacturing and other industry	Ref.	Ref.	Ref.
Construction	-1.80%	-1.50%	-8.40%
Trade, transport and hotels, etc.	0.50%	1.00%	-0.50%
Information and communication	4.30%	3.50%	5.60%
Financial and insurance and real estate	10.60%	8.30%	12.30%
Business services	4.00%	3.50%	4.20%
Public admin; education, human health and social work	13.70%	10.30%	14.70%
Other services	6.50%	4.90%	8.20%
Numeracy in everyday life			
Little use	Ref.	Ref.	Ref.
Median use	4.60%	5.70%	3.30%
Intensive use	7.40%	8.80%	5.70%
Numeracy at work			
Little use	Ref.	Ref.	Ref.
Median use	5.50%	5.50%	5.70%
Intensive use	7.10%	7.80%	7.10%
Type of contract			
Permanent contract	1.10%	1.80%	-0.10%
Fixed term contract	Ref.	Ref.	Ref.
Self-employed	-7.10%	-7.10%	-7.50%
Other	3.90%	5.60%	3.10%
Firm size			
10 and below	-8.00%	-8.00%	-7.70%
11 to 50	Ref.	Ref.	Ref.
51 to 250	4.90%	6.40%	3.30%

	Overall	Men	Women
More than 250	8.40%	10.90%	5.90%
Occupation			
Skilled occupations	Ref.	Ref.	Ref.
Semi-skilled white-collar occupations	-6.20%	-4.60%	-7.00%
Semi-skilled blue-collar occupations	-7.20%	-6.00%	-14.40%
Elementary occupations	-14.50%	-10.90%	-18.90%
Supervision of employees			
Yes	6.40%	5.40%	7.60%
No	Ref.	Ref.	Ref.
Tasks discretion (percentiles)			
Bottom 25th	Ref.	Ref.	Ref.
25th-50th	1.70%	1.20%	1.90%
50th-75th	3.20%	3.10%	2.80%
Top 75th	2.70%	2.50%	3.00%

Note; Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

In analysing the determinants of the probability of participating in formal or informal training, we find that those who are already the most highly educated and occupy the most skilled positions are those who are most likely to participate in professional training; the difference in this respect is greater in the female population than in the male population. For example, women with higher education qualifications are about 15% more likely to have attended training than those with a level of education less than or equal to primary education. Among working males, the same odds ratio is 10%.

It should also be noted that the intensity of use of numeracy, whether in everyday life or at work, significantly increases the probability of training, even when the level of educational attainment, the skill level of the job, the sector and the proficiency level are controlled for. The intensity with which numeracy is used at work, when the job characteristics provide the opportunity to do so, and the intensity of use in everyday life could therefore be correlated with an unobserved variable relating to attitude towards study or open-mindedness. On this hypothesis, which could only be confirmed by introducing questions about adults' socio-emotional competencies, encouraging the use of numeracy would have positive consequences for the general level of numeracy proficiency.

3.4. Conclusions

The close link between the use of skills in the workplace and in everyday life suggests that adults' socio-demographic characteristics (including their level of education) and their attitudes toward learning help to encourage a similar level of use of numeracy in their private and professional lives. At the same time, the use of numeracy skills, whether in the workplace or in the private setting, is also influenced by characteristics related to a person's professional activity, such as the type of occupation and the sector of activity in which he or she works.

The combined action of these two mechanisms helps create a virtuous circle between use of numeracy and numeracy performance which confirms the "use it or lose it" hypothesis (Bynner, Parsons and Agency, 1998[16]) by suggesting that intense engagement in concrete uses of maths helps improve the level of numeracy proficiency, and vice versa.

4. Numeracy proficiency in the labour market

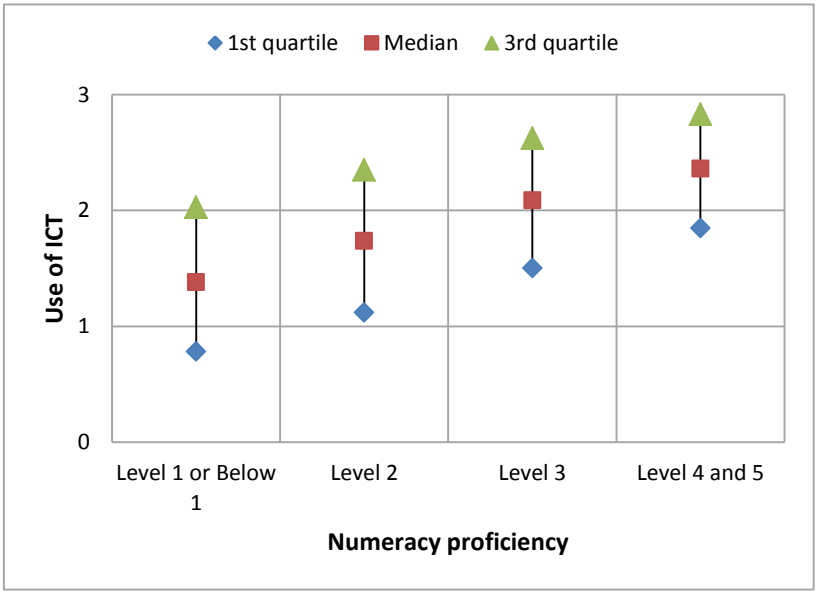
While it is true that the intensity with which workers use numeracy at work is due as much to their personal inclinations as to the expectations and resources specific to the position they hold, it may be useful to gain a better understanding of the factors that might encourage them to engage more in such practices. Based on data from IALS, studies have already shown that the frequency of numeracy practices at work has less of an effect on wages than that of reading practices (Desjardins and Rubenson, 2011[17]). This result was partly confirmed by the study of Allen, Levels and Van der Velden (2013[18]), who, in analysing skills mismatches in the labour market, noted that literacy mismatches appeared to have a greater impact on income than numeracy mismatches.

The purpose of this chapter is to clarify the effects in the labour market of the numeracy proficiency level and of the uses made by adults of numeracy at work and in their daily lives.

4.1. Numeracy and information and communication technology (ICT)

There is a widespread expectation in today's labour market that adults will be able to use the standard computer tools. Studies have already found a strong correlation between numeracy skills and computer skills, especially in the work environment (OECD, 2016[1]). The same type of relationship can be seen when the variation in the use of computer skills is considered at different levels of numeracy proficiency. As Figure 4.1 shows, median use of computer skills increases with numeracy proficiency. However, this relationship is not perfect: it is not uncommon for highly proficient adults to use computer tools less often than some adults at a lower level. This may be due in part to the difficulty of recording accurately the use that adults make of computers and software in everyday life, but it also suggests that it may be less the level of skills than the implementation of those skills in practice that influences the frequency of use of ICT.

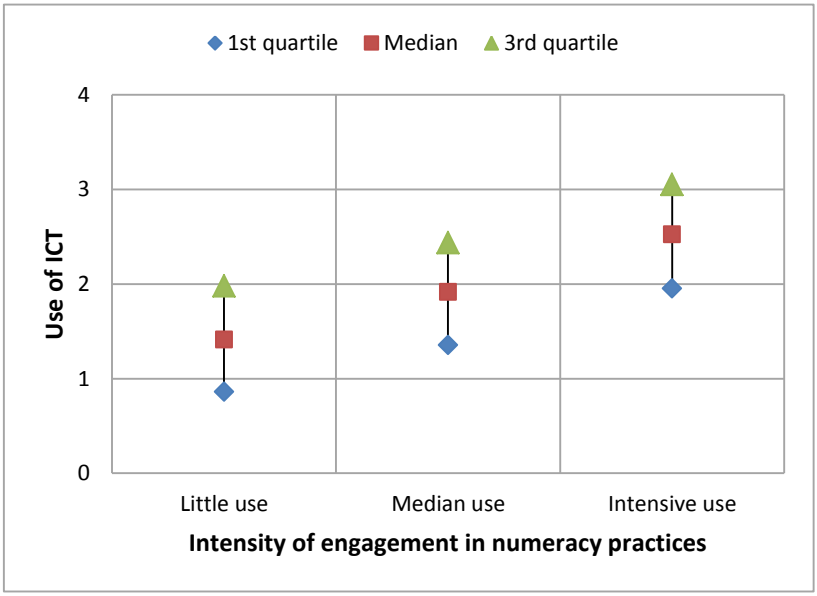
Figure 4.1. Use of ICT skills by numeracy proficiency



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Figure 4.2 illustrates the variation in the use of computer skills by level of engagement in numeracy practices. The distribution overlaps are much smaller than in the previous figure. This result highlights the fact that the intensity of use of numeracy in everyday life is more directly correlated to the frequency of use of computer skills than the level of numeracy proficiency.

Figure 4.2. Use of ICT skills by engagement intensity in numeracy practices in everyday life



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

An attempt can be made to confirm this result by looking at the individual characteristics which, all else being equal, significantly determine the frequency of use of computer tools. The explanatory variables available here are: gender, age, level of literacy and numeracy proficiency, and level of educational attainment. In a second set of regressions, the inclusion of the category of engagement in the use of numeracy in everyday life will make it possible to compare its impact with that of numeracy proficiency, while controlling for other factors.

Table 4.1. Determinants of the use of ICT skills in everyday life

	Overall	Women	Men	Overall	Women	Men
Gender						
Female	-0.1028			-0.0538		
Male	Ref.			Ref.		
Age group						
16-25 years	0.1716	0.1679	0.1852	0.1990	0.1965	0.2060
26-35 years	0.1055	0.1134	0.1048	0.1242	0.1334	0.1182
36-45 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
46-55 years	-0.0923	-0.0959	-0.0872	-0.0922	-0.0912	-0.0928
56-65 years	-0.1590	-0.1923	-0.1374	-0.1573	-0.1751	-0.1512
Education						
Primary or below	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Secondary	0.2565	0.2626	0.2531	0.2135	0.2271	0.2025
Tertiary	0.6505	0.5883	0.7209	0.5340	0.5050	0.5654
Numeracy proficiency						
Level 1 and below 1	-0.1270	-0.1394	-0.1306	-0.0809	-0.1031	-0.0677
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	0.1326	0.1182	0.1487	0.0649	0.0649	0.0672
Level 4 and 5	0.2544	0.2239	0.2586	0.1073	0.1100	0.0901
Literacy proficiency						
Level 1 and below 1	-0.1295	-0.1153	-0.1289	-0.1212	-0.1075	-0.1247
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	0.1103	0.0838	0.1315	0.0921	0.0678	0.1116
Level 4 and 5	0.1610	0.1218	0.1984	0.1236	0.0907	0.1559
Numeracy in everyday life						
Little use				Ref.	Ref.	Ref.
Median use				0.3560	0.3160	0.3962
Intensive use				0.8825	0.7769	0.9654

Note: Field: overall adult population. Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

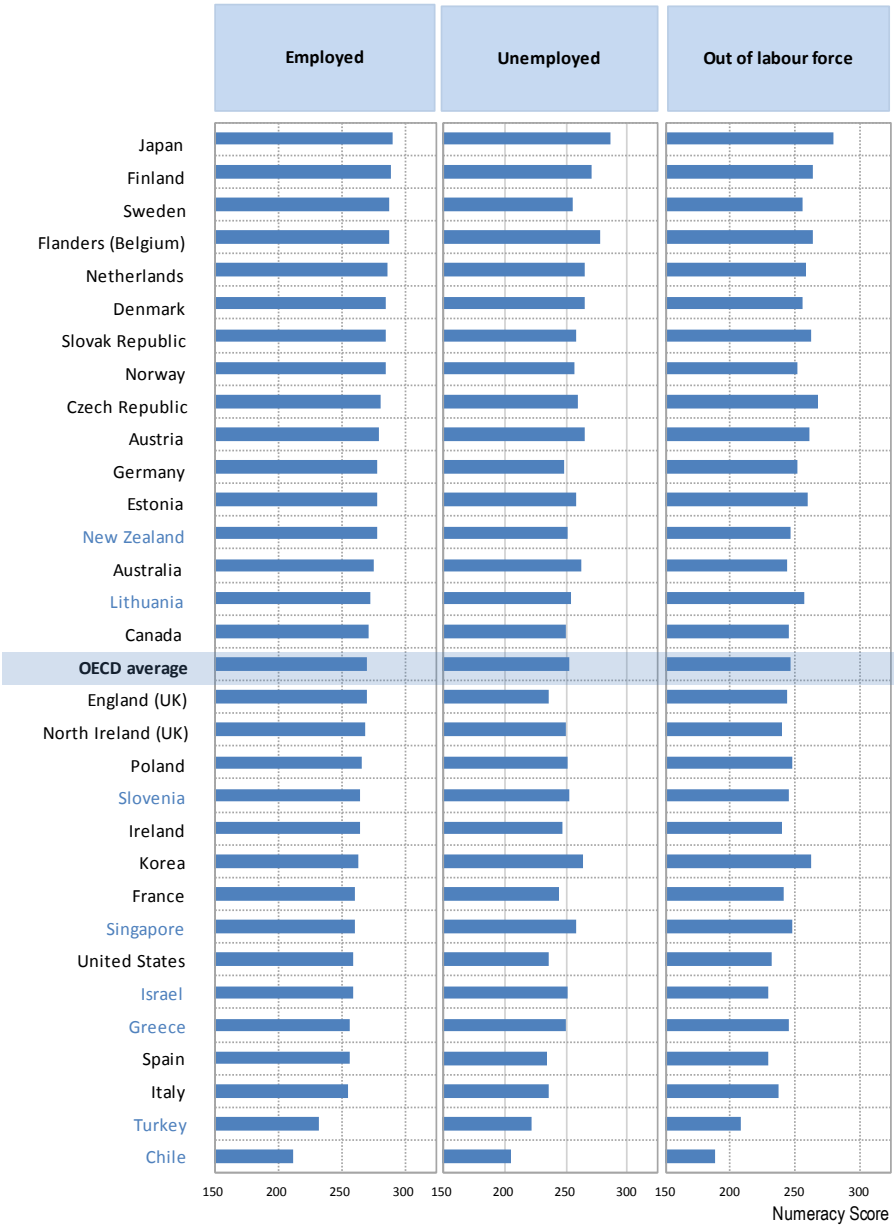
Analysis of the determinants of the use of computer skills suggests that, all else being equal, the intensity of use of numeracy is the best predictor of the frequency of ICT use in everyday life.

However, this result has to be put into perspective, as some of the questions relating to numeracy practices often imply the underlying use of computer equipment. For example, the question about the frequency of use of a calculator includes calculators integrated into computers. Similarly, the construction of figures or graphs almost invariably requires the use of a computer. Finally, it is increasingly hard to imagine a situation where advanced statistics or maths would be used without any dedicated software, such as statistical analysis software.

4.2. Numeracy and employability

It might be expected that numeracy skills are one of the aspects of human capital that are sought after and valued in the labour market. When the total population is divided into three main groups according to employment status (employed, unemployed, inactive), the average numeracy skills of employed persons are generally higher than those of the unemployed and inactive (Figure 4.3). However, the skill gaps are surprisingly low. Among OECD participating countries, the average numeracy score among employed persons is about 18 percentage points higher (about 7%) than that of unemployed adults, which is itself almost identical to that of the non-working population.

Figure 4.3. Mean proficiency in numeracy by labour force status



Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A5.1 (N), http://dx.doi.org/10.1787/888933366489.

This weak correlation suggests that the level of numeracy proficiency is not important in terms of individuals' employment chances. However, while some unemployed people may have numeracy scores similar to those of the employed, they may lack other key skills needed to get a job, such as skills specific to the job or the usual ICT skills required in the workplace. It is therefore reasonable to assume that consideration of the frequency and intensity of use of numeracy would be, if not a superior proxy, at least an adjunct to numeracy proficiency for assessing the employability of adults in the labour market.

An alternative approach is therefore possible to study the link between labour market outcomes and skills: determining the probability that members of the labour force will be employed by taking account not only of their educational attainment and personal characteristics, but also of their level of numeracy proficiency and, secondly, of their level of numeracy practice (see Table 4.2). The explanatory variables are thus defined as follows:

- Personal characteristics: gender, age, place of birth to distinguish between those who were born abroad and those who were not, and level of education.
- Degree of proficiency in information-processing: numeracy proficiency category and literacy proficiency category.
- Degree of use of engagement in numeracy practices: intensity of use of numeracy in everyday life and frequency of use of computer tools.

Unemployment and inactivity turn out to be more frequent among individuals with lower numeracy skills (a score lower than or equal to Level 1). For example, those with the strongest skills (whose score corresponds to Level 4 or 5) are about 7% more likely than individuals who score at or below Level 1 to be employed. When the index of intensity of engagement in numeracy practices and the index of use of computer skills are included in the regression model, this odds ratio changes little. In both sets of models, regardless of gender, the numeracy level has a significant positive impact on the probability of being employed. Its influence is greater than the level of proficiency in literacy.

The most surprising result is the fact that the intensity of use of numeracy plays a slightly negative overall role in the probability of being in employment. For example, people who use numeracy intensively in everyday life, all things being equal, are slightly less likely to be employed than people with limited levels of engagement. This negative effect is roughly twice as pronounced for women as for men. The underlying cause of such a result is not obvious. It could represent a purely mechanical effect: people in employment have less time available to perform certain daily tasks than others. The constraints imposed by work on their free time could mean that – all else being equal – the intensity with which they use numeracy in everyday life may be lower than that of people not in work. Unfortunately, lack of information on the amount of time spent on these activities does not allow us to confirm this hypothesis.

Table 4.2. Determinants of the probability of being employed

		Overall	Women	Men	Overall	Women	Men
Gender							
	Female	-0.010			-0.015		
	Male	Ref.			Ref.		
Age group							
	16-25 years	-0.107	-0.108	-0.108	-0.111	-0.111	-0.112
	26-35 years	-0.024	-0.027	-0.022	-0.026	-0.028	-0.023
	36-45 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	46-55 years	0.013	0.024	0.004	0.010	0.021	0.003
	56-65 years	0.019	0.038	0.006	0.009	0.029	-0.003
Education							
	Primary or below	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Secondary	0.044	0.047	0.043	0.050	0.058	0.044
	Tertiary	0.067	0.079	0.060	0.079	0.095	0.066
Foreign born							
	Yes	-0.028	-0.027	-0.029	-0.023	-0.032	-0.015
	No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Numeracy proficiency							
	Level 1 and below 1	-0.030	-0.027	-0.033	-0.030	-0.029	-0.030
	Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Level 3	0.018	0.014	0.023	0.020	0.017	0.026
	Level 4 and 5	0.030	0.024	0.036	0.036	0.029	0.043
Literacy proficiency							
	Level 1 and below 1	0.005	0.005	0.007	0.004	0.001	0.007
	Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Level 3	-0.003	-0.001	-0.004	0.000	0.003	-0.002
	Level 4 and 5	-0.002	0.002	-0.006	0.003	0.009	-0.002
Numeracy practices in everyday life							
	Little use				Ref.	Ref.	Ref.
	Median use				-0.010	-0.016	-0.005
	Intensive use				-0.025	-0.036	-0.017
Use of ICT skills in everyday life							
	1st quartile				Ref.	Ref.	Ref.
	2nd quartile				-0.008	-0.006	-0.010
	3rd quartile				-0.015	-0.016	-0.013
	4th quartile				-0.032	-0.037	-0.028

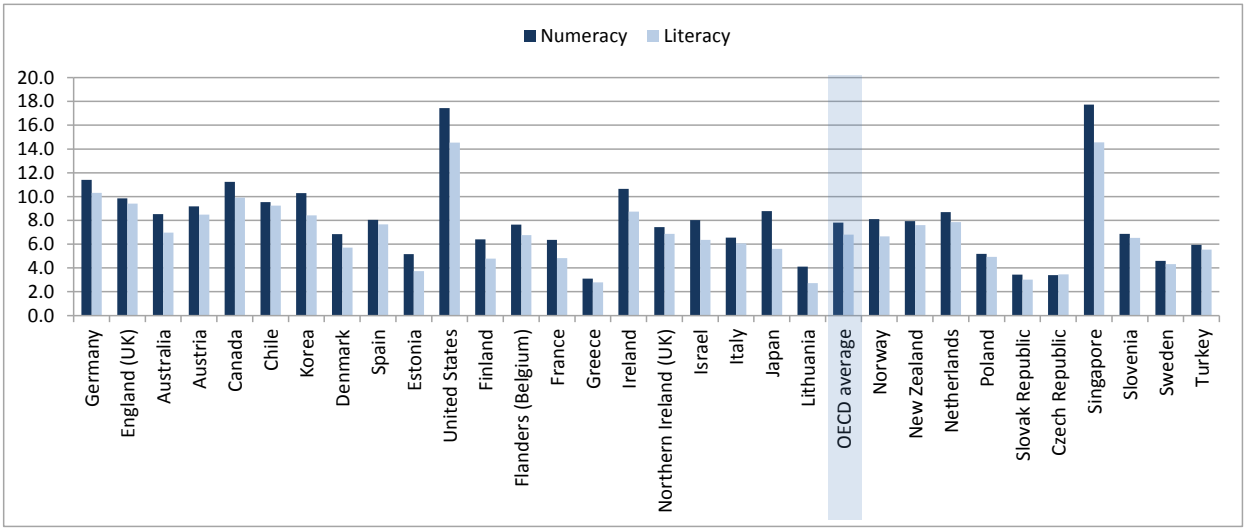
Note: Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

4.3. Numeracy and economic well-being

Variation in wage and salaries related to differences in numeracy proficiency and the intensity of practices is undoubtedly one of the most obvious aspects of the importance attached to numeracy skills in the labour market. In general, workers who make more frequent use of their skills tend to be paid more highly, even after allowing for differences in level of education, in proficiency and nature of employment. However, studies suggest that other skills areas are valued more highly than numeracy: computer and reading skills are those most closely correlated to hourly pay (OECD, 2016[1]). Moreover, the correlation between the use of numeracy skills and hourly pay appears weaker than that between use of ICT and reading skills and hourly pay (OECD, 2016[1]). However, *ceteris*

paribus reasoning throws a different light on this question, with numeracy proficiency even being seen as the most important predictor of wage differentials. For example, comparative economic studies have shown that an increase of one standard deviation in the numeracy score leads to a wage increase in most countries of between 12% and 15% of the reference wage. This increase is as high as 28% in the United States (Hanushek et al., 2015[19]).

Figure 4.4. Difference in median hourly earnings between highly skilled employees (Level 4 or 5) and the lowest skilled employees (Level 1 or below 1), in numeracy and in literacy



Note: Employees only. Hourly wages, including bonuses, in purchasing-power-parity-adjusted USD (2012).
Source: Survey of Adult Skills (PIAAC) (2012, 2015), tables A5.3 (L) and A5.3 (N), http://dx.doi.org/10.1787/888933366489.

It is worth asking whether the degree of use of numeracy skills in everyday life and in the workplace has an additional impact on workers' pay. To establish whether this is true, we can compare conventional salary regression models which take account of personal characteristics, proficiency level and the characteristics of the job, with models which include as additional explanatory variables engagement intensity in the use of numeracy in everyday life, frequency of use of ICT in everyday life and engagement intensity in the use of numeracy at work.

Table 4.3. Determinants of hourly earnings

	Overall	Men	Women	Overall	Men	Women
Gender						
Female	-0.149			-0.145		
Male	Ref.			Ref.		
Age group						
16-25 years	-0.269	-0.291	-0.248	-0.288	-0.316	-0.267
26-35 years	-0.118	-0.138	-0.096	-0.133	-0.159	-0.103
36-45 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
46-55 years	0.038	0.037	0.035	0.054	0.056	0.057
56-65 years	0.059	0.044	0.071	0.082	0.069	0.097
Education						
Primary or below	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Secondary	0.068	0.072	0.055	0.049	0.044	0.043
Tertiary	0.227	0.217	0.231	0.201	0.179	0.211
Foreign born						
Yes	-0.017	-0.032	-0.011	0.005	-0.009	-0.003
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Numeracy proficiency						
Level 1 and below 1	-0.043	-0.053	-0.034	-0.032	-0.034	-0.027
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	0.054	0.061	0.042	0.045	0.053	0.031
Level 4 and 5	0.117	0.124	0.114	0.099	0.106	0.095
Literacy proficiency						
Level 1 and below 1	-0.019	-0.021	-0.016	-0.014	-0.009	-0.024
Level 2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Level 3	0.025	0.018	0.033	0.023	0.018	0.028
Level 4 and 5	0.055	0.048	0.063	0.058	0.049	0.070
Numeracy practices in everyday life						
Little use				Ref.	Ref.	Ref.
Median use				0.009	0.006	0.014
Intensive use				-0.002	0.006	-0.012
Use of ICT skills in everyday life						
1st quartile				Ref.	Ref.	Ref.
2nd quartile				0.028	0.025	0.034
3rd quartile				0.040	0.033	0.053
4th quartile				0.039	0.039	0.048
Occupation						
Skilled occupations	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Semi-skilled white-collar occupations	-0.248	-0.266	-0.244	-0.237	-0.253	-0.231
Semi-skilled blue-collar occupations	-0.200	-0.185	-0.272	-0.169	-0.158	-0.247
Elementary occupations	-0.334	-0.303	-0.362	-0.298	-0.266	-0.318
Tasks discretion (Percentiles)						
Bottom 25th	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25th-50th	0.030	0.027	0.037	0.026	0.019	0.033
50th-75th	0.059	0.067	0.054	0.050	0.057	0.043
Top 75th	0.086	0.092	0.077	0.076	0.080	0.064
Supervision of employees						
Yes	0.103	0.113	0.097	0.091	0.096	0.090
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Numeracy practices at work						
Little use				Ref.	Ref.	Ref.
Median use				0.044	0.039	0.046
Intensive use				0.071	0.068	0.073

Note: Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The results show that controlling for actual use of numeracy does not diminish the influence of the numeracy score on the hourly wage, which is greater than the influence of the literacy score. All else being equal, individuals classified at Level 4 or 5 for numeracy have an average hourly income that is about 13% higher than that of individuals in the Level 1 or less than 1 category. The influence of the level of engagement in numeracy practices is a little less clear. While the intensity of such engagement in everyday life has an almost negligible effect on the level of remuneration, behaviour in the workplace has a net positive impact on the hourly wage.

Interestingly, even when level of educational attainment, age and proficiency are controlled for, familiarity with computer tools is still a significant factor in hourly wages. People who use computers very often in their daily lives are paid about 5% more than those who do so infrequently.

4.4. Conclusions

The correlations between proficiency levels in numeracy, probability of employment and hourly wage presented above could have resulted from simple compositional phenomena. The proficiency level might have simply reflected a higher level of education, which in turn influenced both income and the probability of participating in the labour market and having a job. Our analyses have shown that this is not the case, and that numeracy skills play an important and independent role in success in the labour market, beyond the role played by formal education.

When the intensity of adults' use of numeracy is also taken into account, incidentally, additional insights are yielded into the importance of numeracy for successful integration into the labour market. First, intensity of everyday use of numeracy has a specific effect on adults' degree of familiarity with computer technology, which is an increasingly standard expectation on the labour market. Second, all other factors being equal, intensity of use of numeracy at work significantly improves the level of pay, even when proficiency level and educational attainment are controlled for.

Nevertheless, the correlations identified above do not provide information about the direction of causality. It is not clear for instance that the intensity of engagement in numeracy practices is the unequivocal cause of better labour market outcomes such as increased in employment and wages. Causality may also operate in the reverse direction. Workers with higher wages might have on average more economic resources at their disposal and in general are likely to have been more exposed to technology use (because of the nature of their work or higher education). As a result, they could be more likely to be engaged with technology and numeracy in their everyday life.

5. Numeracy proficiency and well-being

While employability and remuneration are important factors in individual well-being, non-economic factors also play a part in it – as well as, more generally, in the proper functioning of societies as a whole.

Empirical studies analysing the correlations between these two aspects of individual well-being are numerous, and among other things have encouraged governments to promote the joint measurement of economic performance and social progress (Stiglitz, Sen and Fitoussi, 2009[20]). However, fewer studies have been carried out that focus more specifically on the mechanisms linking economic and non-economic benefits at the individual level, in particular because of the difficulty of obtaining sufficiently rich and detailed data to establish causal relationships.

The Survey of Adult Skills is the only international statistical source that, by collecting standardised data from households, provides information on education, skills, labour market status and certain dimensions of individual well-being. It thus offers a unique opportunity to identify the common factors of economic and social well-being and to analyse the possible relationships between them.

A first report (OECD, 2016[1]) already pointed out that proficiency in information-processing, and especially in numeracy, is positively correlated with a wide range of dimensions of individual well-being, such as trust or the state of health reported by respondents. The intensity of this correlation varies from country to country, but remains consistently observable, even after taking socio-demographic characteristics into account such as education, level of parental education, age, sex, country of birth and language of socialisation.

The objective of this chapter is to question and consider in greater depth this initial finding in the particular case of numeracy. This will be done by asking about the mechanisms by which, through the mediation of numeracy practices which represent the practical implementation of skills, proficiency in numeracy may lead to a number of positive or negative socio-economic consequences for individuals.

5.1. Making sense of numbers

Numeracy proficiency includes the ability to understand numbers, mathematical reasoning and the appropriate use of numerical information (Peters, 2012[21]; Peters et al., 2006[22]; Reyna et al., 2009[23]). But numeracy goes well beyond these elements: it systematically engages psychological mechanisms. In particular, high numeracy proficiency has been shown to reduce adults' propensity to be subject to framing effects, to reduce the influence of non-numerical information such as mood states, and to increase the ability to take account of different levels of risk in decision-making processes. The results of research into decision-making processes suggest that there are many reasons to believe that numeracy skills have considerable and varied consequences for many areas of people's daily lives.

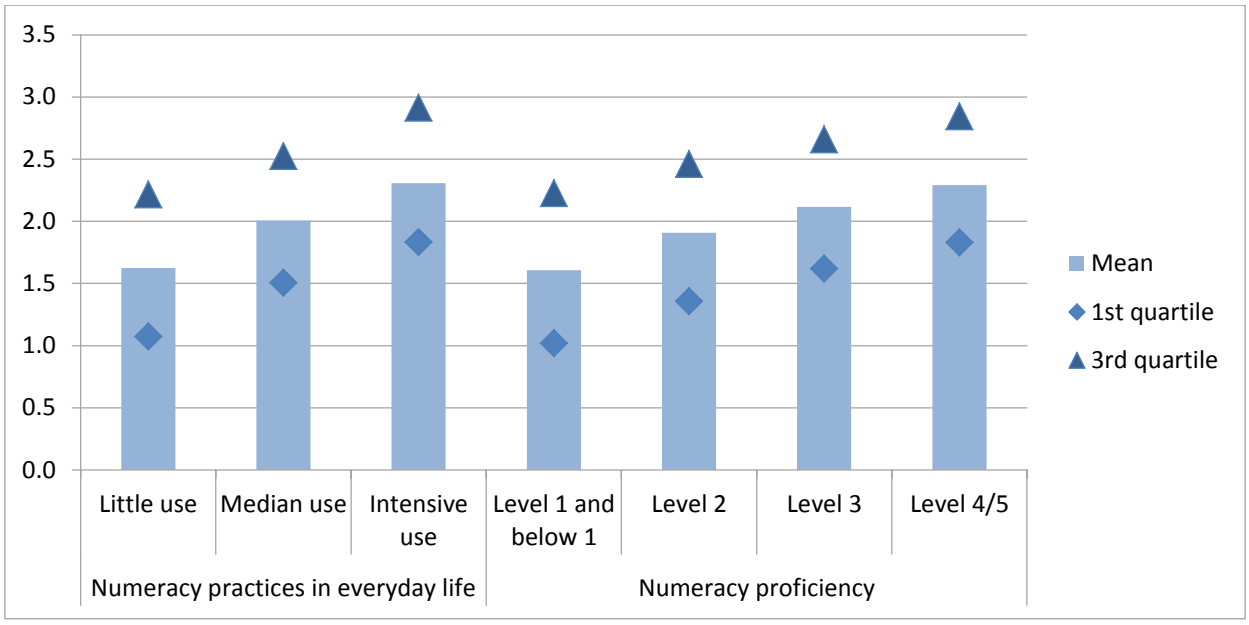
First, many studies have shown that the level of numeracy can predict errors of judgement in probabilistic decision-making. These errors can have very harmful consequences, particularly for individuals' economic and budgetary strategies. In particular, compared with people with numeracy difficulties, highly proficient individuals are less likely to be sensitive to presentation effects and misleading reasoning based on fractions or ratios (Liberali et al., 2012[24]). These biases and distractors distort perceptions of real risk and may lead to poor estimation of possible options in reasoning, and hence to suboptimal decisions.

Second, numeracy skills have an effect on individuals' level of risk aversion and present orientation, which is likely to affect their behaviour, including their financial behaviour. People with strong numeracy skills are more likely to take strategic, rationally defined risks (Jasper et al., 2013[25]; Pachur and Galesic, 2013[26]). They are also less impatient and prefer to delay a smaller immediate gain voluntarily in order to receive a greater future gain (Benjamin, Brown and Shapiro, 2013[27]). In the long term, the extent of individuals' present orientation can have serious consequences for their well-being. As a result of consistently taking suboptimal decisions about health expenditure, for example, people with lower numeracy skills are more likely to report poorer health on reaching retirement age (Hastings and Mitchell, 2011[28]).

Third, people with a high level of numeracy appear to be better able to process the available information correctly and to distinguish between relevant and irrelevant information. In a series of studies, for example, participants were asked to choose from different hospital and health insurance plans; the options were described using multiple numerical and non-numerical attributes (Peters et al., 2007[29]; Peters et al., 2009[30]). People with a high level of numeracy made more "optimal" decisions, choosing the option with the best numerical quality indicators. This suggests that participants with a high numeracy level were better able to take into account multiple types of mathematical information, draw conclusions, develop mathematical arguments and justify their choices. In another area, given the complexity of savings and investment choices that individuals face, it is likely that those who are better able to understand the different alternatives available to them will take better decisions.

Finally, numeracy seems to play an important role in adults' willingness to seek adequate information before making a decision. Six items from the PIAAC questionnaire attempt to measure respondents' appetite for knowledge. The index constructed from these six questions, which summarises adults' inclination and willingness to acquire new knowledge and gain a better understanding of certain phenomena that surround them, is strongly correlated with their mastery of key information-processing competencies, particularly numeracy (Smith, McArdle and Willis, 2010[31]). Figure 5.1 shows that the average obtained for this index by respondents rises steadily with their level of proficiency. The relationship between appetite for knowledge and the practice of numeracy in everyday life is even clearer.

Figure 5.1. "Readiness to learn", by numeracy proficiency and engagement intensity in numeracy practices



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

To understand in more detail the consequences for individual well-being of variations in proficiency in numeracy and in the intensity of use of numeracy in everyday life, the following two sections explore the implications of such variations in two particular areas: financial literacy and health literacy.

5.2. Numeracy and financial literacy: Some elements of analysis

5.2.1. Definitions

Several studies have highlighted the impact of numeracy on households' key financial decisions. For example, Lusardi (2012[32]) notes that studies have shown that adults who are unable to calculate the gain from an interest rate of 2% are much less likely to adopt and hold an effective retirement plan (Mitchell and Lusardi, 2011[33]; Alessie, Van Rooij and Lusardi, 2011[34]), to participate in supplementary private pension schemes (Fornero and Monticone, 2011[35]) or to diversify their pensions by investing capital in pension funds (Klapper and Panos, 2011[36]). The ability to perform calculations, even of a rudimentary nature, is thus critical to the soundness of savings and/or purchasing decisions and can have significant long-term effects on adults' well-being.

In many cases, the large number and the variety of financial decisions that individuals have to take require an increasingly sophisticated understanding of the specific mechanisms of finance – to the point where we now use the term "financial literacy" to cover the skills that need to be acquired in order to make informed decisions in this area. More specifically, the OECD defines financial education as "the process by which financial consumers/investors improve their understanding of financial products, concepts and risks and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to

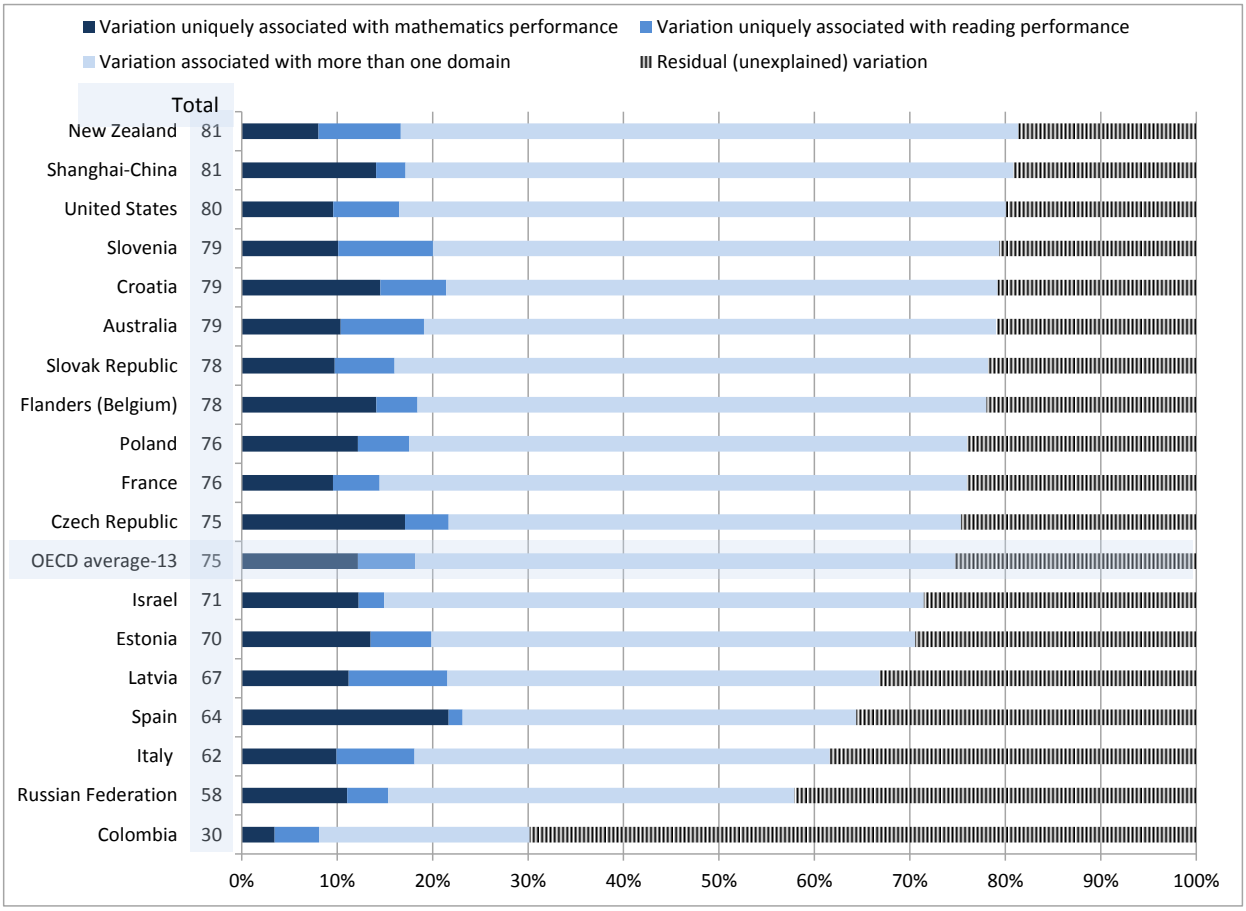
improve their financial well-being" (OECD, 2005[37]). In the context of this report, it would be interesting to know to what extent these purely financial skills can be clearly distinguished from numeracy skills.

The OECD's definition of financial literacy, endorsed by the G20 Heads of State and Government in 2012 (OECD/INFE, 2012[38]) has been broken down into a more operational approach that can be measured through surveys. For the Programme for International Student Assessment (PISA), financial literacy refers to "knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life" (OECD, 2014[39]). In the 2012 edition of the survey, an assessment of the financial literacy of 15-year-old students was offered for the first time to participating countries, on an optional basis, in addition to an assessment in mathematics and reading comprehension. Eighteen countries and economies chose this option, containing two blocks of financial literacy items consisting of 40 questions in all. In the PISA survey, depending on the definition used, four types of content are actually covered by the questionnaire: money and transactions, financial planning and management, risk and return, and knowledge of the financial landscape. This database is the only internationally comparable statistical source that offers the opportunity to study the correspondence between mathematical skills and financial literacy skills.

The correlation between proficiency in mathematics and financial literacy skills is very high, at 0.83. Mathematics performance is in fact the best predictor of students' financial literacy performance. Thus 12% of the variations observed in financial literacy can be explained by students' performance in maths and an additional 56% by the joint results in maths and reading comprehension.

Figure 5.2. Variation in financial literacy performance associated with mathematics and reading performance

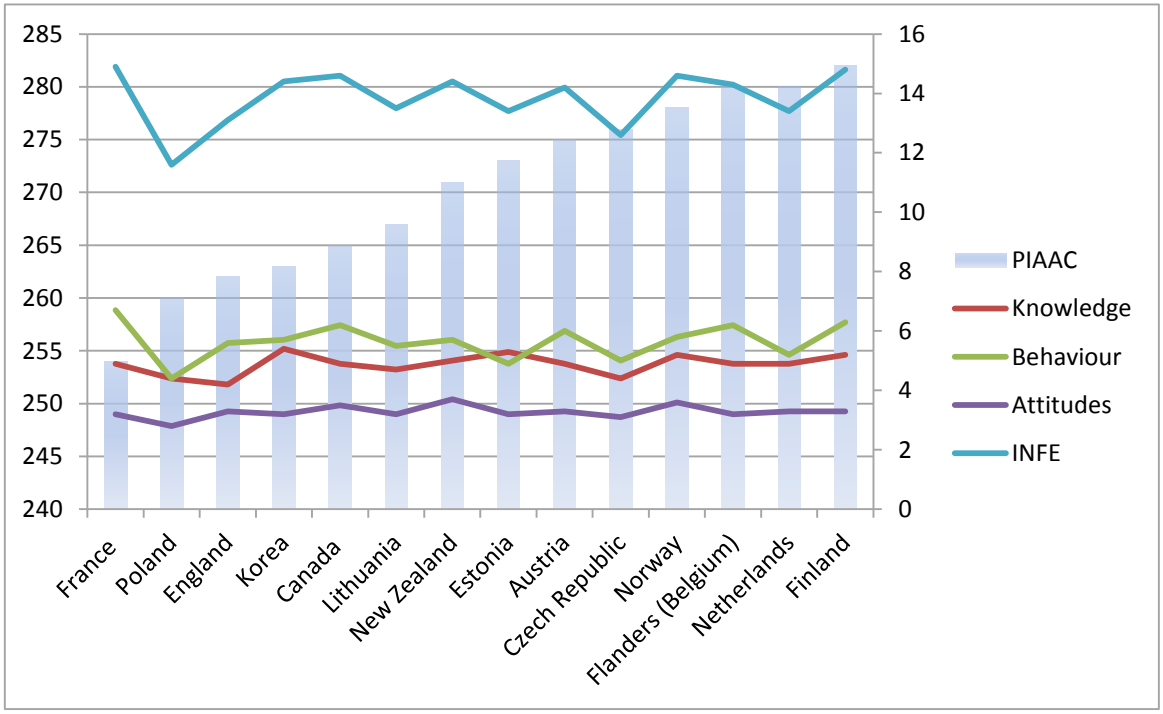
Percentage of variation in financial literacy performance explained



Note: Countries are ranked in descending order of total variation in financial literacy explained.
Source: OECD, PISA 2012 Database, Table VI.2.4.

It should be noted that a definition more specifically tailored to adults has also been proposed and tested in the field as part of the international survey of financial literacy skills. Here, financial literacy is seen as "a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing" (Atkinson and Messy, 2012[40]). Based on this understanding of the concept, the International Survey of Adult Financial Literacy Skills, conducted between 2010 and 2015, administered a series of questions on knowledge (scored out of 7), behaviour (scored out of 9) and financial attitudes (scored out of 5), relating to the financial literacy of the adult population aged 18 to 79 in 30 countries or economies (OECD, 2016[41]).

Figure 5.3. Financial literacy (INFE) and numeracy proficiency (PIAAC) of adults



Note: Countries/economies are ranked in ascending order of average numeracy score.
Source: Survey of Adult Skills (PIAAC) (2012, 2015) www.oecd.org/skills/piaac/publicdataandanalysis; OECD/INFE International Survey of Adult Financial Literacy Competencies.

The results (Figure 5.3, for countries that also participated in PIAAC) rank countries by financial literacy score. They do not show a clear correlation with the average numeracy scores of the PIAAC survey. However, this lack of a link may be due to the calculation method for this overall index, which is obtained by summing each country's average performance for each of the three dimensions of financial literacy. This method tends to erase the differences between countries. It also goes well beyond a skills-based approach by aggregating knowledge and skills of very varied natures. It is therefore difficult to draw satisfactory conclusions on the possible link between adults' numeracy skills and financial literacy skills based solely on data from the INFE survey.

5.2.2. Everyday financial practices of adults

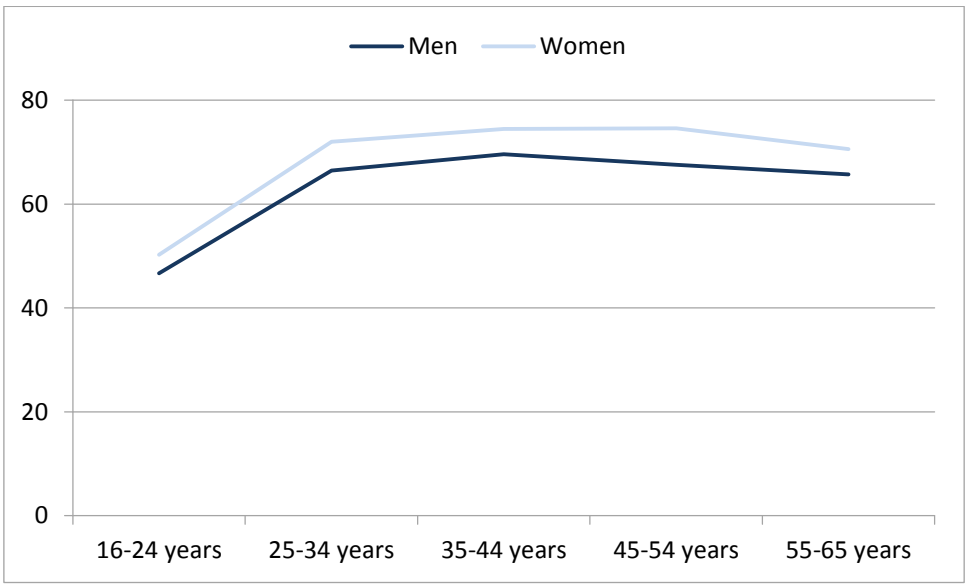
The PIAAC survey data do not allow the same type of estimates to be made for adults as those obtained from the PISA survey. However, three items in the background questionnaire directly address financial literacy practices, giving us the opportunity to examine the potential links between financial practices and numeracy skills. In these three items, respondents were asked how often in everyday life they usually:

- "read bills, invoices, bank statements or financial statements"
- "calculate prices, costs or budgets"
- "perform Internet transactions, for example buying or selling products or services or banking operations".

Figure 5.4 shows the results of the first item. Reading financial documents is a relatively common activity. It is done at least monthly by about 70% of respondents and at a

comparable level for all age groups, except 16-25 year-olds, among whom the rate is less than 50%. It is more common among women than men: they are about 5% more likely to report engaging in this activity at least once a month.

Figure 5.4. Percentage of men and women reading bills in everyday life at least once a month, by age



Note: Excluding students.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

While educational attainment has a significant impact on the likelihood of a respondent reading bills regularly in everyday life, the role of literacy and numeracy skills varies considerably by gender. For men, the numeracy level is the main predictor, whereas for women, the literacy level holds this position. This mixed result is partly due to the ambiguous nature of this activity, which is as much a matter of reading skills (literacy) as of the ability to manage information presented in a numerical format (numeracy). It may also be partly due to the distribution of tasks negotiated within families. Thus, while the presence of children in the household has no influence on the reported activity of male respondents, it increases the probability that female respondents will report such activity by 33%.

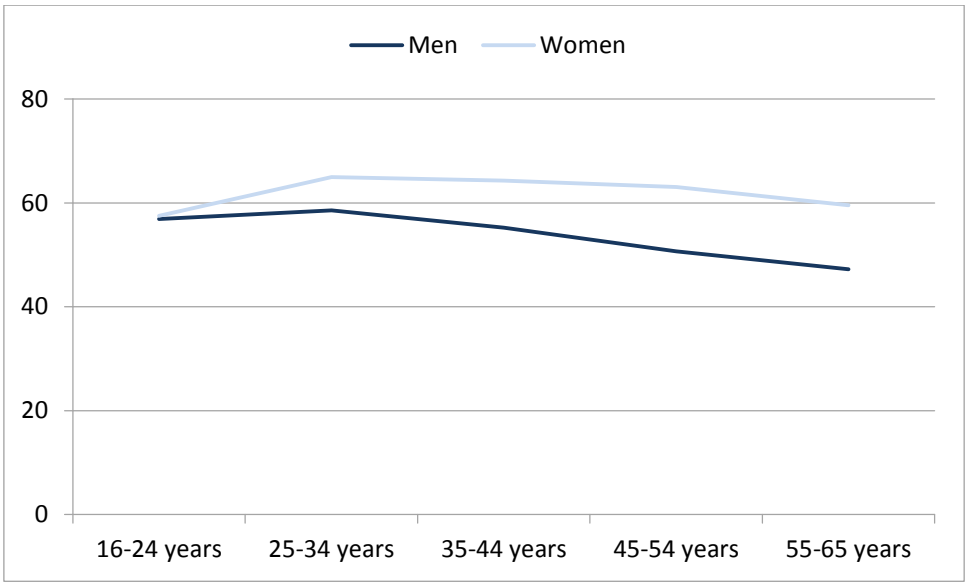
Table 5.1. Determinants of "reading bills in everyday life" (at least once a month), odd-ratios

		Model 1	Model 2 (men)	Model 3 (women)	Model 3bis (women)
Gender	Male	Ref.	-	-	-
	Female	0.037	-	-	-
Age group	16-25 years	-0.156	-0.141	-0.163	-0.162
	26-35 years	0.002	0.000	0.003	0.003
	36-45 years	Ref.	Ref.	Ref.	Ref.
	46-55 years	-0.009	-0.015	-0.002	0.000
	56-65 years	-0.004	-0.005	0.000	0.007
Education	Primary or below	Ref.	Ref.	Ref.	Ref.
	Secondary	0.107	0.106	0.109	0.108
	Tertiary	0.122	0.140	0.109	0.108
Numeracy proficiency	Level 1 and below 1	-0.052	-0.061	-0.048	-0.048
	Level 2	Ref.	Ref.	Ref.	Ref.
	Level 3	0.039	0.047	0.031	0.031
	Level 4 and 5	0.074	0.076	0.067	0.067
Literacy proficiency	Level 1 and below 1	-0.032	-0.017	-0.041	-0.040
	Level 2	Ref.	Ref.	Ref.	Ref.
	Level 3	0.009	0.015	0.004	0.004
	Level 4 and 5	0.015	0.016	0.018	0.018
Work situation	Active	0.069	0.076	0.070	0.069
	Out of labour force	Ref.	Ref.	Ref.	Ref.
Matrimonial situation	Single	Ref.	Ref.	Ref.	Ref.
	Living with partner	0.002	0.013	-0.001	-
	Active partner	-	-	-	-0.017
	Partner out of labour force	-	-	-	0.005
Children	Yes	0.041	0.017	0.060	0.059
	No	Ref.	Ref.	Ref.	Ref.

Note: Excluding students. Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The results for the item concerning the calculation of prices, costs and budgets are comparable. Women are more likely than men to report engaging in this activity at least once a month, but the gap is more marked this time. This is especially true at age 35 or above, when men's reported engagement in this activity declines sharply, while remaining relatively stable for women (Figure 5.5).

Figure 5.5. Percentage of men and women calculating costs or prices in everyday life at least once a month, by age



Note: Excluding students.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Here too, when we distinguish between men and women in two regression models to analyse the determinants of calculating "prices, costs or budgets" at least once a month, we find that the different types of information-processing skills differ in their impact depending on the gender of the respondent. For women, the numeracy level has no influence on this practice, whereas for men it is as important as other control variables, such as educational attainment or even age.

Table 5.2. Determinants of "calculating costs and prices" (at least once a month), odd-ratios

		Model 1	Model 2 (men)	Model 3 (women)	Model 3bis (women)
Gender	Male	Ref.	-	-	-
	Female	0.056	-	-	-
Age group	16-25 years	0.009	0.039	-0.010	-0.011
	26-35 years	0.031	0.045	0.018	0.017
	36-45 years	Ref.	Ref.	Ref.	Ref.
	46-55 years	-0.038	-0.038	-0.037	-0.037
	56-65 years	-0.067	-0.073	-0.059	-0.061
Education	Primary or below	Ref.	Ref.	Ref.	Ref.
	Secondary	0.028	0.032	0.024	0.024
	Tertiary	0.031	0.049	0.023	0.024
Numeracy proficiency	Level 1 and below 1	-0.047	-0.059	-0.038	-0.039
	Level 2	Ref.	Ref.	Ref.	Ref.
	Level 3	0.040	0.055	0.027	0.027
	Level 4 and 5	0.087	0.101	0.062	0.062
Literacy proficiency	Level 1 and below 1	-0.024	-0.011	-0.032	-0.032
	Level 2	Ref.	Ref.	Ref.	Ref.
	Level 3	0.009	0.007	0.012	0.012
	Level 4 and 5	0.017	0.017	0.015	0.015
Work situation	Active	-0.073	-0.069	-0.067	-0.065
	Out of labour force	Ref.	Ref.	Ref.	Ref.
Matrimonial situation	Single	Ref.	Ref.	Ref.	Ref.
	Living with partner	-0.006	-0.001	-0.003	-
	Active partner	-	-	-	0.003
	Partner out of labour force	-	-	-	-0.007
Children	Yes	0.053	0.028	0.077	0.077
	No	Ref.	Ref.	Ref.	Ref.

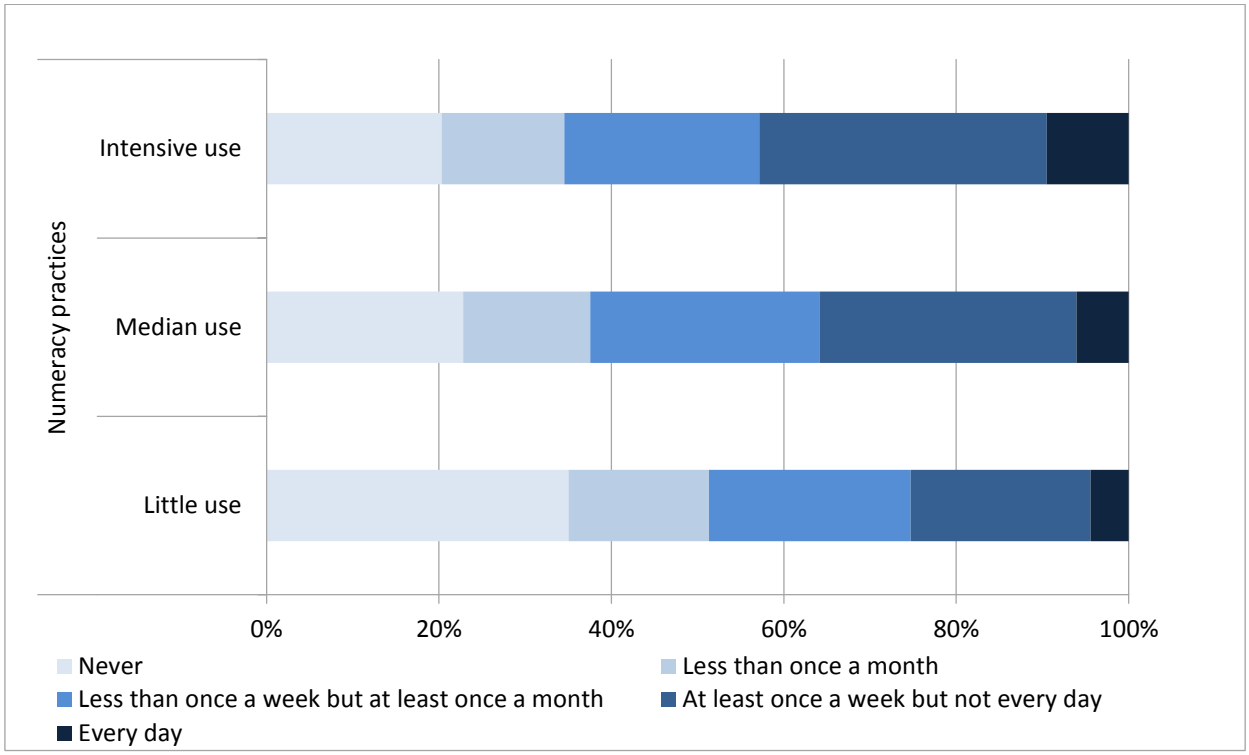
Note: Excluding students. Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

This set of results is all the more remarkable in that women display a lower average numeracy performance than men: it has been found (OECD, 2016[1]) that in a large majority of countries, there is a significant difference in the numeracy score between men and women according to PIAAC data: the former score an average of 12 points more than the latter in the numeracy assessment. These differences are highly variable, with some countries showing greater differences between the sexes, such as Chile or Turkey (around 20 points), and others such as Estonia, Lithuania, the Slovak Republic and Slovenia displaying more modest ones. In general, though, this gap is clear and increases with the age of the respondents. As we have seen here, exactly the opposite happens for financial practices.

5.2.3. Financial practices and Internet use

As the preceding chapter shows, the intensity with which adults use numeracy in their daily lives plays a decisive role in their familiarity with computer tools. This finding is reflected in the particular case of the use of the Internet to make purchases or perform bank transfers. Three times as many people who engage intensively in numeracy practices report that they use the Internet for these purposes at least once a week as those with limited engagement.

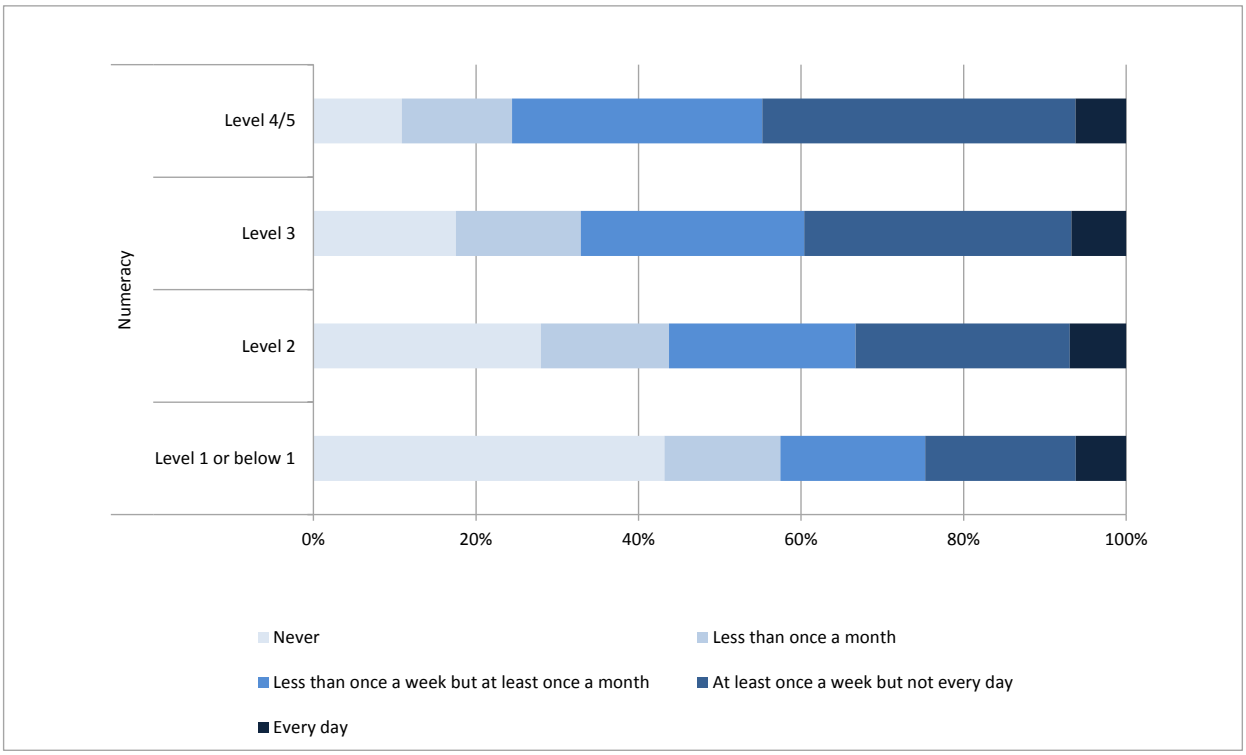
Figure 5.6. Frequency of "conducting transactions on the Internet", by engagement intensity in numeracy practices



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

However, with the growth of online shopping and banking, this practice is now widespread in the adult population, regardless of the sex of the respondent. About 8% of 16-65 year-olds even report daily engagement in these activities. Strikingly, daily use is a little more prevalent among people with a numeracy Level of 2 or below. This raises concerns about the vulnerability of certain groups of the population, whose lack of the skills needed to understand numerical information properly exposes them to more risks in their online financial behaviour.

Figure 5.7. Frequency of "conducting transactions on the Internet", by numeracy proficiency



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

The results of the PISA survey show that there is a significant relationship between mathematical and financial literacy skills for students of 15 years of age. The picture is a little more mixed for adults, although the PIAAC data only contribute marginally to this debate. Some financial literacy practices are related to numeracy and, more importantly, to familiarity with numeracy. However, for the usual household financial practices (checking bank statements, calculating budgets, Internet transactions), this link is sometimes less clear: those with the best skills in managing and using numerical information are not always those who report the most engagement in these activities.

At least two complementary hypotheses can be advanced to address this apparent contradiction. The first possible reason is that numeracy skills may not be closely correlated with financial literacy skills for adults. The second possible explanation is that the financial practices measured by PIAAC are only the most common ones, which do not require a very high level of competence to carry out correctly. For example, by contrast with the INFE survey, the PIAAC questionnaire does not include questions about risk management, debt management, or understanding an interest rate.

But it is also possible that there is in fact no contradiction here: in their daily lives, adults have to keep to a budget and make spending and savings decisions regularly, regardless of their abilities in maths or financial literacy. Those who lack sufficient skills are therefore likely to have their financial well-being affected by their suboptimal decisions, which, through their cumulative effect over time, are one of the drivers of increasing economic inequality. If true, this poses a challenge for public policy: how can adequate

training be provided to the most at-risk adults to ensure that their everyday financial behaviour is underpinned by adequate financial literacy skills?

5.3. Numeracy and health

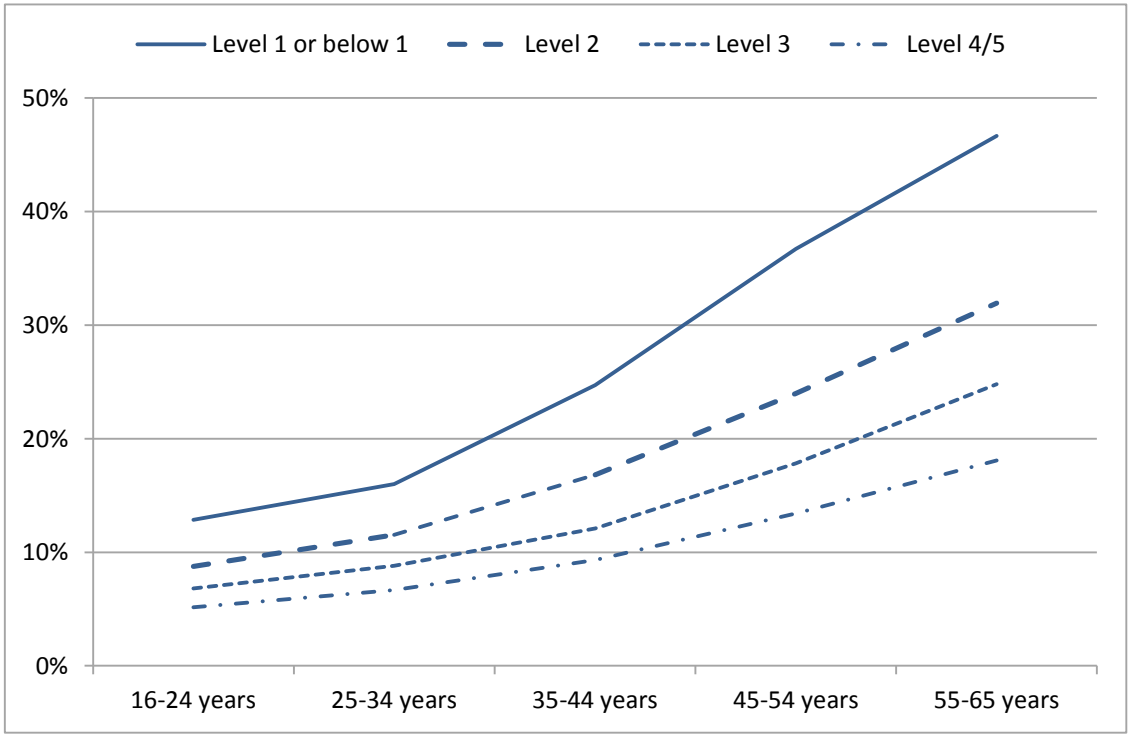
Some proficiency in numeracy is needed to perform many of the most common tasks of everyday life, not just work-related ones. In the area of health, the skills that aid medical decision-making and the understanding of indications in mathematical form (such as the risks and effects of treatment) are "literally, a matter of life and death" (Reyna and Brainerd, 2007[42]). In today's healthcare systems, the burden of decision-making is being increasingly transferred to patients, who therefore have a growing need to understand numerical information about their own health and manage their care path effectively.

This set of specifically medical skills and forms of understanding is grouped together under the term "health literacy". The 2003 National Adult Literacy Survey (NAAL) in the United States, which was the first large-scale attempt to assess literacy in an adult population, proposed the following definition. Health literacy is defined as "the ability to obtain, process, and understand basic health information and services needed to manage one's health and make appropriate health decisions" (Kutner et al., 2006, p. 3[43]).

Health-related knowledge is one of the essential aspects of health literacy, and includes knowledge about the characteristics of the health system, an understanding of health insurance (Politi et al., 2016[44]), and knowledge of a purely medical nature about matters such as fertility (Maeda et al., 2015), cardiovascular events (Riechel et al., 2016[45]) or HIV (Ciampa et al., 2012[46]). It is strongly correlated with numeracy proficiency regardless of the age and income of patients. The results of a series of studies suggest more generally that numeracy may have a role to play in understanding health-related information (Pires, Vigário and Cavaco, 2016[47]). The understanding of risk is lower among individuals with low numeracy, regardless of the mathematical format (frequency vs. percentage) used to present the information (Sinayev et al., 2015[48]). For example, adults with a low level of numeracy are more likely to use a drug even when information about the likelihood of adverse drug reactions is presented on a warning label (Sinayev et al., 2015[48]). In general, a greater numeracy proficiency is associated with greater effectiveness in personal health management and greater effectiveness at searching for health information (Chen and Feeley, 2014[49]). Studies also suggest that numeracy plays a role in decision-making processes of patients (Goggins et al., 2014[50]; Hanoch et al., 2015[51]), who often have to process a considerable quantity of information about their health.

The correlation between health and numeracy skills is strong in most countries/economies that participated in the Survey of Adult Skills. On average, the probability of reporting good to excellent health are 22 percentage points higher for adults at Level 4 or 5 numeracy than for adults at Level 1 or below 1. The gap is much greater for the older age groups. For the youngest (16-25 years old), the difference is 5.5 percentage points, whereas among adults aged 55 to 65, the difference between highly numerate individuals and those with poor numeracy is 32 percentage points.

Figure 5.8. Percentage of adults in fair or poor health, by age and numeracy proficiency



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis

The available data do not indicate to what extent this age-related deterioration is attributable to a generational effect rather than to an age effect. In the first hypothesis, this would mean that the overall decrease in health inequalities in developed countries is due to the fact that health care systems are much more inclusive today than 40 or 50 years ago and/or that living conditions (food, working conditions, housing, hygiene, etc.) have markedly improved. The second hypothesis, which does not exclude the first, would instead confirm the idea that inequalities in numeracy proficiency result in the long term, because of their cumulative effect, in a more marked and more frequent deterioration in the state of health of those with low proficiency than of those with high proficiency as age increases.

Analysis of the determinants of the probability of reporting poor or very poor health confirms the important role of age in adults' subjective health (Table 5.3) in the three regression models tested, even when controlling for respondents' educational attainment and proficiency. Analysis also suggests that the level of numeracy is a much stronger predictor of perceived state of health than the level of literacy. For example, the second model shows that, all else being equal, those with Level 4 or 5 literacy are 30% less likely to report poor health than those with Level 1 or lower, whereas the same difference in probability between those with high and low numeracy proficiency is 65%.

Table 5.3. Determinants of being in 'fair or poor health', odd-ratios

		Model 1	Model 2	Model 3
Gender	Male	Ref.	-	-
	Female	0.03	0.024	0.024
Age group	16-25 years	-0.115	-0.103	-0.101
	26-35 years	-0.045	-0.043	-0.043
	36-45 years	Ref.	Ref.	Ref.
	46-55 years	0.075	0.071	0.070
	56-65 years	0.165	0.154	0.153
Education	Primary or below	Ref.	Ref.	Ref.
	Secondary	-0.091	-0.066	-0.065
	Tertiary	-0.164	-0.118	-0.116
Numeracy proficiency	Level 1 and below 1	-	0.052	0.051
	Level 2	-	Ref.	Ref.
	Level 3	-	-0.020	-0.019
	Level 4 and 5	-	-0.035	-0.033
Literacy proficiency	Level 1 and below 1	-	0.035	0.035
	Level 2	-	Ref.	Ref.
	Level 3	-	-0.005	-0.005
	Level 4 and 5	-	-0.004	-0.003
Numeracy practices in everyday life	Little use	-	-	Ref.
	Median use	-	-	-0.009
	Intensive use	-	-	-0.011

Note: Ref. in a cell means that the variable indicated in the line is the group of reference for the regression model.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Introducing engagement intensity in numeracy activities in everyday life into the model makes little difference to the coefficients of the variables of sex, age, educational attainment and proficiency. It also makes it clear that the intensity of use of numeracy plays a significant role in the probability of reporting poor or very poor health – similar in magnitude to the level of numeracy. This means that information about respondents' numeracy proficiency and information about their numeracy practices is not interchangeable: on the contrary, it is cumulative, suggesting that people with very strong skills in numeracy and making frequent use of numeracy in many situations in everyday life benefit from a considerable comparative health advantage, all things being equal, over other categories of the adult population.

5.4. Conclusions: The importance of numeracy in individual well-being

Financial literacy and health literacy are essential elements of individual well-being, and numeracy as a whole seems to play a determining role in these two areas. However, it appears to be not so much the level of numeracy proficiency as the degree to which these skills are used that influences adults' financial and health behaviour.

6. Conclusions

6.1. Summary of findings

The two fundamental aspects of numeracy – the level of proficiency in numeracy skills and the frequency engagement in numeracy practices – support one another: proficient adults feel sufficiently at ease with numerical tasks to perform them frequently in their private lives and in their working lives, and adults who regularly engage in numeracy practices are more likely to maintain or improve their performance in numeracy.

The analyses conducted in this report have identified a number of individual and contextual factors that can break this virtuous circle. The intensity of use of numeracy in everyday life tends to decrease as the time elapsed since a person completed his or her studies increases. This trend is accentuated by the characteristics of the working environment: employed people engage in numeracy activities less in the private setting if they do not do so sufficiently in the workplace.

Over the long term, the risk for adults who engage little in maths-related activities is that they will experience a decline in their numeracy skills. This risk is all the greater because it has been shown that it is these people who are least likely to undergo professional training that could update or improve their skills in information-processing.

These mechanisms can have very negative consequences for the well-being of the individuals concerned, as proficiency in numeracy is an attractive quality in the labour market, leading in particular to a lower probability of being unemployed and higher wages. In addition, poor numeracy has significant cumulative consequences in everyday life, including in health and budgetary management.

These results reinforce the findings already made regarding the need to encourage adult education in numeracy, to promote practice-based education and the use of computer tools, and to place particular emphasis on the basic level of maths of the entire population at the end of secondary school education.

6.2. Limitations

A number of weaknesses identified throughout the previous chapters limit the scope of the results. Apart from possible problems of equivalence of translations, the most glaring weaknesses relate to three aspects:

- The imperfect coverage of numeracy practices. Many mathematical operations with concrete applications which are numerous and frequent in everyday life (the measurement of time and distance, risk management, etc.) are missing from the list of practices evaluated by the questionnaire.
- A confusion between purely numeracy practices and activities that in principle require technical skills, such as the use of a computer or of certain software programmes.

- Lack of data on socio-emotional skills that would have provided a better understanding of adults' willingness to put their numeracy skills into practice.

6.3. Improvement proposals

This report, by demonstrating that the intensity of use of numeracy skills shows strong and significant links – even when other factors are controlled for – with many aspects of economic and social life, underlines the importance of keeping a measure of adult use of numeracy in private and professional settings in future surveys. However, such a measure could be refined by addressing the limitations identified above.

The first line of improvement would be to modify the series of questions relating to numeracy practices, which confuse derived uses (calculators, construction of graphs, etc.) and direct uses (fraction, statistics) of mathematical skills, and which also confuse abstract uses (use of advanced maths, use of simple formulas) and concrete and contextualised uses (calculation of costs, checking of financial statements). The objective is to clarify the conceptualisation of numeracy practices in order to improve the measurement of the adults' engagement in those practices.

Another strategy would be to distinguish between activities in everyday life and activities at work by offering different sets of questions for each of these two environments. The report suggests that some activities are far less relevant in one context than in the other one, such as the use of advanced maths or statistics in everyday life compared to its use at work. But differentiating the numeracy practices for everyday life and work would imply the loss of the parallels between the two contexts that the report uses for its analysis. One intermediate solution could be to keep only a sub-set of practices in common.

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Annex A.

Table A A.1. Coefficients of the path causal analysis (students)

	Numeracy practices		Numeracy proficiency		Literacy proficiency		Field of study		Years of education	
	b	se	b	se	b	se	b	se	b	se
Gender	-0.058	0.007	-0.117	0.008	-0.031	0.008	-0.198	0.006	0.033	0.006
Age	-0.136	0.008	-0.115	0.009	-0.155	0.009	0.016	0.009	0.524	0.006
Years of education	-0.091	0.009	0.372	0.009	0.380	0.009	0.287	0.008		
Field of study	0.079	0.007	0.071	0.008	0.021	0.008				
Numeracy proficiency	0.265	0.016								
Literacy proficiency	0.021	0.016								

Note: Standardised coefficients.
Source: Survey of Adult Skills (PIAAC) (2012, 2015, www.oecd.org/skills/piaac/publicdataandanalysis.

Table A A.2. Coefficients of the path causal analysis (non-students)

	Numeracy practices		Numeracy proficiency		Literacy proficiency		Field of study		Years of education	
	b	se	b	se	b	se	b	se	b	se
Gender	-0.035	0.003	-0.107	0.003	-0.025	0.003	-0.317	0.003	0.010	0.003
Age	-0.019	0.003	-0.072	0.003	-0.114	0.003	0.013	0.003	-0.138	0.003
Years of education	0.187	0.004	0.477	0.003	0.457	0.003	0.209	0.003		
Field of study	0.035	0.003	0.048	0.003	0.007	0.003				
Numeracy proficiency	0.277	0.008								
Literacy proficiency	0.011	0.009								

Note: Standardised coefficients.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

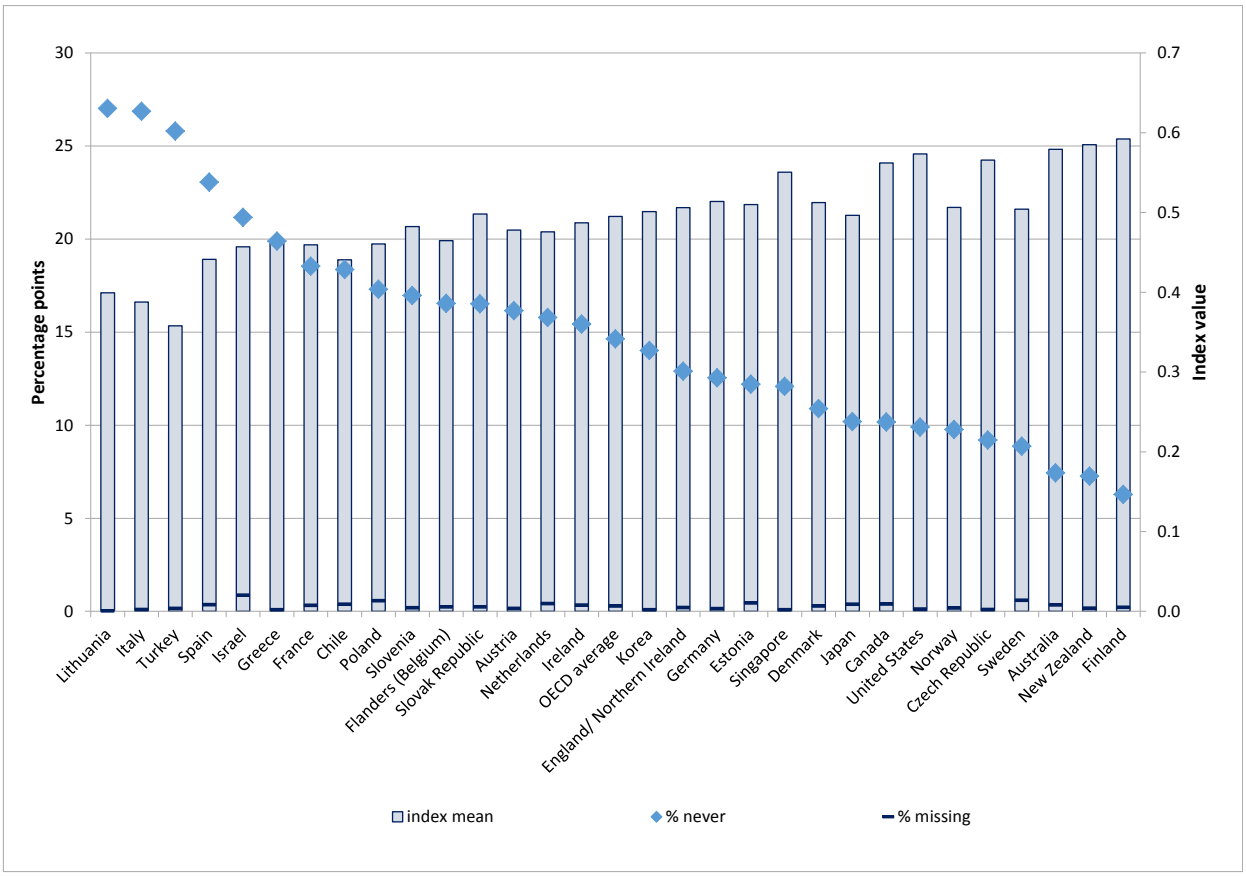
Annex B.

Table A B.1. Country mean: Numeracy practices at work

Countries and economies	Reading bills, invoices or bank statements	Calculating prices, costs or budgets	Using a calculator	Using or calculating fractions, decimals or percentages	Using simple algebra or formulas	Reading diagrams, maps, or schematics	Preparing charts, graphs or tables	Using advanced maths or statistics
Australia	2.9	3.0	3.5	3.1	2.3	2.8	2.1	1.4
Austria	2.6	2.2	3.2	2.6	2.2	2.5	1.9	1.2
Canada	2.7	2.8	3.5	3.1	2.3	2.6	2.1	1.4
Chile	2.3	2.8	3.0	2.5	1.9	1.9	1.7	1.2
Czech Republic	2.6	2.4	3.6	2.7	3.8	2.6	2.1	1.3
Denmark	2.8	2.4	3.4	2.7	2.3	2.5	1.9	1.3
England/Northern Ireland (UK)	2.5	2.7	3.2	2.8	2.0	2.6	2.0	1.3
Estonia	2.7	2.4	3.4	2.5	2.5	2.5	2.0	1.2
Finland	2.5	2.6	3.4	3.0	3.4	2.8	2.1	1.4
Flanders (Belgium)	2.4	2.3	3.1	2.5	2.1	2.5	1.8	1.3
France	2.4	2.4	3.2	2.5	2.0	2.4	1.8	1.3
Germany	2.4	2.4	3.3	2.6	2.5	2.9	2.0	1.3
Greece	2.7	2.9	3.1	2.5	2.2	2.0	1.7	1.2
Ireland	2.6	2.7	3.3	2.7	1.9	2.3	2.0	1.2
Israel	2.4	2.5	3.1	2.6	2.0	1.9	2.0	1.3
Italy	2.1	2.4	2.9	2.3	1.6	2.1	1.6	1.3
Japan	2.3	2.4	3.8	2.3	2.0	2.6	2.1	1.2
Korea	2.7	2.9	3.4	2.5	2.1	2.5	1.9	1.2
Lithuania	2.1	2.2	2.9	2.0	2.8	1.9	1.7	1.1
Netherlands	2.5	2.4	3.1	2.6	2.1	2.6	1.9	1.3
New Zealand	2.8	2.9	3.6	3.2	2.3	2.9	2.1	1.4
Norway	2.7	2.3	3.3	2.6	2.1	2.7	1.9	1.3
OECD mean	**2.5**	**2.5**	**3.3**	**2.6**	**2.3**	**2.4**	**1.9**	**1.3**
Poland	2.5	2.2	3.1	2.2	2.7	2.2	1.8	1.3
Singapore	2.7	2.9	3.6	2.9	2.2	2.5	2.2	1.3
Slovak Republic	2.4	2.5	3.4	2.7	2.8	2.2	1.9	1.2
Slovenia	2.3	2.4	3.3	2.6	2.6	2.3	1.8	1.2
Spain	2.3	2.5	3.0	2.6	1.9	2.1	1.9	1.3
Sweden	2.6	2.3	3.3	2.7	2.1	2.7	1.7	1.3
Turkey	2.1	2.4	2.5	2.0	1.9	1.5	1.5	1.1
United States	2.6	2.8	3.5	3.2	2.4	2.6	2.2	1.4

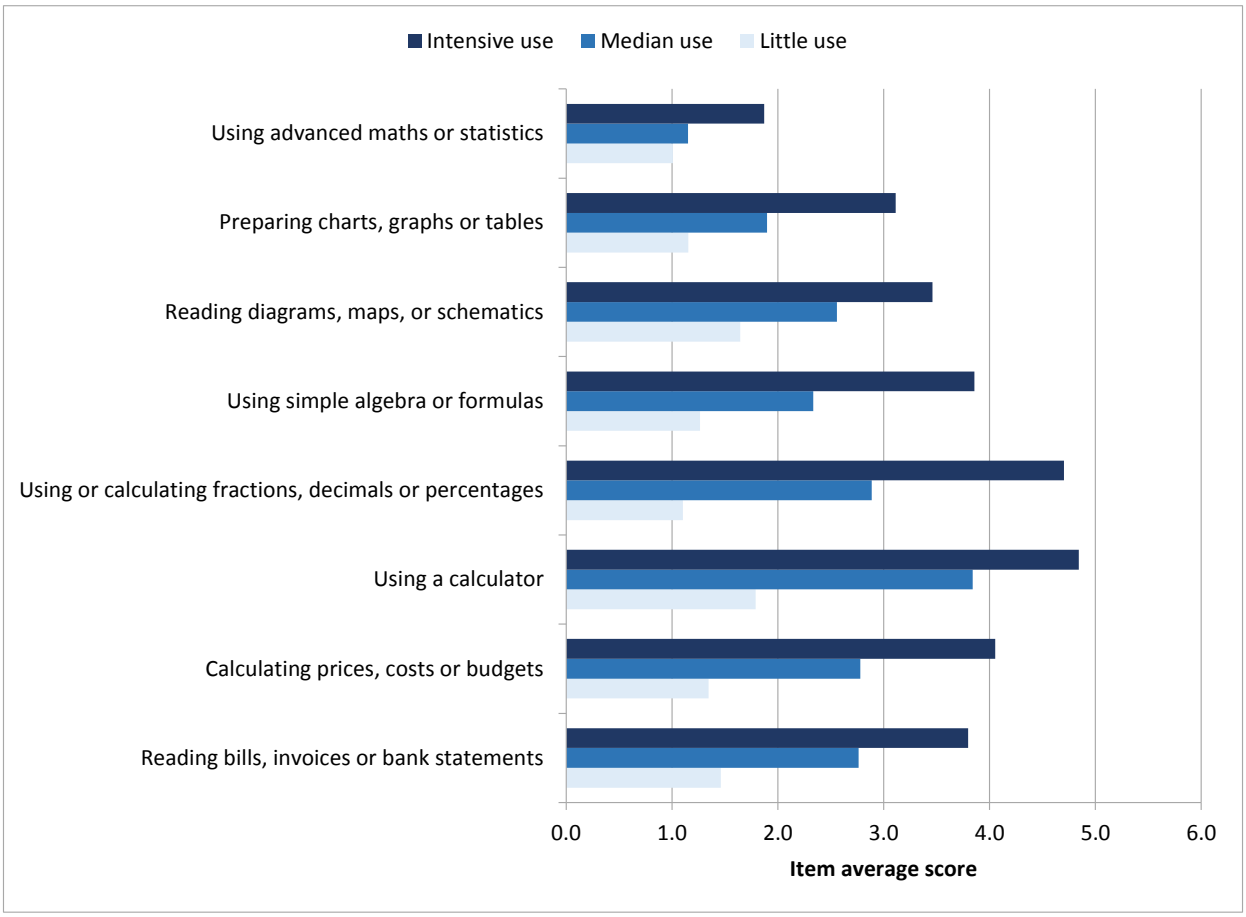
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Figure A B.1. Index of intensity of engagement in numeracy practices at work and quality of responses, by country



Note: Axis 1: Percentages of respondents answering "Never" (% Never) and giving no answer (% Missing) to all eight questions in the index. Axis 2: Engagement index value (Min = 0 and Max = 1).
Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Figure A B.2. Means of responses to questions on numeracy practices at work, by level of engagement in numeracy practices



Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.

Table A B.2. Highly proficient workers who make little use of numeracy at work

		OECD average	Australia	Austria	Canada	Chile	Denmark	England/ Northern Ireland (UK)	Germany	Korea	Spain
Gender	Female	56.7	52.2	44.5	56.7	80.3	50.1	54.5	64.5	55.5	57.6
	Male	43.3	47.8	55.5	43.3	19.7	49.9	45.5	35.5	44.5	42.4
Age group	16-25 years	9.5	24.1	16.9	15.3	0.0	9.0	13.9	7.7	2.3	4.2
	26-35 years	33.1	32.8	25.5	32.2	100.0	27.1	23.9	17.2	43.3	28.4
	36-45 years	26.5	22.5	35.7	18.2	0.0	28.4	32.2	37.0	26.7	28.7
	46-55 years	19.9	15.2	19.7	18.8	0.0	22.6	15.4	22.3	18.8	28.6
	56-65 years	11.1	5.5	2.2	15.5	0.0	12.9	14.6	15.8	8.9	10.1
Education	Primary or below	6.8	5.7	6.3	1.8	0.0	5.9	3.6	0.0	1.4	21.5
	Secondary	42.5	48.2	67.7	30.2	0.0	36.5	49.8	57.7	37.6	20.8
	Tertiary	50.7	46.1	26.1	68.0	100.0	57.6	46.6	42.3	61.0	57.7
Industry	Agriculture, forestry and fishing	1.5	2.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Manufacturing and other industry	14.4	12.7	10.6	11.7	0.0	9.5	9.2	20.5	17.5	0.0
	Construction	4.3	0.5	2.9	7.1	0.0	3.3	10.4	3.5	3.1	0.0
	Trade, transport and hotels etc.	17.5	40.0	27.2	21.3	0.0	15.3	22.2	16.0	12.9	16.3
	Information and communication	3.9	0.0	1.4	4.8	0.0	1.5	8.7	4.5	0.0	13.0
	Financial and insurance and real estate	2.3	0.9	0.0	4.7	0.0	3.0	2.1	2.3	2.6	0.0
	Business services	10.3	3.5	3.4	3.2	80.3	2.5	9.5	3.1	10.8	13.7
	Public admin; education, human health and social work	40.0	37.8	52.1	37.4	19.7	61.0	31.3	44.6	38.8	44.8
	Other services	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Numeracy practices at home	Little use	30.7	11.9	29.0	26.1	0.0	32.0	25.5	20.2	44.3	59.0
	Median use	45.1	47.0	42.2	46.5	0.0	44.9	39.8	46.9	47.0	18.3
	Intensive use	24.1	41.2	28.9	27.4	100.0	23.1	34.7	32.9	8.7	22.7
Type of contract	Permanent contract	71.8	62.5	74.8	70.7	80.3	80.6	68.8	77.9	49.3	83.4
	Fixed term contract	15.6	12.1	20.2	9.5	19.7	13.1	18.8	14.2	30.3	16.6
	Self-employed	7.5	25.4	3.7	9.0	0.0	5.8	4.8	4.4	20.4	0.0
	Other	5.1	0.0	1.3	10.8	0.0	0.5	7.7	3.5	0.0	0.0

		OECD average	Australia	Austria	Canada	Chile	Denmark	England/ Northern Ireland (UK)	Germany	Korea	Spain
Firm size	10 and below	23.4	15.4	16.4	13.9	80.3	16.9	22.1	13.7	36.6	16.4
	11 to 50	30.4	31.2	35.8	27.3	0.0	34.4	15.5	25.0	23.1	25.0
	51 to 250	21.8	23.5	20.3	28.2	19.7	35.6	24.0	25.0	14.7	18.6
	More than 250	14.0	25.2	19.6	15.7	0.0	7.8	16.7	13.3	21.9	31.7
Occupation	Skilled occupations	44.6	39.2	46.8	59.6	19.7	60.2	33.9	50.9	47.5	54.3
	Semi-skilled white-collar occupations	25.3	26.1	26.1	13.5	0.0	21.5	30.6	19.6	25.6	42.1
	Semi-skilled blue-collar occupations	21.3	22.5	21.6	23.8	0.0	13.3	22.3	25.4	23.9	3.6
	Elementary occupations	8.9	12.2	5.5	3.2	80.3	5.1	13.2	4.1	3.1	0.0
Tasks discretion (percentiles)	Bottom 25th	27.9	48.6	21.9	29.5	0.0	18.8	35.2	15.9	46.6	23.9
	25th-50th	29.0	30.5	22.7	31.4	19.7	28.6	28.6	25.8	17.2	44.6
	50th-75th	23.7	10.2	27.4	24.7	0.0	29.7	25.6	24.1	26.0	22.9
	Top 75th	19.4	10.7	28.1	14.5	80.3	23.0	10.5	34.1	10.2	8.6
Supervision of employees	Yes	20.9	25.7	27.8	7.8	0.0	9.2	19.5	12.6	17.9	37.0
	No	79.1	74.3	72.2	92.2	100.0	90.8	80.5	87.4	82.1	63.0
TOTAL		1.90	1.61	2.4	1.9	0.2	3.1	1.9	1.9	0.9	0.7

		Estonia	Finland	Flanders (Belgium)	France	Greece	Ireland	Israel	Italy	Japan	Lithuania	United States
Gender	Female	50.2	58.9	61.1	48.6	61.8	52.5	44.9	58.1	47.3	60.0	42.5
	Male	49.8	41.1	38.9	51.4	38.2	47.5	55.1	41.9	52.7	40.0	57.5
Age group	16-25 years	10.0	14.8	2.9	8.0	2.6	8.9	29.4	1.8	9.3	11.7	8.6
	26-35 years	23.9	30.1	27.6	39.8	20.7	33.3	38.9	41.0	24.0	14.5	30.1
	36-45 years	26.2	26.8	33.3	26.4	40.1	30.2	18.9	18.8	27.9	26.4	31.4
	46-55 years	22.6	15.1	32.8	16.2	19.9	20.5	11.9	31.2	21.7	35.2	15.7
	56-65 years	17.2	13.1	3.3	9.6	16.6	7.2	0.9	7.2	17.1	12.2	14.3
Education	Primary or below	3.1	10.3	3.0	4.6	17.0	5.0	0.0	19.9	0.7	2.9	0.0
	Secondary	44.5	49.7	46.6	34.0	30.8	44.0	40.0	49.3	44.0	55.9	29.8
	Tertiary	52.4	40.0	50.3	61.4	52.1	50.9	60.0	30.8	55.3	41.3	70.2

		Estonia	Finland	Flanders (Belgium)	France	Greece	Ireland	Israel	Italy	Japan	Lithuania	United States
Industry	Agriculture, forestry and fishing	4.2	4.8	0.0	0.0	0.0	3.0	0.0	0.0	4.4	4.0	0.0
	Manufacturing and other industry	11.0	22.2	19.5	14.9	5.5	16.6	8.8	31.7	10.5	16.9	3.2
	Construction	6.9	10.2	3.9	2.1	8.1	2.6	2.3	1.2	3.7	7.5	0.0
	Trade, transport and hotels etc.	12.4	9.3	17.3	22.3	20.0	9.6	6.8	23.0	22.0	17.7	13.9
	Information and communication	2.5	0.0	4.5	4.0	7.1	5.1	9.5	0.0	4.6	3.9	4.9
	Financial and insurance and real estate	10.5	0.0	4.6	1.8	0.0	0.0	0.0	0.0	9.1	0.0	5.2
	Business services	4.3	13.6	7.2	4.7	5.0	25.6	6.8	13.3	7.0	6.8	20.3
	Public admin; education, human health and social work	37.7	35.4	40.6	48.6	49.6	29.9	60.3	26.4	36.2	33.6	38.0
	Other services	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0
Numeracy practices at home	Little use	24.1	15.0	54.5	31.4	32.2	39.1	28.2	81.4	59.4	52.7	11.2
	Median use	58.7	50.8	39.2	56.0	61.9	48.0	52.4	18.6	36.9	29.7	26.8
	Intensive use	17.3	34.2	6.3	12.6	5.9	12.9	19.4	0.0	3.6	17.6	62.0
Type of contract	Permanent contract	83.5	71.4	90.4	85.0	64.7	70.4	50.3	90.8	66.7	87.1	27.0
	Fixed term contract	14.0	18.9	5.6	11.6	20.0	9.2	25.6	8.1	24.6	10.5	1.6
	Self-employed	1.2	0.0	0.7	0.0	5.7	9.8	9.4	0.0	3.8	2.4	71.4
	Other	1.3	9.7	3.2	3.4	9.6	10.6	14.7	1.1	5.0	0.0	0.0
Firm size	10 and below	31.1	25.3	14.4	15.6	35.4	23.2	12.2	10.1	24.6	14.9	26.0
	11 to 50	26.6	41.4	19.1	35.8	39.4	21.4	22.0	34.1	31.3	30.7	38.4
	51 to 250	24.4	23.4	30.5	21.3	15.0	31.5	33.4	9.8	24.3	34.1	12.8
	More than 250	12.0	7.5	23.6	16.0	7.2	17.5	15.2	10.2	9.3	13.3	9.8
Occupation	Skilled occupations	38.7	43.3	49.0	49.1	43.4	38.4	65.7	36.1	32.3	42.8	46.2
	Semi-skilled white-collar occupations	27.8	17.3	26.6	26.7	14.7	34.7	30.4	26.4	45.2	13.6	35.9
	Semi-skilled blue-collar occupations	24.8	37.0	19.9	18.7	25.7	18.9	3.9	33.1	17.7	38.4	7.5
	Elementary occupations	8.7	2.3	4.5	5.5	16.2	8.0	0.0	4.4	4.8	5.3	10.5
Tasks discretion (percentiles)	Bottom 25th	31.1	30.8	20.2	39.1	46.4	35.7	12.8	22.5	25.5	42.8	15.5
	25th-50th	31.5	20.3	25.7	21.7	35.5	38.1	33.4	41.3	18.7	19.1	50.3
	50th-75th	17.2	25.6	32.8	26.2	10.9	22.3	34.5	32.7	26.5	23.4	18.3
	Top 75th	20.2	23.3	21.3	13.0	7.2	3.9	19.3	3.4	29.3	14.7	15.9
Supervision of employees	Yes	15.5	7.9	26.6	23.2	34.3	25.3	15.8	33.2	21.5	11.8	33.9
	No	84.5	92.1	73.4	76.8	65.7	74.7	84.2	66.8	78.5	88.2	66.1
TOTAL		1.7	1.4	4.0	1.4	2.4	1.3	1.6	1.1	3.5	3.18	1.0

		Czech Republic	Netherlands	New Zealand	Norway	Poland	Singapore	Slovak Republic	Slovenia	Sweden	Turkey
Gender	Female	77.7	47.9	53.9	50.3	60.4	58.2	55.4	58.0	55.7	87.6
	Male	22.3	52.1	46.1	49.7	39.6	41.8	44.6	42.0	44.3	12.4
Age group	16-25 years	1.5	6.8	11.6	9.5	5.9	19.8	8.8	7.5	12.6	11.0
	26-35 years	23.6	33.9	20.3	38.7	39.9	44.6	24.0	33.5	32.0	40.9
	36-45 years	21.6	22.4	27.0	22.0	22.8	13.9	32.4	25.9	27.4	30.0
	46-55 years	22.2	23.4	23.8	16.1	24.0	14.3	16.5	25.5	19.5	18.0
	56-65 years	31.1	13.5	17.3	13.7	7.3	7.4	18.3	7.6	8.6	0.0
Education	Primary or below	18.8	11.2	7.6	8.3	0.7	0.0	2.3	3.6	11.9	16.1
	Secondary	61.1	38.3	27.2	32.2	56.3	16.2	76.4	56.2	58.7	22.7
	Tertiary	20.1	50.5	65.2	59.5	43.0	83.8	21.3	40.2	29.4	61.3
Industry	Agriculture, forestry and fishing	1.2	0.7	2.1	1.1	7.9	0.0	2.8	5.3	1.6	0.0
	Manufacturing and other industry	30.5	6.5	10.3	4.1	20.8	4.3	36.4	22.5	15.2	20.2
	Construction	6.2	5.5	2.3	6.5	9.1	0.0	6.7	2.7	8.8	0.0
	Trade, transport and hotels etc	25.7	13.1	17.3	12.1	20.7	8.7	15.4	14.8	12.8	30.6
	Information and communication	3.7	3.1	9.1	5.0	4.4	14.4	3.1	0.0	5.6	0.0
	Financial and insurance and real estate	4.5	4.5	0.0	0.9	0.0	4.2	0.0	2.6	3.8	0.0
	Business services	1.1	8.3	11.3	6.8	1.3	2.2	5.6	0.0	8.1	9.1
	Public admin; education, human health and social work	21.1	53.6	38.1	57.2	30.0	56.5	29.4	45.1	37.8	37.4
	Other services	0.1	0.0	0.1	1.0	0.2	0.0	0.5	0.3	0.0	0.0
Numeracy practices at home	Little use	10.6	47.6	8.5	15.3	33.2	19.8	35.9	19.7	17.1	48.5
	Median use	71.0	35.4	49.0	73.1	48.3	50.0	43.8	60.9	65.7	34.2
	Intensive use	18.4	17.1	42.5	11.6	18.5	30.2	20.3	19.5	17.2	17.3
Type of contract	Permanent contract	83.9	79.1	58.5	82.1	64.8	42.5	77.9	74.9	71.5	69.9
	Fixed term contract	13.2	14.6	12.1	10.2	25.8	36.9	17.5	17.9	13.2	20.0
	Self-employed	2.6	0.0	5.4	2.0	0.2	9.4	0.0	0.0	13.0	10.1
	Other	0.3	6.3	24.0	5.7	9.2	11.2	4.6	7.2	2.3	0.0
Firm size	10 and below	22.5	13.0	44.3	9.0	12.9	12.1	21.6	26.0	31.1	25.9
	11 to 50	33.2	32.3	20.5	40.1	45.1	12.4	28.8	35.9	25.5	63.0
	51 to 250	24.3	34.9	21.2	24.0	17.8	24.3	22.4	15.2	13.4	2.0
	More than 250	15.4	12.0	6.1	12.5	14.0	26.1	19.6	12.7	17.1	3.5

		Czech Republic	Netherlands	New Zealand	Norway	Poland	Singapore	Slovak Republic	Slovenia	Sweden	Turkey
Occupation	Skilled occupations	30.4	52.7	57.3	49.7	47.1	77.4	29.9	41.4	37.3	47.8
	Semi-skilled white-collar occupations	41.7	30.9	22.2	29.1	12.3	20.2	15.6	25.4	26.4	13.1
	Semi-skilled blue-collar occupations	20.3	9.6	9.6	19.1	32.1	2.5	44.8	30.2	26.7	39.1
	Elementary occupations	7.6	6.8	10.8	2.1	8.5	0.0	9.7	3.0	9.6	0.0
Tasks discretion (percentiles)	Bottom 25th	16.0	26.6	30.7	20.5	23.4	45.0	43.9	36.3	23.5	39.2
	25th-50th	27.9	19.1	18.0	30.5	23.1	23.3	35.5	40.2	24.4	28.2
	50th-75th	32.8	26.6	24.6	33.3	21.9	15.6	10.4	18.7	29.3	28.9
	Top 75th	23.2	27.7	26.7	15.7	31.6	16.1	10.2	4.8	22.8	3.8
Supervision of employees	Yes	13.0	26.2	32.7	23.0	22.3	33.4	12.7	15.3	17.8	26.6
	No	87.0	73.8	67.3	77.0	77.7	66.6	87.3	84.7	82.2	73.4
TOTAL		1.2	3.76	1.6	2.9	1.8	1.3	2.8	1.2	3.4	0.65

Source: Survey of Adult Skills (PIAAC) (2012, 2015), www.oecd.org/skills/piaac/publicdataandanalysis.