Investment in Human Capital: Formal Education, Training and Skills – Analyses with PIAAC

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1 Introduction to the dissertation

1.1 Background and overarching research question

Becker (1962) and (Mincer, 1958) first introduced Human Capital Theory, a groundbreaking model in the Social Sciences. It includes the notion of investing in human capital through education, thus creating better earnings and employment opportunities. Even beyond its role for labor market participation, human capital is argued to be important for individuals to navigate today's society successfully (Sum et al., 2004). Human capital is not easy to define unambiguously, but key components include innate ability, education and training, as well as competencies acquired through them (Blundell et al., 1999).[1] Figure 1.1 illustrates these key components within the "black box" of human capital.

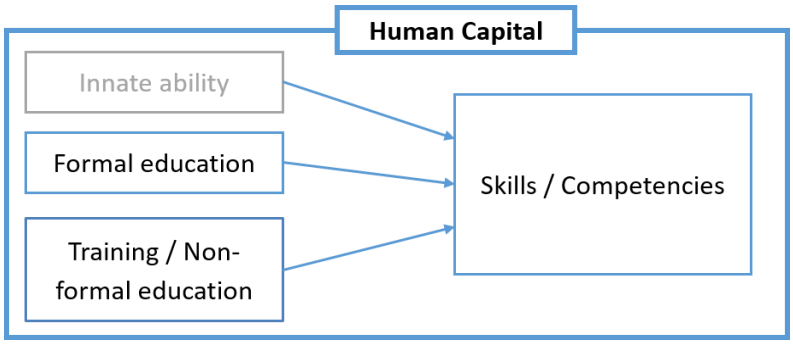


Figure 1.1 Forms of Human Capital

According to UNESCO Institute for Statistics (2012, p. 11) formal education is defined as "Education that is institutionalized, intentional and planned through public organizations and recognized private bodies and, in their totality, make up the formal education system of a country. Formal education programmes are thus recognized as such by the relevant national educational authorities or equivalent". Formal education is therefore structured and follows a curriculum and usually ends with certification, such as education degrees or qualifications which are also referred to as educational attainment. Formal education usually includes different schools and institutions from primary education to university. In some countries, the education system includes specialized vocational, technical and professional training

[1] Human capital could in principle include all personal attributes considered important for improving individual productivity (such as individual health). While there is no single operationalization of human capital, the components mentioned by (Blundell et al., 1999) seem to be generally accepted.

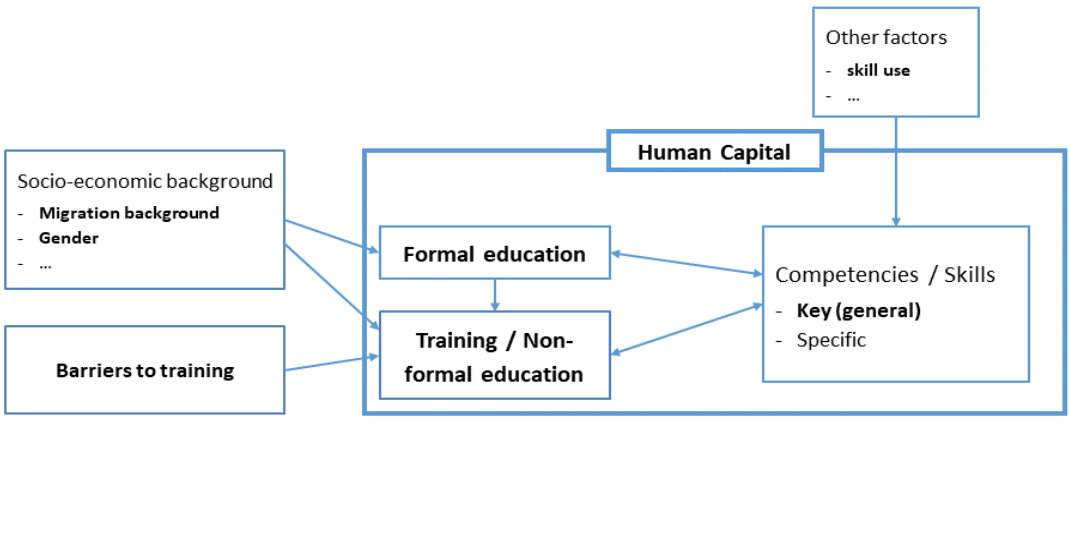
systems. Formal education qualifications can be subdivided into various categories or levels. The International Standard Classification of Education (ISCED) was created by UNESCO in order to compare education systems in (official) statistics. It aims at mapping national educational qualifications into comparable levels of education and their orientation (UNESCO Institute for Statistics, 2006, 2012). In addition to educational degrees showing which educational program an individual has completed, education also equips individuals with implicit and social knowledge which can be important when navigating society.

Non-formal education, also conceptualized as training, is usually defined in comparison to formal education and includes organized education activities that are not part of the formal education system. Non-formal education is often shorter in duration. Examples for non-formal education are mental health or language classes, work-related workshops, such as a software course or security training. Non-formal education has to be distinguished from informal learning which is not intentional. It can include reading books or watching videos, not with the aim to learn something specific. As there is no organized setting, this kind of learning is not regarded as non-formal education or training, and will thus not be investigated in this dissertation. Innate ability, sometimes operationalized as (fluid) intelligence (Garlick, 2002), in contrast cannot be influenced by specific investments. Classical ability theories, first introduced by Cattell (1963) distinguish fluid and crystallized intelligence: while fluid intelligence describes the ability to respond to new situations in a flexible and adaptive way, crystallized intelligence describes acquired knowledge.

As indicated by Figure 1.1, innate ability, formal education, and training should all feed into the formation of competencies (also referred to as skills in this work).[2] These components together form important parts of human capital. Other components, such as informal learning or experiential learning can also build human capital but according to Becker (1993), the two most important forms of human capital are education and training (Becker 1993, p. 17), as they are the result of a personal investment and therefore can be influenced directly.

[2] The terms competencies and skills are used interchangeably here.

While a vast amount of research has investigated the determinants and effects of formal education, training (or non-formal education) has received less attention. Also, many dynamics within the 'black box', such as the relationship between formal education, training and competencies, are not well understood yet. This dissertation investigates these dynamics, focusing on the determinants of training and the relationship between formal education, training activities, and competencies in adult life. Figure 1.2 provides a brief overview of the key aspects studied in this dissertation and how they are related:



Note. Key aspects studied in this dissertation are marked as bold.

Figure 1.2 Determinants and Dynamics of Human Capital

Relatively little is known about the relationship between educational attainment and competencies in adult life. To study this relationship, we have to understand what competencies are and how they are formed. Competencies have to be distinguished from fluid intelligence, i.e. generalized cognitive functioning, as only the former can be acquired through specific investment, such as education and training activities. Although fluid intelligence facilitates building competencies (for a discussion, see (for as discussion, see Engelhardt et al., 2021), in principle it should be possible to improve them at any level of intelligence.

There are different kind of competencies, such as the ability to use knowledge adequately and different kind of skills that can be learnt. The usefulness of different competencies depends on what is required

in the specific environment. There are competencies which are specific, while others are broader. Competencies which are "relevant to all members of the working population and across all fields of economic and social activity" (OECD, 2013b, p. 95), are sometimes referred to as key competencies. Key competencies can cover different domains which are important for all individuals and form the basis for other cognitive skills. These can focus on literacy or numeracy, for example. There are various definitions for literacy but in its widest sense, literacy means the ability to read and write, while numeracy refers to the ability to use and understand numbers.[3] In contrast to key competencies, specific competencies are related to particular disciplines or occupations. Due to its more general relevance, my work focuses on key competencies only.

From a theoretical point of view, educational attainment and competencies should be highly related because the aim of education is to equip students with skills. Prior research finds that of all background variables examined, educational attainment shows the strongest relationship with key competencies when controlling for other socio-demographic factors (for example, Desjardins, 2003; and OECD & Statistics Canada, 2005). Despite the strong correlation between educational qualifications and competencies, the relationship is not perfect (Desjardins, 2003; Reder, 2009), which means that in addition to educational qualifications other factors also influence competencies. The development of competencies is influenced by the background of an individual, such as educational attainment of parents and social background. Part of this relationship is mediated by own education.

Substantial differences have been found across countries when comparing competencies at the same level of educational attainment when measured in broad categories (Maehler et al., 2013; OECD, 2013a; OECD & Statistics Canada, 2005). This can partly be explained by the fact that education considered as being on the same level can be heterogeneous, especially in countries with strong vocational education, such that skill development has a high variability.

The relationship between education and key competencies, especially literacy, can be reciprocal: individuals who show higher competencies in literacy (i.e. who have higher literacy skills and are thus

[3] For a definition of literacy in this research, see Chapter 1.2. Data description

more literate) stay in education longer and achieve a higher level of attainment, and staying in education longer and reaching higher levels of attainment produces higher literacy (Kirsch et al., 2002). Earlier literacy skills are thus predictive of later literacy skills (Bynner & Parsons, 2009). An explanation for this is that higher early literacy skills facilitate learning and, thus performance in education, the successful completion of an educational level, and making the transition to the next higher level of education. This reciprocity unfortunately cannot be disentangled with cross-sectional data lacking information on competencies at earlier points in life (OECD & Statistics Canada, 2005).

However, competencies can also be developed after leaving formal education. They can be acquired through non-formal training such as language classes or workshops on specific topics and through informal learning, such as experiences at work and in private life, and through opportunities for skill use. Examples for non-formal training are language classes or workshops on specific topics. Experiences at work and in private life can be very diverse, for example acquiring skills in order to use a specific software or working together in a team and communicating with others. Opportunities for skill use include reading and writing texts, using a computer or finding solutions to complex problems.

Research shows that individuals with higher human capital tend to acquire even more human capital. For example, Støren and Børing (2018) find that adults with higher education (measured as ISECD 97, level 5 and 6) participate about three times as much in employer-sponsored training than those with low education levels (measured as ISCED 97, level below 3). Therefore, respondents with higher education will most likely have more opportunities for lifelong learning (also see Desjardins (2015) for more evidence on this). It is also important to acknowledge that skills cannot only be developed but can also decline. In order to maintain skills, it is important to use them. After a peak at the age of around 30, age is negatively related to literacy skills (Paccagnella, 2016). However, as older adults do not necessarily do worse in terms of labor market outcomes, it seems to be possible for them to acquire different kinds of skills which are important on the labor market.

When assessing the role of formal education and non-formal training for skill development, a question of immediate policy relevance is which factors drive education and training. There is already a lot of research focusing on how several factors influence formal educational attainment, also across countries.

Many studies explore the relation to social and migration background as well as to labor market outcomes as dependent variable (see for example, Breen and Jonsson (2005); Heath and Brinbaum (2014); Shavit and Blossfeld (1993); Shavit and Müller (1998)). Previous research also shows that parents' own educational attainment is positively related to educational opportunities of their children (Erikson & Jonsson, 1996; Shavit & Blossfeld, 1993). This effect is partly mediated by families' cultural capital (often measured through the number of books in the home). Cultural capital can have an additional effect for families in which parents have low levels of formal education: possessing more books creates a cognitively more stimulating environment and gives opportunities for literacy practice, i.e. the opportunity to read and engage with written text, in comparison to families with few or no books (Evans et al., 2010). Furthermore, social class and social status are identified as important influences on educational attainment (Breen et al., 2010; Erikson & Jonsson, 1996; Shavit & Blossfeld, 1993). Partly related to this is migration background, which also has been shown to affect educational outcomes (Heath & Brinbaum, 2014; Heath et al., 2008; Marks, 2005; OECD, 2012)).

In contrast to formal education, research on the drivers of training participation received less attention up to now. What is known is that individuals with higher formal educational qualifications are more likely to participate in training activities (Blundell et al., 1999). This could be because more relevant training is available for this group or because they are more familiar with education-related topics and find it easier to locate training activities. Another reason is that training is often job-related, and that employer support varies across different occupations and some occupations incentivize training participation more than others. Less research has focused on the reasons preventing training participation. The perceived so-called barriers to participation are likely to vary across different groups and across countries because different factors influence the access to training opportunities.

Thus, the main hypothesis driving this work are that human capital in form of formal education and non-formal training is positively related to key competencies. This relationship however is influenced by several other variables such as migration background, gender and skill use. This dissertation tries to close some of the gaps in the literature by addressing the following questions: (i) How are formal qualifications related to key competencies in adults? Are there differences between countries and

different education system? If yes, which factors help to explain these differences? (ii) What influences the chances to participate in non-formal training? In particular, how are chances to participate in non-formal training across different groups, such as men and women and migrants and natives, distributed? What are factors deterring respondents from participating in training? Are there any observable patterns across countries and across different welfare state regimes?

1.2 Data description

For chapters 2 to 4, data from the first cycle of the Programme for the International Assessment of Adult Competencies (PIAAC) 2012 is used (OECD, 2013a, 2013c), which was collected between 2011 and 2017. PIAAC is an international study commissioned by the Organisation for Econonomic Cooperation and Development (OECD) and carried out in more than 40 countries. PIAAC was chosen for this research because it assesses central basic competencies – also called "key competencies" - which are considered essential for successful participation in today's society. About 5,000 individuals from the working-age population (16-65 years old) were surveyed in each country. Respondents were chosen using probability-based methods, thus aiming at a representative sample of the population in each country. In addition to this, PIAAC data benefitted from a high degree of input harmonization and other high quality control standards.

Each participant in PIAAC first completed a background questionnaire using computer-assisted personal interviewing (CAPI). The background questionnaire elicits respondents' social and migration background, their educational attainment, their participation in non-formal education, their work history and current employment status as well as their skill use at work and in everyday life and other information. After the background questionnaire, respondents were asked to complete a series of tasks on the computer for the assessment of competencies. For the analyses in this dissertation, the sample was restricted to respondents aged 25 and older because in many countries, respondents are still in their initial phase of education when they are younger than 25 years (see also, Desjardins (2003)).

PIAAC measures three different competency domains: literacy, numeracy and problem-solving in technology-rich environments. The competency scores are calculated using psychometric tests based on IRT scaling procedures (OECD, 2013c). The focus in this dissertation is on literacy. Literacy is defined

as “[...] understanding, evaluating, using and engaging with written texts to participate in society, to achieve one’s goals, and to develop one’s knowledge and potential” (PIAAC Literacy Expert Group, 2009). Compared to numeracy, it is the more generally needed competency and does not presuppose other skills (Engelhardt et al. (2021). The acquisition of numeracy (and other competencies) to some degree presupposes literacy, and most of the competency test items in PIAAC were text based. The literacy and numeracy scales are thus highly correlated (estimated intercorrelations across countries who participated in PIAAC round 1 and 2: 0.861, OECD (2016)). Therefore, results for literacy are potentially relevant beyond this domain.

1.3 Chapter Overview

The two key research questions of this dissertation address the gaps in the literature described above: First, how does formal education relate to adult competencies across different countries? This question is assessed in Chapter 2 of this thesis, entitled “Degrees of competency: the relationship between educational qualifications and adult skills across countries”. The second central research question of this dissertation focusses on factors influencing participation in non-formal training activities. Chapter 3 “Training Participation and Gender: Analyzing Individual Barriers Across Different Welfare State Regimes”, focuses on whether training participation rates differ between men and women, and which barriers prevent men and women from training participation. The results are compared between countries belonging to different welfare state regimes in order to explore whether barriers of men and women differ between these different systems. In Chapter 4 “Participation of migrants in non-formal training: An international comparison using PIAAC data”, I examine differences in training participation between migrants and non-migrants, and whether these two groups face similar barriers in training participation. I explore country differences in order to assess whether some countries are better at providing training opportunities for both groups.

1.3.1 Study 1: Degrees of competency: The relationship between educational qualifications and adult skills across countries[4]

Educational qualifications, also referred to as educational attainment, are often taken as proxy for human capital. This is due to the fact that one of the fundamental aims of the education system is to equip individuals with competencies which are important to take part in society. Therefore, it is not surprising that educational qualifications and competencies are highly related. However, from a theoretical perspective, there are also many reasons why the relationship between educational qualifications and competencies is not perfect.

The central research question of this chapter assesses how educational attainment and literacy skills are related across different countries. Furthermore, it looks at how this relationship changes when controlling for several other variables which are likely to influence educational attainment or literacy skills (or both), such as parents' education and participation in non-formal education activities.

In this chapter, we use educational attainment measured according to the International Standard Classification of Education (ISCED) and focus on the relationship between attainment and literacy skills. The aim is to find out how much competencies vary within education levels considered the same across different countries. Educational qualifications are often measured using broad categories. However, as there is a high degree of educational differentiation in most countries, we use a more differentiated educational attainment variable, also including information on vocational and academic orientation of educational degrees. For this analysis, we use data from 21 countries from the Programme for the International Assessment of Adult Competencies 2012, comparing the literacy skills of adults who achieved different levels of educational attainment across countries.

In order to explore the relationship between educational qualifications and literacy competencies, we first control for factors that are likely to affect the access to education and the acquisition of educational qualifications as well as literacy competencies, such as parental education, language and migration

[4] This was published by Natascha Massing and Silke L. Schneider, in *Large-scale Assessments in Education* 5 (6): 1-34.

background. In a second step, we also control for variables affecting skill development after initial formal education, such as non-formal training, occupation and skill use at home.

The results show that educational levels (measured by ISCED) cannot be matched perfectly to skills. On the one hand educational degrees which are considered equivalent according to ISCED come along with heterogeneous levels of skills. On the other hand, educational degrees classified as different levels sometimes show comparable literacy competencies, at times even breaking the hierarchical order of 'higher education entails higher competencies'. We conclude that ISCED levels cannot be taken as a cross-nationally comparable proxy for human capital in terms of literacy skills, and that education has to be harmonized in a substantively more meaningful way in future adult literacy surveys, especially considering different educational systems and their orientation.

1.3.2 Study 2: Training participation and gender: Analyzing individual barriers across different welfare state regimes[5]

Lifelong learning is an important aspect, helping individuals to cope with changes in today's societies. Individuals are encouraged to develop their skills through training in order to be successfully integrated in the labor market. In this chapter, we use data from the Programme for the International Assessment of Adult Competencies to investigate gender differences in training across 12 countries. We compare participation in training and perceived barriers to training between women and men, controlling for family structure, such as having children who are 13 years old or younger, and employment status.

The analysis revolves around two main research questions: 1) Are there gender differences in participation in training when controlling for family structure and employment status? and 2) How are barriers to participation in training related to being employed and having young children?

As the decision to participate in training is not only related to individual preferences but can be influenced by structural conditions, we use four different welfare state regimes as institutional framework to show how policies can affect the decision to participate and the perceived barriers that prevent training participation.

[5] This was published by Natascha Massing and Britta Gauly, in *Adult Education Quarterly* 67 (4): 266–285.

Our results show that the participation rate differs between welfare regimes and that they have an impact on perceived barriers. In all countries except the Nordic countries, men are more likely to participate in training. Some of the gender differences can be explained by employment status, as being employed has a strong positive effect on the chances of participation in training. We find that having young children lowers the chance of women to participate in training compared with men with young children. When it comes to perceived barriers, there seems to be less gender inequality in the Nordic countries in comparison to countries in other welfare regimes when reporting family responsibilities as barriers to training. Nordic States thus seem to be better able to provide access to training to both women and men. In countries from the Liberal states, reducing financial barriers and in Southern countries providing adequate childcare opportunities could improve the chances to participate in training for women.

1.3.3 Study 3: Participation of migrants in non-formal training: An international comparison using PIAAC data

Migrants in OECD countries have lower chances on the labor market, lower educational attainment, their qualifications from other countries are often not recognized in the host country, or their skills sometimes do not match with the local labor demands. Non-formal education or 'lifelong learning' is a possible way to mitigate these problems and address existing inequalities. This study thus analyzes the following key questions: Does participation in non-formal education and training vary between migrants and natives? Is it possible to observe any patterns across countries? Do the same kind of barriers prevent migrants and natives from participation in training or do they differ?

Using data from the Programme for the International Assessment of Adult Competencies (PIAAC) from 11 countries, I confirm previous findings that migrants participate less in training than natives. These disadvantages, however, tend to disappear in the second generation. I also show that formal educational attainment cannot explain the lower training participation of the first generation. A possible explanation is that, compared to those who completed their formal education in the host country, migrants who obtained a comparable degree abroad exhibit lower levels of literacy in the language of the host country, which is an important driver of access to training. First generation migrants also more often tend to report financial reasons as barrier to obtaining training. All these findings are relatively robust across different countries and welfare regimes.

1.4 Conclusion

My research investigates the relationship between formal education, non-formal education, and competencies, and thus contributes to understanding the black box of investment into human capital (see Figure 1.2). Study 1 assesses the relationship between formal education and competencies. It shows that when analyzing the relationship between supposedly equivalent educational levels with literacy skills, considerable differences between countries appear. Especially when comparing broad levels of education, those cannot be taken as proxies for competencies across countries. This is especially true for countries with education with strong vocational orientation. In study 2, the focus is on non-formal training and determinants influencing participation in it. We find that there are differences in training participation between men and women in almost all countries but countries from Nordic welfare states. Part of this is due to differences in employment opportunities between men and women, as training is often job-related. Perceived barriers to training also differ between welfare states; again, in most countries except for the Nordic states, family responsibilities are mentioned more often by women than by men. Study 3 looks at a different aspect of non-formal training and focuses on participation in training of migrants compared to natives. The study shows that there are differences between first-generation migrants and natives in the chances to participate in training but that this inequality is reduced when looking at second-generation migrants.

All these studies include policy-relevant findings. Although formal education and competencies are related, study 1 reveals that using broad levels of education, such as broad ISCED categories, can be misleading. Therefore, in order to deduce valid information for policies, it is important to look at detailed education categories, especially including differences between vocational and non-vocational education. When measuring education in surveys, it is important to invest into the quality of the measurement, especially for cross-national research. Therefore, it is great news that in PIAAC cycle 2, the process for measuring education has been adapted, putting in place a process of ex-ante harmonization with a measurement of education using ISCED 2011 distinguishing vocational and academic orientation. Furthermore, an item collecting data on educational pathways has been introduced creating new opportunities for further research with PIAAC cycle 2 data.

Another aspect of my research shows that the institutional framework has an impact on individual decisions concerning participation in education and training. In Nordic countries there is a long history of non-formal education systems (European Association for the Education of Adults, 2011a, 2011b), such that training opportunities are easily accessible, thus reducing opportunity costs for participation. Furthermore, these countries (e.g. Norway, Sweden) have many different providers for adult learning, such as "folk high schools", making learning opportunities readily available (European Association for the Education of Adults, 2011a, 2011b). In countries with high participation rates in the whole population, sub-groups also profit from this learning culture and inequality between different groups is reduced. It can be assumed that a positive learning culture is supported by policies. Policies fostering such a positive learning culture could include the availability of information about learning opportunities, fostering a positive attitude towards learning, and the absence of financial burden to training, for example by creating training opportunities which are subsidized by the State. If the aim is to provide training opportunities for all, it is necessary to find ways to make training opportunities accessible. Understanding barriers to training can help to reduce inequalities in training participation between different groups. Training opportunities are often still related to being employed and having an employer which supports participation in training. Increasing opportunities can involve making training available independent of jobs and employers, thus allowing everyone to aspire to reach their full potential. One effort in this direction is the discussion on a law on training participation ("Weiterbildungsgesetz") in Germany, involving the possibility to take a year of paid leave to participate in training activities.

Besides offering sufficient opportunities, study 3 suggests that potential participants have to bring the right prerequisites. For example, it turned out that literacy skills are an important determinant for training participation, thus putting migrants at a particular disadvantage. It is important to note that literacy skills were measured in the language of the residence country and, hence, are related to language skills. Investing into language and literacy skills early after arrival thus should be a sensible investment. Access to early childhood education for non-native speakers also seems important for the acquisition of language and eventually literacy skills. Having lower chances to access this kind of education for

migrant children, as found by a recent study in Germany, is not helpful in this respect (Schmitz et al., 2023).

PIAAC is a cross-sectional survey and as such faces the fundamental limitation that drawing causal conclusions is difficult. While my studies focus on descriptive analyses mainly, it would have been interesting to disentangle causal from selection mechanisms. For example, it is not possible to attribute different levels of competencies between education categories to a causal learning effect, as initial measures of competencies before following a certain educational path are not available. In particular regarding the differences in competencies between vocational and non-vocational upper secondary education found in study 1, it would have been interesting to see whether those are driven by selection effects or whether these two tracks at the same ISCED level cause different levels of competencies. The results presented are limited to providing evidence of existing differences only.

Furthermore, not all countries provided data in the same amount of detail in the public use file for PIAAC. This is particularly an issue in study 3, where I could not include Canada, as items on barriers to training were missing in the public use file. Also, in spite of PIAAC being a large-scale data collection effort with relatively high numbers of observations per country, subsample analyses sometimes face limitations. This problem mainly affects minority groups, such as migrants, who are the center of interest in study 3. Here, differentiating barriers to training participation for migrants of varying generations, who did not participate in training but were interested, eventually becomes a challenge and results in limited power.

My dissertation has a strongly quantitative focus throughout, exploiting the strength of the large-scale and nationally representative PIAAC datasets. The quantitative focus comes at the cost, however, that it does not always explain processes very well. My results can therefore point to issues of relevance, but further research on processes of individual decision-making and (causal) mechanisms is needed. Qualitative research can be a valuable complement to my work in that respect.

Studies using PIAAC data rely on the fact that the data collected is of high quality. As PIAAC's core contribution is the measurement of competencies, it requires interviewers to carry out the study using computer-assisted personal interviewing (CAPI). Interviewers ensure that competencies are measured

using standardized conditions and that the randomly selected individuals supposed to take part indeed carry out the assigned tasks. Many studies in academic or market research, however, are exploring possibilities to carry out data collection using other methods, such as online surveys, self-completion or mixed modes designs (for example the European Value Survey[6]). For a study such as PIAAC, reverting to other ways to collect data seems to be difficult, though, because some important quality standards are best ensured when relying on personal interviewing. With a decreasing share of studies being carried out using CAPI, however, the size of the market for personal interviews might decrease, making it more and more difficult to find survey firms ensuring highest scientific standards. Anecdotal evidence already suggests that carrying out CAPI interviews has become increasingly difficult after the Covid pandemic, during which no or only limited personal interviewing took place and many interviewers changed careers. With a decreasing market size, employment prospects of interviewers might not easily recover, eventually decreasing the inflow of qualified staff. Against this background, efforts have to be made and resources need to be put in place to ensure that data collection can be carried out with high quality standards, such that more insights related to education, training and competencies can be generated in the future.

My work points to interesting possible extensions. Across the topics of my studies, specific analyses could be conducted on contextual factors explaining differences across groups and countries. For example, differences in literacy skill across countries and levels of education (explored in study 1) might change over cohorts, with educational systems and attainment adapting over time (Shavit & Blossfeld, 1993). Also the specific experiences within educational systems (Heisig & Solga, 2015) may be an important factor to explain competencies. Additionally, PIAAC in principle allows to explore the role of socioeconomic status and social inequalities on competencies, for example what impact social background have on competencies beyond its impact on formal qualification. In terms of the determinants of participation in training (studies 2 and 3), important further contextual factors might be labor market characteristics, differences in the educational system, or differences in school-to-work-transitions. My work on participation in training (studies 2 and 3) explains different determinants and

[6] See Luijkx et al. (2020) for more information.

barriers to training. Whether training participation is a sensible decision, however, depends on the benefits derived by training and formulating policy recommendations without proper evidence on these effects is difficult. A study by Gauly and Lechner (2019) has explored the effect of training on competencies using longitudinal data from PIAAC and PIAAC-L, a panel using PIAAC participants in Germany. The evidence suggests that there is no causal effect from training on literacy competencies but that rather individuals with higher literacy skills participate in training activities more often. Such analyses could be extended to other countries or to other outcomes, such as employment opportunities or wages, which have not been analyzed with panel data internationally yet. Furthermore, it could be explored what kind of training has positive outcomes for different group of individuals, making participation in training activities more attractive. Other potentially interesting analyses relate to study 3, investigating training participation of migrants. While my cross-country assessment provides broad insights, an evaluation of specific migration policies would be a valuable addition to help explain varying outcomes. Furthermore, a comparison of migrants by country of origin might help to explain international differences.

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2 Study 1: Degrees of competency: The relationship between educational qualifications and adult skills across countries[7]

2.1 Abstract

Educational qualifications and literacy skills are highly related. This is not surprising as it is one aim of educational systems to equip individuals with competencies necessary to take part in society. Because of this relationship educational qualifications are often used as a proxy for "human capital". However, from a theoretical perspective, there are many reasons why this relationship is not perfect, and to some degree this is due to third variables. Thus, we want to explore the net relationship between educational attainment (harmonized according to the International Standard Classification of Education, ISCED) and literacy skills, and how much skills vary within education levels across countries.

We use data from 21 countries from the Programme for the International Assessment of Adult Competencies 2012. This paper compares the literacy skills of adults who achieved different levels of educational attainment across countries. Given the high degree of educational differentiation in most countries, we do this using a more differentiated educational attainment variable than what is commonly used. In our analyses we firstly adjust for factors that are likely to affect access to education and the acquisition of educational qualifications and literacy skills, such as parental education and language and migration background. In a second step, we also take into account factors affecting skill development after initial formal education, such as occupation and skill use at home.

We firstly find a high degree of heterogeneity of skills across countries for equivalent education categories. Secondly, we find skill similarities for equivalent education categories classified at different broad education levels, sometimes even breaking the hierarchical order of 'higher education entails higher competencies'.

We conclude that ISCED levels cannot be taken as a cross-nationally comparable proxy for human capital in terms of literacy skills, and that education has

[7] This was published by Natascha Massing and Silke L. Schneider, in *Large-scale Assessments in Education* 5 (6): 1-34.

to be harmonized in a substantively more meaningful way in future adult literacy surveys.

2.2 Introduction

Educational attainment and how it relates to social and migration background as well as labor market outcomes has been studied extensively using comparative data and methods (see for example Breen & Jonsson, 2005; Heath & Brinbaum, 2014; Shavit & Blossfeld, 1993; Shavit & Müller, 1998). Due to limited data on nationally-representative adult samples, there is much less cross-national research on these relationships taking basic competencies or skills into account. Research using large-scale assessment data of the adult population across countries has shown that education is a key determinant of adult basic competencies (Maehler et al., 2013; OECD, 2013a; OECD & Statistics Canada, 2000, 2005). This is not surprising as one aim of formal education is to develop basic competencies in order to prepare students for life and specifically the job market.

However, OECD (2013a) and other authors (Desjardins, 2003; Park & Kyei, 2011; Reder, 2009) also show that the relationship between educational qualifications and skills is imperfect, meaning that formal education does not entirely explain skill differences amongst adults, and other factors must also play an important role. Thus we agree that "better understanding the link between formal qualifications and actual skills is important because qualifications are more readily observable than skills and therefore often serve as an important proxy for the latter" (Heisig & Solga, 2015, p. 203). The use of education as a proxy for skills is especially common when arguing from the point of view of human capital theory (Becker, 1964; Steedman & McIntosh, 2001; Steedman & Murray, 2001) and other functionalist approaches to education.[8] However, there is also longstanding opposition to the functionalist view of education, claiming that education also or even mostly reflects the distribution of power in society (e.g., Collins, 1971). In fact, large-scale assessments are largely motivated by the desire to more directly measure adult competencies than using educational attainment as a proxy.

[8] A notable exception is some literature on educational and skill mismatches in the labor market, which critically examines the relationship between educational certificates and actual skills (Allen & van der Velden, 2001; Green & McIntosh, 2007).

In addition, policy makers may want to know whether individuals who completed a given level of education show the same level of competencies in their country as in other countries, or whether they 'lag behind'. They are also keen to find out whether migrants from other countries possess similar competency levels as natives at comparable levels of educational attainment. Comparable or equivalent education levels are typically defined by the International Standard Classification of Education (ISCED; UNESCO Institute for Statistics, 2006) and used in many cross-national surveys. We however do not yet know very much about how and why competencies differ across countries for the same, supposedly comparable, education levels (but see Heisig & Solga, 2015; Park & Kyei, 2011).

All prior research looking at the relationship between formal education and competencies (for example, Desjardins, 2003; OECD, 2013a; OECD & Statistics Canada, 2000, 2005) found that educational attainment shows the strongest relationship with competencies of all background variables[9] examined, when adjusting for other socio-demographic factors. At the same time, there are substantial differences across countries in average proficiency levels at the same broad level of educational attainment (Maehler et al., 2013; OECD, 2013a; OECD & Statistics Canada, 2005). Part of the OECD (2013a, chapter 5) report also looks more closely into different factors that may affect adult literacy skills beyond demographics, which is an important analysis step:. For example, if the higher educated show comparatively low literacy skills in one country, this may be due to many of them working in occupations not nurturing competencies, i.e. the structure of the labor market, rather than ineffective formal education or low selectivity of educational transitions by skills. This kind of confounding is also referred to as compositional effects in the literature (Raudenbush & Kim, 2002). Therefore, when trying to compare the relationship between formal education and competencies across countries, it is important to adjust for these factors: otherwise, cross-country differences could come about through mere differences in the composition of countries according to e.g. parental education or respondents' occupation since some countries have more expanded educational systems than others, and they differ in their industrial and thus occupational structures.

[9] It is interesting to note that the OECD treats educational attainment as a mere 'socio-demographic' variable (just as socio-economic background, another important factor in skill development).

Furthermore, the OECD, as most reports in official statistics, mostly uses three very broad education levels derived from the International Standard Classification of Education (ISCED) 1997, by only distinguishing between 1) less than upper secondary, 2) upper secondary and post-secondary non-tertiary and 3) tertiary levels of education. Academic studies (for example Heisig & Solga, 2015; Park & Kyei, 2011) often follow this approach. Sometimes the investigation is even limited to the contrast between 1) less than upper secondary and 3) tertiary education. However, we know from previous research that such highly aggregated education measures may not be valid measures of attainment within countries (Müller & Klein, 2008), and may, as a consequence, be cross-nationally not actually comparable (Schneider, 2010). For example, if upper secondary graduates in one country are largely graduates of vocationally oriented programs, and in another country of academically oriented programs, lumping them together in one education category for analysis does not help our understanding of differences and similarities in outcomes of basic skill acquisition and educational selection across these two countries. Therefore, before jumping to conclusions about differences in the quality and academic selectivity of education across countries, it is important to describe 'net' skill differences by disaggregated, cross-nationally more comparable educational attainment categories than has so far been done.

With our analyses we want to broaden the scope of the analyses presented by the OECD in 2013 based on data from the Programme of International Assessment of Adult Competencies (PIAAC) (OECD, 2013a, chapter 3). In doing so, we build on related work by Desjardins (2003), Park and Kyei (2011), Maehler et al. (2013) and Heisig and Solga (2015). This paper has two aims: First of all, we describe how *detailed* educational attainment relates to literacy skills across different countries. Secondly, we explore how far cross-country differences in skills by detailed educational attainment remain or change when adjusting for a wide range of micro-level variables likely to influence educational attainment and/or adult competencies. We will thereby be able to approximate 'net' cross-country differences and similarities in competencies by educational attainment.

With the results we hope to be able to answer the following research questions: Firstly, how closely are adult basic competencies related to educational attainment across countries? Are the competencies of

individuals who have achieved ‘comparable’ levels of education also comparable, adjusting for factors related to the acquisition of formal education and basic competencies? Do we find the same differences in skills across countries already identified in the OECD reports when looking at detailed rather than highly aggregated education levels and controlling for a wide range of individual level variables? If we find substantial differences, these potentially point to a) differences in the quality (effectiveness of skill acquisition) and skill selectivity of education between countries, b) substantive lack of comparability of harmonized education categories regarding competencies as one outcome of formal education or c) omission of important further confounding factors influencing educational attainment and competencies.

We first describe the theoretical relationship between detailed educational attainment categories and competencies, reviewing the literature and evidence in the field. Then, we turn to the data, measures and methods we use. In our results we show how adult competency scores of groups with ‘comparable’ educational qualifications vary between countries. We include several variables in order to disentangle which other factors could influence this relationship. We summarize our findings and discuss them in relation to potential improvements when measuring educational qualification in surveys, as well as opportunities for further research.

2.3 The relationship between educational qualifications and competencies

Competencies “…refer to the ability or capacity of an agent to act appropriately in a given situation” (OECD, 2013b), especially to someone’s proficiency in performing certain tasks. Competencies “… represent skills essential for accessing, understanding, analyzing and using text-based information and, in the case of some mathematical information, information in the form of representations (e.g. pictures, graphs)” (OECD, 2013b). We use the terms ‘competency’ and ‘skill’ interchangeably in this study.

Although the specific competencies measured in large-scale assessments can be expected to be closely related to general cognitive ability or fluid intelligence, and some authors treat them as almost exchangeable (Kerckhoff et al., 2001; Marks, 2014) these two concepts are theoretically and empirically distinct. Most importantly, competencies are conceptualized as domain specific skills, focusing e.g. on

literacy or numeracy, whereas fluid intelligence refers to generalized cognitive functioning (Baumert et al., 2009).

While competencies are understood as a continuum and typically unobserved latent characteristics, educational qualifications, going along with receiving a formal diploma, certificate or an academic title, reflect manifest thresholds or steps in the educational career. Having achieved an educational qualification usually confers some explicit opportunity or entitlement to the holder of the qualification, e.g. the opportunity to enroll in a university or (further qualify to) practice a specific occupation. Educational qualifications correspond to 'institutionalized' cultural capital (Bourdieu, 1986). They allow the individual to objectify their embodied cultural capital, which includes competencies, and "makes the difference between the capital of the autodidact, which may be called into question at any time [...] and the cultural capital academically sanctioned by legally guaranteed qualifications, formally independent of the person of their bearer" (Bourdieu, 1986). Educational qualifications facilitate the conversion of cultural capital to economic capital. Qualifications also serve as signaling devices (Arrow, 1973; Spence, 1973) that employers, university admissions or other selecting agents can actually see when an applicant sends in copies of the diplomas and degrees she holds, whereas her actual competencies remain unobserved.

Basic competencies are "[…] the results of cumulative processes of knowledge acquisition that are moderated to some extent by reasoning ability" (Baumert et al. 2009, p. 174). Many of these processes are facilitated by formal education. Therefore, the more opportunities for knowledge acquisition are provided to and used by an individual, the higher the level of formal education and basic competencies achieved. This point of view thus leads to the expectation that educational attainment and basic competencies are closely related. Indeed, using data from the International Adult Literacy Study (IALS), the Adult Literacy and Life Skills Survey (ALL) and PIAAC, OECD and Statistics Canada (2000, 2005) Boudard (2001), Desjardins (2003), and OECD (2013a), among others, show that across countries, education has the strongest relationship with competencies of all background variables examined, confirming results from the US National Adult Literacy Survey (Kerckhoff et al., 2001; Kirsch et al., 1993).

However, as the imperfect correlation between educational attainment and competencies suggests, knowledge acquisition and competency formation are not limited to formal education (Desjardins, 2003): competency development is an experience that is both "lifewide" (occurring in the home, at school, work and in the community) and "lifelong" (starting during fetal development and continuing into old age). Practice engagement theory (Reder, 1994) posits that literacy is generally learned through engagement in literacy practices, which extend far beyond formal education. Also, some of the correlation may be spurious, i.e. due to common causes. In order to assess the net relationship between educational attainment and skills, we first need to theoretically reflect on factors affecting both success in education and skills (in the sense of common causes), as well as factors potentially depending on education further impacting skills (in the sense of mediators). Only after adjusting for these factors and thus controlling compositional differences across countries, we can try to better understand competency differences across countries within supposedly comparable education levels.

To a large extent, especially in the early years of life, competency formation, especially relating to language, takes place through informal learning or primary socialization in the family context. The family is also important in nourishing curiosity and motivation to learn in children. These early skills and attitudes to learning facilitate further competency gains and transitions in formal education. Therefore, the gross or total relationship between educational attainment and competencies will partly be due to opportunities for informal learning as well as attitudes to learning bred in the home, which differ across families. When estimating the net relationship between formal education and competencies, it is thus important to adjust for characteristics of the family of origin that likely influence their offspring's education and skills.

The literature discusses a diverse range of family characteristics when dealing with educational outcomes, which can mostly be attributed to three dimensions, namely genetic, cultural and economic resources. Firstly, cognitive abilities or general intelligence have been shown to correlate strongly between parents and their children (by 0.4 to 0.7, see the review by Marks, 2014, chapter 4), and, using twin and adoption studies, to have a substantial degree of heritability, with monozygotic twins reared apart showing a correlation of cognitive abilities of around 0.7 (Marks, 2014). This may be due to either

genetic or pre-natal/pre-separation environmental commonalities though. At the same time, cognitive abilities positively influence competency formation and success in formal education (Marks, 2014, chapter 5). However, only few studies have both measures of general cognitive abilities and later specific competencies, none of them cross-national. Therefore, we need to be aware that some of the effects of family characteristics that are described in the following will have some (maybe substantial) genetic component, and that some genetic effects remain unobserved.

Secondly, in terms of culture, parents' own educational attainment is regarded as the most important asset boosting offspring's educational opportunities (Erikson & Jonsson, 1996; Shavit & Blossfeld, 1993): more educated parents provide a more stimulating home environment to their children than less educated parents, for example by reading more to their children and using more complex language. They also have their own experience navigating the educational system and can thus better support their children in educational decision making, leading to higher levels of attainment. The influence of parents' education on adult literacy net of formal education was already found for the US by Kirsch et al. (1993), cross-nationally by OECD and Statistics Canada (2000, 2005) and Desjardins (2003), and confirmed with PIAAC data by OECD (2013a). Bynner and Parsons (2009) find in their research using British cohort study data that family background has an effect on proficiency, which is mediated through earlier skill acquisition.

Closely related with parental education is the availability of books in the home when growing up, commonly used as an indicator of family's cultural capital in large-scale assessments. This factor mediates some of the effect of parental education, but also has an effect on top of that: families with low levels of formal education that nevertheless possess more books provide a more cognitively stimulating environment, especially more opportunities for engagement in literacy practice, for their children than families with no or fewer books (Evans et al., 2010). Children's reading practice has been shown to strongly support their reading competencies (Anderson et al., 1988). OECD (2013a) however does not control for the number of books in the home.

Another cultural family characteristic is migration background, which has often been shown to affect educational outcomes (Heath & Brinbaum, 2014; Heath et al., 2008; Marks, 2005; OECD, 2012). First

of all, respondents who were educated abroad may have had very different educational experiences, including different quality of basic education, in their country of origin. Secondly, first generation migrants and their children will lack knowledge of and first-hand experience with a country's educational system and thus may not navigate it in an optimal way. Thirdly, it can be assumed that respondents who were born in the survey country and are familiar with the survey language can more fully benefit from the learning opportunities provided to them in formal education than those born abroad or having a different mother tongue, positively contributing to both educational attainment and skills. Finally, the assessment is also language based so that respondents completing it in their native (and thus likely most proficient) language are expected to show higher competencies in literacy measured in this language. This has also been shown empirically before (Boudard, 2001; Desjardins, 2004; Elley, 1992; Kirsch et al., 1993; OECD, 2012; OECD & Statistics Canada, 2000, 2005). Using multivariate models and PIAAC data, Heisig and Solga (2015) as well as OECD (2013a) find substantial effects of migration background on numeracy and literacy skills, after adjusting for parental education, educational attainment and occupation.

Thirdly, in terms of economic circumstances, the most often-discussed family characteristic is social class or status (Breen et al., 2010; Erikson & Jonsson, 1996; Shavit & Blossfeld, 1993). It reflects the occupational position, economic security and material circumstances of the family, for example nutrition, housing and access to healthcare. Economically secured parents have more capacity to support their children's learning than those struggling to make ends meet. Some educational resources, such as a quiet place to study, books or out-of-school tutoring also have direct costs. Further family characteristics reflecting economic circumstances during childhood are parental income and wealth. Since these cannot be reliably measured in a survey interviewing the children's generation only, they are rarely used in empirical studies. Bynner and Parsons (2009) provide a vivid insight into social and material conditions of literacy skill development for Britain. Cross-national large-scale assessments have however shown considerably less interest in material than cultural conditions of competency development, using parental education as a proxy measure for 'socio-economic status' (following NALS, see Kirsch et al., 1993) instead of differentiating cultural and economic aspects, leading to a gap in comparative research on this issue.

Moving on to secondary socialization in the formal education system, higher early literacy skills facilitate learning and thus performance in education, the successful completion of an educational level, and making the transition to the next higher level of education. Earlier literacy skills are thus predictive of later literacy skills (Bynner & Parsons, 2009). Therefore, the relationship between education and literacy is reciprocal: more literate individuals stay in education for longer and achieve a higher level of attainment, and staying in education for longer and reaching higher levels of attainment produce higher literacy (Kirsch et al., 1993). This reciprocity however cannot be disentangled with cross-sectional data lacking information on skills at earlier points in life (OECD & Statistics Canada, 2005) so that to date, no cross-national evidence is available on this. What however can be disentangled with available data are differences in skills (whether coming about by differential skill selectivity or opportunities to learn and practice literacy) within broad education levels, namely those between attainment of vocational and non-vocational educational qualifications. Given that vocational programs focus on learning of vocational rather than basic skills such as literacy, and students with low literacy more likely select (or are selected into) vocational over generally or academically oriented courses, we expect average literacy skills related to vocational qualifications to be lower than those related to general qualifications (Heisig & Solga, 2015). This was shown to be the case for most PIAAC countries allowing this analysis by Maehler et al. (2013).

Finally, competency acquisition does not end with the end of formal education but continues through the life course especially through work (and life) experience, opportunities for skill use, as well as deliberate efforts of life-long learning. Previous research has shown that literacy levels of individuals indeed change after the completion of educational qualifications (Reder, 2009), and more so for respondents with non-manual jobs because they have been able to further develop their skills throughout their working lives (Steedman & McIntosh, 2001). Opportunities for literacy skill use as well as adult training indeed strongly differ across occupations or types of jobs, even after controlling for educational attainment (Desjardins et al., 2006; OECD & Statistics Canada, 2005). Individuals in different occupational groups, even if measured inconsistently across studies, therefore show diverging literacy skills, on top of education, parental education, and language (Desjardins, 2003; OECD, 2013a; OECD & Statistics Canada, 2000). Also, not only the work context offers opportunities for skill use, and reading

for leisure or other forms of literacy practice outside of work have also been shown to contribute to skill maintenance and enhancement after formal education both for the US (Smith, 1996) as well as cross-nationally (Desjardins, 2003; OECD, 2013a, chapter 5; OECD & Statistics Canada, 2000). With respect to adult training, using IALS data, Park and Kyei (2011) find that training participation is related to literacy gaps. However, they only measured training participation at the country level. Desjardins (2003), OECD (2013a) and OECD and Statistics Canada (2000, 2005) find that adult training has an – albeit weak – effect, on top of formal education and other variables, since training participation is strongly related to formal education.

Turning to cross-country differences in the relationship between educational attainment and competencies as well as skill gaps between education levels, OECD and Statistics Canada (2000, 2005) and OECD (2013a) find that firstly, higher educational attainment goes along with higher competencies, but secondly, that there are marked differences in average competency scores across countries for equivalent levels of education, as well as in the competency gaps between education levels. Differences in skills across countries are more pronounced for the low than the highly educated. Using multivariate models, Park and Kyei (2011) find that in all countries, individuals with higher qualifications have higher literacy skills, as measured in IALS. They also find differences in average literacy across countries for comparable education levels. Again, the differences are more pronounced at the lower than the higher education level. The OECD report (2013a) provides more detailed multivariate results in chapter 5, which does not substantially change the result: formal education is still considerably related to adult competencies, and literacy skills still vary substantially across countries for equivalent levels of formal education (even if less so than in the unadjusted model). In line with this, Heisig and Solga (2015), using PIAAC data, find that respondents with completed upper secondary education generally acquire higher numeracy scores than respondents with lower educational qualifications, and that some of the variation between countries is related to compositional effects. However, the latter only adjust for age, sex, and migration/language status.

Available studies to date only look at skill gaps between the high and low educated (OECD, 2013a, chapter 3), between the medium and the low educated (Heisig & Solga, 2015) or between low, medium

and high educated (Park & Kyei, 2011), ignoring the heterogeneity of educational programs and qualifications within these broad levels. When unpacking broad education levels into more detailed educational attainment categories, as suggested by Schneider (2010), important cross-country differences but also previously hidden similarities may emerge. Different distributions of education *within* broad education categories, such as vocationally educated individuals dominating the medium educated in one country and generally educated individuals dominating the medium educated in another country, may partly explain why the same broad education levels show different average literacy skills across countries, or why some countries show surprisingly small skill gaps between educational groups (look e.g. at Switzerland and Germany in Park & Kyei, 2011) or low overall associations between attainment and competencies (for example, see the weak associations for Sweden, the Czech Republic and Germany in OECD & Statistics Canada, 2000, all countries with substantial differentiation of education within broad levels). In some analyses, the OECD (2013a, pp. 200-205) report actually looks at some of those more detailed differences by looking at differences between respondents with vocational vs. general upper secondary education, and type of education at the tertiary level, but only for age groups that are potentially still in education. Maehler et al. (2013) report competency by detailed education categories for Germany, finding that on average, individuals with vocational tertiary education achieve lower competency levels than individuals with general upper secondary education, contradicting the general finding of higher competencies at higher education levels found using broad education categories. In this paper we argue that such detailed analyses should be the rule rather than the exception because detailed educational attainment categories are more substantively comparable across countries and easier to interpret than broad education levels.

Summing up, we expect that parents' education as well as migration background has an influence on the way competencies are developed. It is likely that part of this effect is mediated through educational qualifications. Furthermore, we expect individuals working in occupations requiring higher literacy skills, individuals who regularly read at home, and those who participate in adult training to better sustain or even further develop their competencies than individuals who do not work, work in manual occupations, do not read at home, and do not participate in adult training. Because all these factors are likely to be influenced by educational attainment, we furthermore expect the skills gaps by education to

be further reduced when taking post-educational experiences into account. Regarding the cross-country comparison of literacy skills by detailed educational attainment, we expect substantial differences in competencies for equivalent education categories even when adjusting for the above micro-level factors: equivalent educational programs (as defined by ISCED) in different countries differ in both skill selectivity upon entrance, as well as effectiveness of skill development.

2.4 Data & methods

For this paper, we use data from the Programme for the International Assessment of Adult Competencies (PIAAC) 2012 (OECD, 2013a, 2013c). PIAAC is an international study which assessed central basic skills which are considered essential for successful participation in today's society: literacy, numeracy and problem-solving in technology-rich environments. In this paper, we concentrate on literacy, defined as "[…] understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (PIAAC Literacy Expert Group, 2009). In the first round of PIAAC, 24 countries took part. The focus of the study was on the working-age population between the ages of 16 and 65. In each country, respondents for PIAAC were chosen using probability based methods, thus aiming at a representative sample of the population. In addition to this, PIAAC data benefitted from a high degree of input harmonization and other high quality control standards.

We restrict the sample to respondents aged 25 and older because in many countries, respondents are still in their initial phase of education and not yet highly involved with the labor market when they are younger than 25 years (see also Desjardins, 2003). In contrast to Park and Kyei (2011), we do not restrict our sample to young adults in an attempt to eliminate the effects of post-educational learning. Instead, we take advantage of the measures of continuing training, occupational group and private reading habits available in PIAAC (see below) and analyze the whole PIAAC sample. Finally, in comparison Park and Kyei (2011) we do not restrict the sample to respondents born in the country. Instead we exclude respondents who have completed their highest education abroad as the aim is to measure the relationship

between education and measured competencies within various educational systems.[10] For our analyses we include 21 countries. We excluded data from the Russian Federation as the data is not representative for the whole resident population of the Russian Federation (OECD, 2013a). We also exclude Australia, since this data is not publicly available, and Cyprus, because results showed unusual patterns, shedding substantial doubt on comparability with the other countries, as well as the high degree of literacy related non-response (LRNR) in Cyprus, meaning the non-participation because of language difficulties, or learning or mental disabilities (see Heisig & Solga, 2015).

2.5 Measures used

Competencies (or skills) are measured using psychometric tests based on IRT scaling procedures (OECD, 2013c). As mentioned above, in PIAAC, three different competency domains were measured: literacy, numeracy and problem-solving in technology-rich environments. The results of the scaling produced one scale for each of the domains assessed. Each of these scales ranges from 0 to 500. Tasks at the lower end of the scale are easier than those at the higher end. In order to make interpretation of the scales easier, each scale was divided into proficiency levels with intervals of 50 points (Levels 1-5 for literacy and numeracy and levels 1-3 for problem-solving in technology-rich environment, OECD, 2013b). For the purposes of this study, we have opted for literacy (rather than numeracy) because it is the more generally needed competency. As such, the acquisition of further skills such as numeracy to some degree presupposes literacy, and most of the numeracy test items in PIAAC were text based, too. Both scales are thus highly correlated.

Educational qualifications are measured by directly asking respondents for the highest qualification they have obtained or level of education completed, using a country-specific show card representing the relevant responses in any given country. The resulting categories are harmonized into a common scheme, which is based on the International Standard Classification of Education (ISCED) 1997 (UNESCO Institute for Statistics, 2006). ISCED 1997 main levels are known for their heterogeneity and thus risk of lacking validity for cross-national comparisons (Schneider, 2009, 2010). Therefore in this

[10] In order to compute this information, the age when completing the highest degree as well as the age of immigration was needed. However, Germany, Canada, Estonia, and the United States did not provide this information as continuous variable. For the three latter countries, the information had to be derived from the categorized age and can therefore only be treated as proxy. For Germany, the continuous variable from the German Scientific Use File was used.

study, we do not employ ISCED main levels but code the detailed ISCED variable available in the PIAAC data in such a way as to render the resulting categories less heterogeneous.

Not all countries provided the ISCED information in the same level of detail. With the PIAAC data it is not possible to distinguish program destinations "A", "B" or "C" at ISCED levels 3 and 4. Instead, we distinguish whether the qualification is vocationally oriented or not (including all qualifications that are considered 'general' or 'unspecified' orientation).[11] Due to limited cell sizes in ISCED levels 3 and 4 in a large number of countries, especially when distinguishing vocational and non-vocational education, we had to aggregate both levels into one. This is as close as possible to the previously tested, ISCED-based "European Survey Version of ISCED" (ES-ISCED) coding scheme (Schneider, 2010). For the final coding and the distribution of education categories across countries, see Table 2.1. We do not report results for cells including fewer than 30 individuals in this table.

[11] The orientation of the highest qualification is documented in a separate variable in the PIAAC data, which was derived from the national educational attainment questions ex-post. Not all countries seem to have succeeded in this task, resulting in 'unspecified' (Canada and Japan, Denmark, Germany, Sweden, England/Northern Ireland, United States) or missing (Italy and Flanders) orientation, despite the fact that the ISCED mappings indicate an orientation for every educational program. We treated 'unspecified' and missing orientation as non-vocational, i.e. merged it with the general category, based on the theoretical argument that vocational programs will put less emphasis on the development of basic competencies. For the German data, we used the German Scientific Use File in order to derive this information from the country-specific education variable on vocational and higher education.

Table 2.1 Distribution of ISCED levels across countries (frequencies and percentage distribution)

	below ISCED 2	ISCED 2/ 3Cs	ISCED 3/4 voc.	ISCED 3/4 non-voc.	ISCED 5B	ISCED 5A BA	ISCED 5A MA 6	Total
Austria	30	506	2057	153	356	51	464	3,617
	0.8%	14.0%	56.9%	4.2%	9.8%	1.4%	12.8%	100%
Canada	1,025	2,032	3,514	4,660	4,510	4,449	1,472	21,662
	4.7%	9.4%	16.2%	21.5%	20.8%	20.5%	6.8%	100%
Czech Republic	--	349	2,821	197	130	142	777	4,423
		7.9%	63.8%	4.5%	2.9%	3.2%	17.6%	100%
Denmark	90	879	1,510	562	1,267	426	760	5,494
	1.6%	16.0%	27.5%	10.2%	23.1%	7.8%	13.8%	100%
England/ N.Ireland	1,065	1,960	251	960	815	1,968	--	7,019
	15.2%	27.9%	3.6%	13.7%	11.6%	28.0%		100%
Estonia	40	763	1,584	1,217	1,047	176	1,337	6,164
	0.7%	12.4%	25.7%	19.7%	17.0%	2.9%	21.7%	100%
Flanders (Belgium)	218	446	497	2,030	--	52	541	3,784
	5.8%	11.8%	13.1%	53.7%		1.4%	14.3%	100%
Finland	272	288	1,502	270	800	613	625	4,370
	6.2%	6.6%	34.4%	6.2%	18.3%	14.0%	14.3%	100%
France	454	834	1,691	545	621	523	527	5,210
	8.7%	16.0%	32.5%	10.5%	11.9%	10.0%	10.1%	100%
Germany	92	220	1,763	362	582	384	559	3,962
	2.3%	5.5%	44.5%	9.1%	14.7%	9.6%	14.1%	100%
Ireland	426	752	897	868	743	659	458	4,803
	8.9%	15.7%	18.7%	18.1%	15.5%	13.7%	9.5%	100%
Italy	401	1,082	412	1,315	--	609	83	3,902
	10.3%	27.7%	10.6%	33.7%		15.6%	2.1%	100%
Japan	--	445	503	1,161	982	1,093	140	4,326
		10.3%	11.6%	26.8%	22.7%	25.3%	3.2%	100%
Korea	557	596	876	1,190	932	1,201	168	5,520
	10.1%	10.8%	15.9%	21.6%	16.9%	21.8%	3.0%	100%
Netherlands	239	898	1,103	328	169	832	382	3,951
	6.0%	22.7%	27.9%	8.3%	4.3%	21.1%	9.7%	100%
Norway	35	590	866	365	193	821	531	3,401
	1.0%	17.4%	25.5%	10.7%	5.7%	24.1%	15.6%	100%
Poland	37	420	2,376	443	--	336	1,191	4,803
	0.8%	8.7%	49.5%	9.2%		7.0%	24.8%	100%
Slovakia	--	743	1,319	1,473	--	134	735	4,431 1
		16.8%	29.8%	33.2%		3.0%	16.6%	00%
Spain	1,107	1,220	110	797	419	504	587	4,744
	23.3%	25.7%	2.3%	16.8%	8.8%	10.6%	12.4%	100%
Sweden	113	392	618	856	362	446	478	3,265
	3.5%	12.0%	18.9%	26.2%	11.1%	13.7%	14.6%	100%
USA	78	300	372	1,516	384	822	566	4,038
	1.9%	7.4%	9.2%	37.5%	9.5%	20.4%	14.0%	100%
Average	6,315	15,715	26,642	21,268	16,252	14,27	12,381	112,889
	5.6%	13.9%	23.6%	18.8%	12.7%	14.4%	11.0%	100%

Note. ISCED 5A BA in England includes respondents with ISCED 5A BA, MA and ISCED 6.

The social background of respondents in both cultural and economic[12] terms is mostly indicated by their parents' education. Parental education is measured with broad ISCED levels only. Three categories can be distinguished: 1) ISCED 2 or below, 2) ISCED 3 and 4 and, 3) ISCED 5 and 6. We have integrated the information from both parents and distinguish whether (1) both parents have ISCED 2 or below (reference category), (2) at least one parent has achieved ISCED 3 or 4, (3) both parents have ISCED 3 or 4, (4) at least one parent has achieved ISCED 5 or 6 or (5) both parents have completed ISCED 5 or 6.

As another variable concerning family cultural background, we include a measure of books in the home when the respondent was 16 years old. Respondents were asked about the number of books in their home based on five different categories ranging from '10 books or less' to 'more than500 books'. We standardized the measure to a mean of 0 and a standard deviation of 1.

Respondents' migration background is measured by a combination of two indicators: (1) whether a respondent is born abroad and (2) whether his or her native language (mother tongue) is different from the assessment language. The resulting indicator distinguishes whether a respondent has the following status: (1) native-born and native language (reference category), (2) native-born and foreign language, (3) foreign-born and native language and (4) foreign-born and foreign language.

The PIAAC background questionnaire provides three measures of post-educational experiences likely to affect skills and probably partly determined by educational attainment: Firstly, we include a scale indicating whether people read at home ('reading practice')[13]. The scale was calculated by OECD based on several items on different types of reading activities outside work (e.g. reading of instructions, letters, books, professional journals etc.). It is divided into quintiles, where the lowest category reflects that respondents read never or rarely (e.g. less than once a month) outside work and the highest category that respondents read different types of texts daily or weekly (OECD, 2013a, p. 217).

[12] Parental education is used as a proxy for both cultural and economic resources because there is no measure of parental occupation or wealth available in PIAAC allowing us to differentiate between cultural and economic social background effects.

[13] OECD (2013a) shows that reading outside work has an even stronger relationship with literacy skills than reading at work. Therefore, we have included this scale.

Secondly, we also include participation in formal or non-formal education in the last 12 months. In the following, we refer to this as training activities. Respondents were asked about various different training activities, such as courses and on-the-job training. A variable was created that separated between respondents who had taken part in any activities during the last 12 months or not (reference category). Beyond a direct effect on competencies, these respondents can be expected to have been participating in continuing training in the past.

Thirdly, we include dummy variables indicating occupational group, combining information on employment and an aggregation of major groups (according to skill levels) of the International Standard Classification of Occupations (ISCO) 2008 (International Labour Office, 2012; International Labour Organisation, 2007) and manual/non-manual work. They distinguish whether a respondent is (1) a skilled worker (ISCO major groups 1 to 3, i.e. managers, senior officials, legislators, professionals, technicians and associate professionals), (2) a semi-skilled white collar worker (ISCO major groups 4 and 5, i.e. clerks; service workers and shop and market sales workers), (3) a semi-skilled blue collar worker (ISCO major groups 6 to 8, i.e. skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers) or (4) an elementary worker (ISCO major group 9) and finally (5) currently not employed (reference category). We thus do not only distinguish whether a respondent is working or not like Park and Kyei (2011), but also take variation in skill use across occupational groups into account (like OECD, 2013a; Steedman & McIntosh, 2001).

We finally use age and gender as control variables. Ageing may relate negatively with competencies due to decreasing cognitive capacities (Barrett & Riddell, 2016; Desjardins & Warnke, 2012) and older cohorts have received less formal education (OECD & Statistics Canada, 2000; Shavit & Blossfeld, 1993). Also, the specific educational experiences in (in terms of ISCED) equivalent educational programs have changed across cohorts. OECD (2013a) also finds age effects in multivariate models of literacy. As this information is not available as continuous information for all countries, it is categorized into 5-year age bands. Because the effect of age does not seem to be linear (Kirsch et al. 1993), we included dummies for each 5-year band, the dummy for age 25 to 30 being the reference category. Previous research has shown that there are net gender effects on the different competency domains in

some but not many industrialized countries (Desjardins, 2003; Maehler et al., 2013; OECD, 2011, 2013a, 2015; OECD & Statistics Canada, 2000) so that we also include a dummy variable for gender (male=0, female=1).

2.6 Analysis method and strategy

The aim of this paper is to estimate net differences in literacy skill by educational attainment across countries. In order to do so, we run country-wise multiple linear regression models in Stata. Our dependent variable is literacy competency, captured by ten plausible values. The main independent variable is educational attainment, measured as highest educational qualification obtained, coded in detailed ISCED. For the analyses, we use the ado *PIAACtools*, accounting for the complex sampling structure in PIAAC.[14]

In our first or baseline model, we include respondents' detailed educational attainment as independent variable only. This model thus estimates the gross (unadjusted) relationship between formal education and competencies. The results of this model will likely overestimate the effect of education on adult competencies because educational attainment and competencies are both to some degree caused by two common third variables, family conditions and cognitive ability (confounding bias, see for example Elwert & Winship, 2013). In the second model, we thus introduce variables measuring family conditions, namely parental education, migration background and books in the home at age 16. This allows us to estimate the relationship between educational attainment and competencies net of family background. We also control for age and gender in this model.

Even then, this model may still overestimate the direct impact of formal education on skill because so far yet omitted variables that are related to educational attainment may affect skills rather than educational attainment itself. In our third model, we thus finally include variables affecting skills *after* completion of formal educational, such as occupational group, reading at home and participation in training activities. Theoretically, these variables are considered to lie on the causal path between educational attainment and adult competencies so they may explain to some degree *why* educational

[14] To cross-check our results, we also estimated our models using syntax-based programs based on syntax provided by Jan Paul Heisig. We did not find any differences.

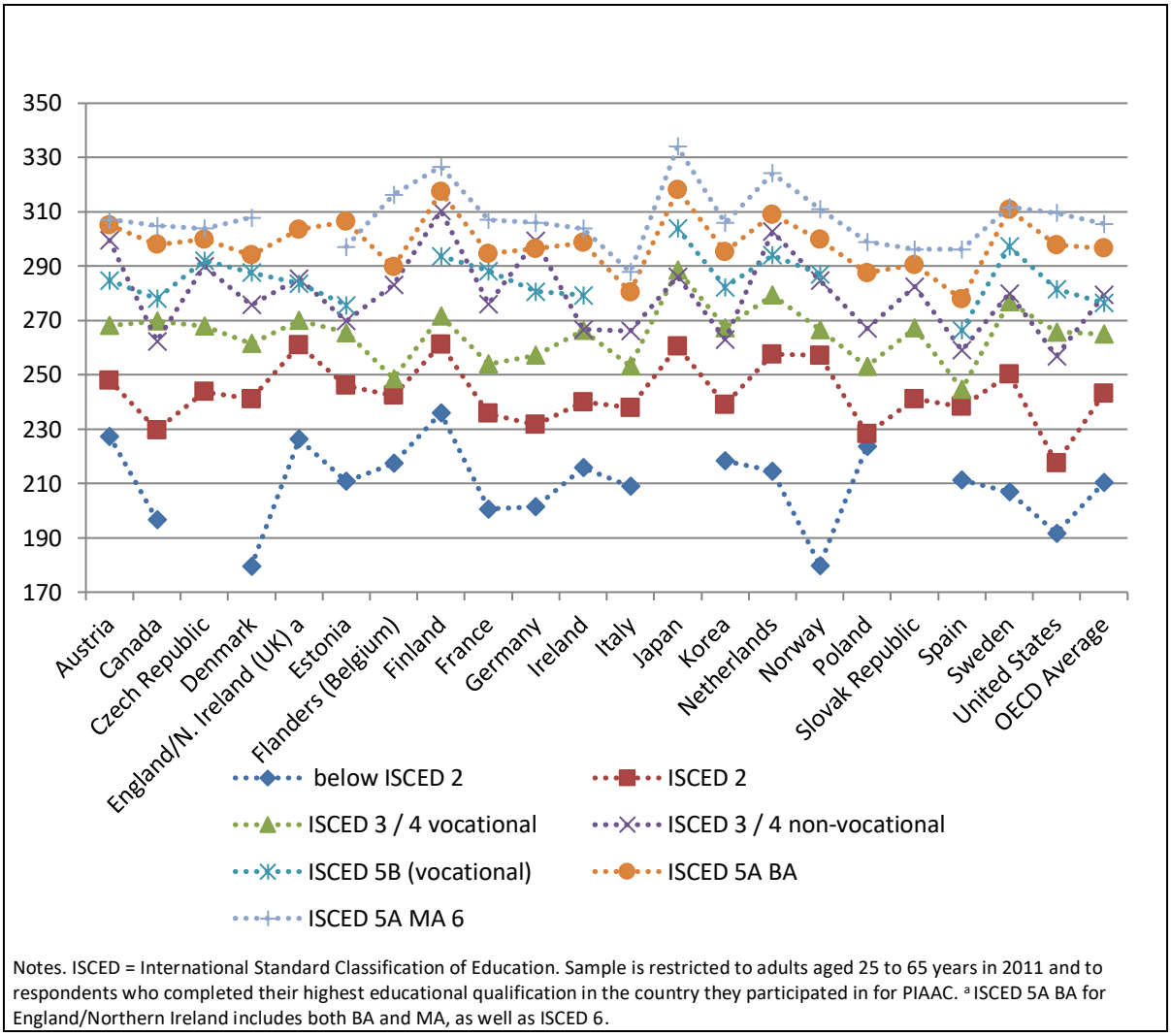
attainment positively relates to literacy skills, or why the relationship between education and literacy differs across countries. The resulting residual education-skill relationship is thus the remaining direct relationship, not total relationship, between education and skills, which cannot be explained by either family background or post-school skill development.[15]

2.7 Results

We start out by describing the unadjusted results regarding the gross relationship between educational qualifications and skills (Model 1, see Table A.1 in Appendix A for more details), and then turn to the adjusted regression models, first describing differences compared to the unadjusted model when adjusting for antecedents of education and skills (Model 2, see Table A.2 in Appendix A for more details), and second describing further differences when also adjusting for post-education factors of skill development (Model 3, see Table A.3 in Appendix A for more details).

Figure 2.1 shows average literacy scores by detailed education categories for all PIAAC countries (basically, conditional means) resulting from Model 1. According to this model, the different ISCED categories follow the same order in most countries, meaning that higher level educational qualifications are associated with higher literacy skills, and within ISCED levels, non-vocational education is usually associated with higher competencies than vocational education. For example, in all countries, respondents with less than lower secondary education have lower average literacy scores than respondents with completed lower secondary education, and those in turn have lower average scores than respondents with completed vocational and non-vocational upper secondary education. Within tertiary education, we find considerable differences between qualifications from short programs that are vocationally oriented (ISCED 5B, usually 2 to 3 years duration full-time) and academic degrees at Bachelor level (ISCED 5A medium) for all countries in which qualifications classified as ISCED 5B exist.

[15] We distinguish models 2 and 3 for two reasons: firstly, because we want to estimate the total net relationship between education and skills, which is achieved by model 2, where entering variables on the causal path from education to skills (like in model 3) would introduce overcontrol bias. Secondly, model 3 is, like many approaches trying to disentangle direct and indirect 'effects', at risk of endogenous selection bias (Elwert and Winship, 2013): rather than conceptualizing occupation, reading habits and adult learning as a mediator between formal education and skills, they could also be regarded as common outcomes (descendants) of education and skills. In this alternative theoretical model, they would be collider variables and controlling for them would introduce a spurious association between education and skills. Still we consider the estimation of model 3 worthwhile in order to control for compositional effects regarding post-educational experiences between countries.



Notes. ISCED = International Standard Classification of Education. Sample is restricted to adults aged 25 to 65 years in 2011 and to respondents who completed their highest educational qualification in the country they participated in for PIAAC. [a] ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6.

Figure 2.1 Literacy skills by detailed educational attainment and country, unadjusted

However, there are some remarkable exceptions to the hierarchical ordering of average literacy skills by education category, mostly affecting upper secondary and vocational tertiary education. The first one are respondents with ISCED 3 or 4 non-vocational in comparison to respondents with vocational tertiary education (ISCED 5B): the former group achieves significantly higher or at least comparable (average) competency scores than the latter group in several countries (especially Austria, Finland, the Netherlands and Germany). However vocational tertiary qualifications consistently go along with higher competencies than vocational upper secondary ones. Another exception is that in Germany, non-vocational upper secondary graduates even slightly (and significantly) outperform tertiary graduates with degrees from medium-duration 5A (i.e. academic) programs – a group that is comparatively small

though and potentially negatively selected due to Bachelor's degrees having been introduced in Germany only recently.[16] Finally, in Estonia, graduates from long (Master's level) academic tertiary programs show 9 points lower literacy scores than those from medium (Bachelor's level) duration programs. Here again, the Bachelor's level category is rather small though.

In some cases, while the order is not broken, there are only very small competency differences between categories located at different main ISCED levels: respondents in Flanders and Spain with ISCED 3 or 4 vocational in comparison to ISCED 2 or 3C short only achieve average literacy levels which are 7 points higher. The difference of mean competency scores between respondents with ISCED 3 or 4 non-vocational and qualifications from vocational tertiary education (ISCED 5B) is small in the Czech Republic, England/Northern Ireland, Norway and Estonia, and the difference between the former and those with medium-duration, i.e. Bachelor's level, university programs (ISCED 5A) is small in Austria, Flanders, Finland and the Netherlands.

Looking more closely at vocational and non-vocational qualifications at ISCED levels 3 and 4, we find substantial literacy skill differences in two-thirds of the countries. In total, in ten out of 21 countries, respondents with non-vocational education show a statistically significantly higher average literacy score than respondents with vocational education. The highest differences can be found in Germany and Finland, where non-vocational upper secondary education is associated with average literacy scores that are 42 or respectively 39 points higher than vocational education. While respondents with vocational upper secondary education on average score slightly higher than respondents with non-vocational education at this level in the United States and Canada (9 and 8 points respectively), these differences are not statistically significant. The *within*-upper secondary competency differences in Estonia, Ireland, Japan and Korea seems to be almost negligible and are statistically not significant in Estonia and Ireland.

Turning to differences between countries within detailed education categories, in all educational groups, we see a range of about 40 to 60 competency scores, i.e. about one competency level, between the countries with the highest average competency scores and the lowest average scores in all education

[16] The common pre-Bologna qualification from polytechnic higher education ('*Diplom Fachhochschule*') should have been classified here, too, but individuals with this qualification are included in the ISCED 5A long category because the measurement instrument used in PIAAC does not differentiate them from university graduates.

groups. The range is especially high in the lowest educational group, i.e. for respondents who have no educational qualification or a qualification below ISCED level 2 (ranging from average competency scores of 179 in Denmark to 236 in Finland). In most countries, the group of low educated adults is very small, however, accounting for only 5.6 % of all respondents across countries (see Table 2.1). With respect to completed lower secondary education, we find somewhat smaller competency differences of around 45 points between countries. Finland, Japan and England/Northern Ireland[17] score highest in this group with around 260 points and the United States the lowest with 217 points. Looking at the completion of vocational upper and post-secondary education (ISCED 3 and 4) we find similar cross-national differences (a difference of 44 points between Japan with 289 and Spain with 245 points). The cross-country range is, with 53 points, rather large again for non-vocational upper and post-secondary education (United States: 257, Finland: 310). For vocational tertiary, Bachelor and Master level education the ranges are 37, 46 and 46 points respectively.

This also means that respondents with more education score lower on the literacy scale in some countries than respondents with less education in other countries. As an example, respondents with ISCED 3 or 4 non-vocational in Finland score about one competency level above respondents with ISCED 5B in Spain. Therefore, in terms of literacy skills, ISCED categories are neither substantively comparable nor consistently ordered across countries, at least when looking at the unadjusted means.

In terms of overall strength of the association as measured by explained variance in this bivariate model, we can see that it also varies considerably between countries: The adjusted R^2 for the Estonia is 0.15, for the Czech Republic 0.18 and for Austria 0.19, while the value is 0.32 for Flanders, and 0.34 for France and the Netherlands (see Table 2.2). Education and literacy competency thus seem to be more

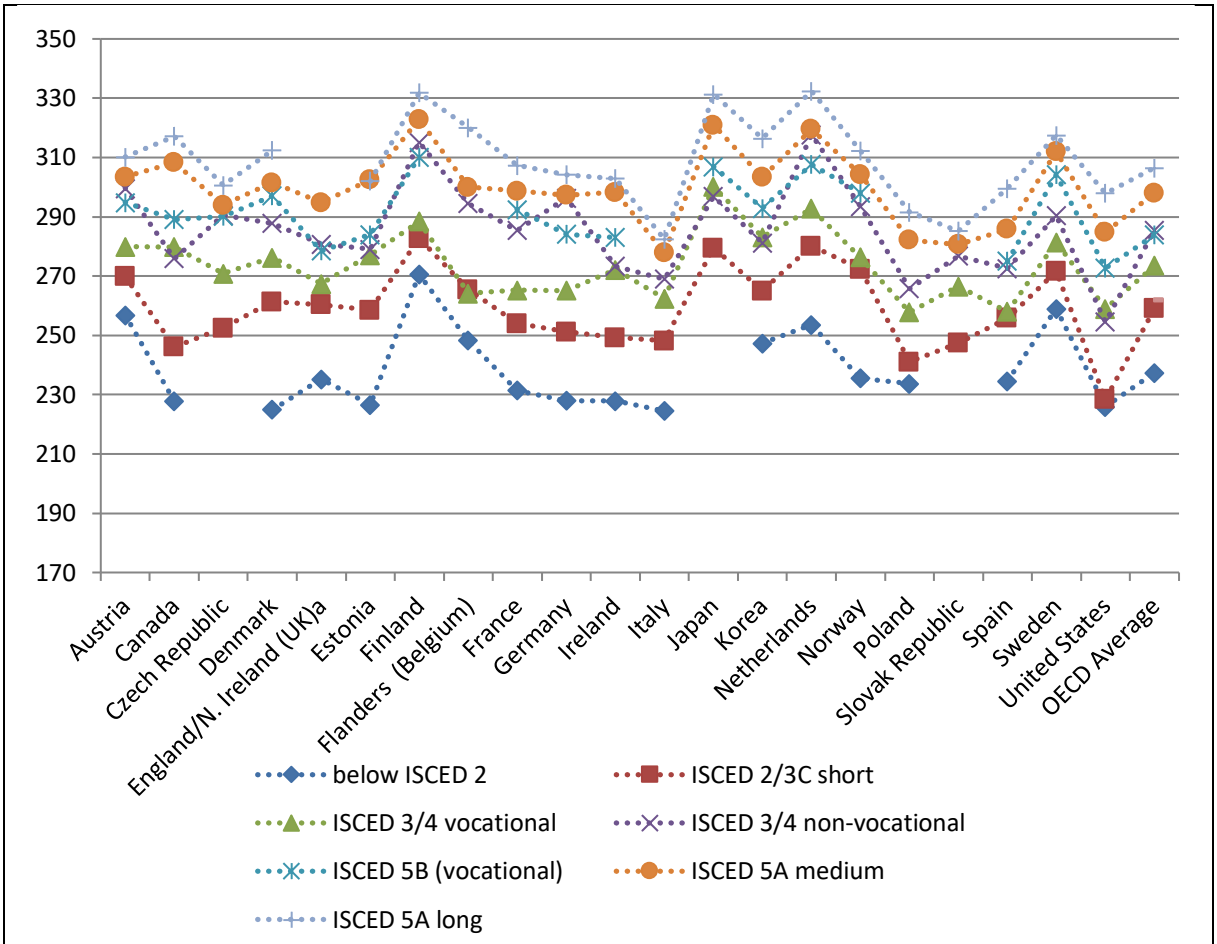
[17] This result is different from what is usually found for the UK, because we reclassified all respondents with GCSEs, the main general school leaving qualification at age 16 which is required to proceed to A-Levels, which in turn give access to university studies, to ISCED level 2. In OECD statistics, only those with 'weak' GCSEs (less than 5, or grades lower then C) are classified at ISCED level 2. Our reason for doing so is that other countries classify such programs at ISCED level 2, and this is in better accordance with ISCED criteria. While ISCED category 3C was never meant to be used for general educational programs, the UK classifies their GCSEs at ISCED 3C if the result is 'strong' (5 or more at grades A to C). Using the official ISCED mapping for the UK, the competency levels at lower and upper secondary education in England/Northern Ireland would be much lower. Unfortunately, the international organizations have only very limited influence on how countries assign educational programs and qualifications to ISCED, which opens the door to politically motivated classification decisions.

closely related in the latter countries than in the former, but in all countries the association is far from perfect.

Table 2.2 Explained variance (adjusted R^2) for three models

	Adjusted R^2			Increment to R^2 from Model 1 to…	
	Model 1	Model 2	Model 3	Model 2	Model 3
Austria	0.19	0.30	0.33	0.11	0.03
Canada	0.23	0.36	0.41	0.13	0.05
Czech Republic	0.18	0.23	0.26	0.05	0.03
Denmark	0.24	0.38	0.42	0.13	0.04
England/N. Ireland (UK)	0.23	0.33	0.37	0.10	0.04
Estonia	0.15	0.24	0.26	0.09	0.02
Finland	0.28	0.40	0.43	0.12	0.03
Flanders (Belgium)	0.32	0.41	0.43	0.09	0.02
France	0.34	0.41	0.43	0.07	0.02
Germany	0.28	0.39	0.42	0.10	0.04
Ireland	0.28	0.35	0.37	0.07	0.02
Italy	0.24	0.29	0.31	0.05	0.02
Japan	0.22	0.32	0.33	0.10	0.01
Korea	0.31	0.37	0.39	0.06	0.02
Netherlands	0.34	0.48	0.50	0.13	0.02
Norway	0.23	0.40	0.43	0.17	0.03
Poland	0.22	0.26	0.28	0.04	0.02
Slovak Republic	0.22	0.26	0.27	0.04	0.01
Spain	0.31	0.39	0.41	0.09	0.02
Sweden	0.24	0.47	0.50	0.23	0.03
United States	0.31	0.42	0.44	0.10	0.03
OECD Average	0.26	0.35	0.38	0.10	0.03

Notes. Sample is restricted to adults aged 25 to 65 years in 2011 and to respondents who completed their highest educational qualification in the country they participated in for PIAAC. Model 1 includes literacy skills by detailed educational attainment. Model 2 adjust for age, gender, parental education, migration background and books in the home at age 16. Model 3 additionally adjusts for occupational group, reading at home, and participation in training activity.



Notes. ISCED = International Standard Classification of Education. Sample is restricted to adults aged 25 to 65 years in 2011 and to respondents who completed their highest educational qualification in the country they participated in for PIAAC. Reference categories: 25-30 years, male, both parents ISCED 2 or below, no migration background, standardized measure of books. [a] ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6.

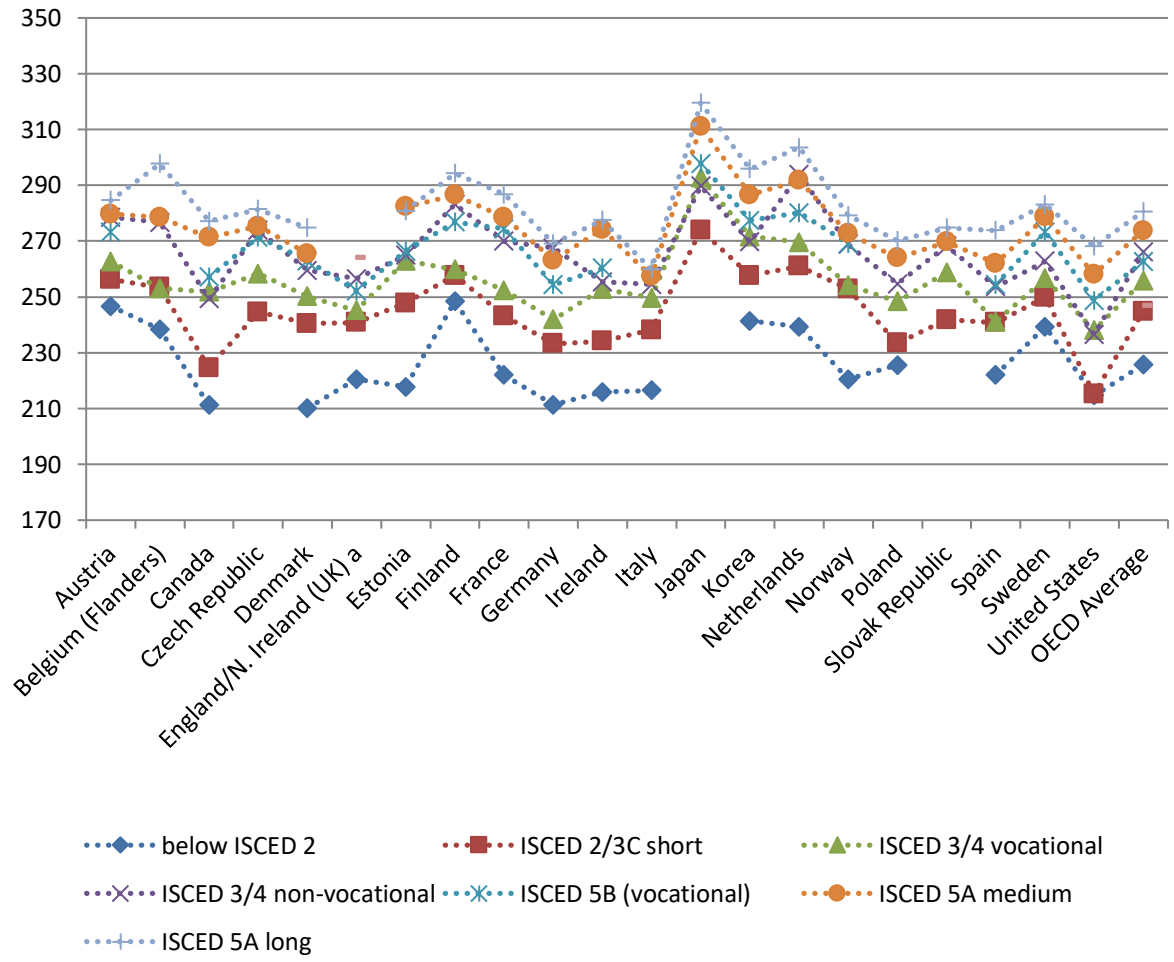
Figure 2.2 Literacy skills by detailed educational attainment and country, adjusting for age, gender, parental education, migration background and books in the home at age 16

When looking at the results of model 2 adjusting for age, gender, parental education, migration background and books in the home at age 16, the hierarchy of skills between ISCED levels remains mostly the same as in model 1. The negative literacy gap between respondents with ISCED 3 or 4 non-vocational and respondents with ISCED 5B has substantially decreased in all countries with the exception of Germany and the Netherlands, however. When comparing vocational and non-vocational qualifications at ISCED level 3 and 4 while adjusting for various background variables, we still find lower competencies for vocational qualifications in ten countries. However, the gap between these qualifications has diminished in all countries but the Netherlands, especially in Germany and Finland, and to a lesser extent in Austria. The difference is still significant and in Germany and Finland they

remain substantial though. Japan, Korea, Ireland and Estonia join Canada and the United States in vocational upper secondary education leading to the same or even slightly higher literacy skills as non-vocational upper secondary education. Turning to the differences between vocational and general/academic education at tertiary level, we find that also in model 2 respondents with a general education score higher in literacy than respondents with a vocational qualification in all countries. Similar as for ISCED level 3 and 4, the gap between qualifications classified as ISCED 5A Bachelor level and ISCED 5B is lower now than in model 1. Especially in Estonia, Finland and Austria, this gap diminished after the adjustment but especially in the former two countries it remains quite substantial and significant. In summary, while some of the relationship between educational attainment and literacy skills is due to social background and migration/language status, formal education still makes a large difference for the achievement of adult literacy skills, whether because of differential skill selectivity or differential skill acquisition in different programs.

In Model 2, the competency gap between respondents with high and low educational qualifications is smaller than in the unadjusted model. However, as in the unadjusted model, there are still large competency differences between respondents with 'equivalent' educational qualifications across countries. Only for respondents below ISCED level 2, the differences across countries diminish between model 1 and model 2. For lower secondary or non-vocational upper secondary education and, to a lesser extent, for the different qualifications at the tertiary level, the differences between the country with the highest and the lowest average proficiency even increase: in the Netherlands, respondents at level 3 or 4 vocational achieve 318 points, while in the United States respondents achieve 254 points – a competency gap of more than half a competency level and 10 points more than in model 1. So while adjusting for important antecedents of both educational attainment and skills reveals that the low levels of literacy of the low educated are to a large extent explained by social and migration background, differences across countries in composition by social and migration background do not make cross-country differences in literacy skills for comparable education categories disappear – on the contrary. Also the countries are ordered more similarly across education categories in terms of average literacy skills than in model 1, with Finland, the Netherlands and Japan always amongst the top and Italy, the Slovak Republic and the United States always amongst the bottom performers.

Between models 1 and 2, the adjusted R^2 has increased by almost 10% (from 26 to 35%) on average across countries. The strongest increase can be seen for Sweden, where the adjusted R^2 for model 2 is 47%, up from 24% in the unadjusted Model 1 (see Table 2.2). This may be due to the Swedish educational system not being very selective, an education policy measure to counter social inequalities in education, but skill development still strongly depending on family background. Therefore, formal education is not as strongly a mediator of social background effects on skills in Sweden as it is in other countries.



Notes. ISCED = International Standard Classification of Education. Sample is restricted to adults aged 25 to 65 years in 2011 and to respondents who completed their highest educational qualification in the country they participated in for PIAAC. Reference categories: 25-30 years, male, both parents ISCED 2 or below, no migration background, standardized measure of books, not currently working, low score on reading at home scale, participated in training during the last 12 months. [a] ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6.

Figure 2.3 Literacy skills by detailed educational attainment and country, additionally adjusting for occupational group, reading at home, and participation in formal or non-formal training activities in the last twelve months

In model 3, we have introduced further adjustments, namely variables which are likely to affect literacy skills *after* initial education. These were occupational group, reading at home, and participation in training activities in the last twelve months. After introducing these variables, the general patterns we already saw in models 1 and 2 remain the same. We will only highlight the most important differences. In model 3 the skill differences between different educational groups become even less distinct within each country, this time specifically in the top education categories: the highly educated have substantially better opportunities for further developing their literacy skill in their working lives than the lower educated, and they also read more in their leisure time. However, we can still find considerable differences in literacy skills between respondents in the same ISCED category across countries.

In comparison to models 1 and 2, we see that the hierarchy of educational levels is less obvious. In particular, this concerns the differences between non-vocational ISCED 3 and 4 qualifications and qualifications at ISCED level 5B. As in model 1 and 2, in some countries, respondents with ISCED 3 or 4 non-vocational score higher than respondents with ISCED 5B. What has changed, however, is the gap between these two which became smaller in all countries. It can now be observed in several countries that respondents with lower secondary education (ISCED level 2 or 3C short) score higher than respondents with ISCED level 3/4 vocational (Flanders, England/Northern Ireland, Finland and Norway). This hints at the literacy skill advantage of those with vocational upper secondary education compared to those with lower secondary education in model 2 being due to their more favorable labor market placement and reading habits rather than their vocational upper secondary education itself (however, their labor market placement to some degree depends on it obviously). Furthermore, we also find in model 3 that literacy scores of respondents with ISCED level 3 or 4 non-vocational do not differ much from scores of respondents with Bachelor level education (with the exception of Canada, Estonia, Ireland, Japan, Korea, Sweden and the United States).

Comparing fully adjusted average literacy by ISCED levels across countries, we see that the gap between countries scoring the highest and scoring the lowest has diminished for the lowest educational group but has increased for ISCED levels 3 and above. For respondents below ISCED 2, the score is 239 for Sweden and 210 for Denmark, a competency gap of a bit more of half a competency level. It was 56

points in Model 1. At ISCED 5B, the competency gap between countries increased from 37 points (between Japan with 304 and 266 in Spain) to 49 points (between Japan with 298 and Spain with 249). Altogether, even after adjusting for a wide range of factors, there are still substantial differences in average literacy skills between countries for supposedly comparable education categories.

The adjusted R^2 suggests that with model 3 not more variance in skills can be explained in all countries, in contrast to model 2. This suggests that the background variables in model 2 seem to be more important in explaining the variation in literacy skills. Introducing the additional mediating variables in model 3 does not add explanatory power to the model. However, since the effects of education on skills somewhat decrease between models 2 and 3 in most countries, those additional variables mediate some of the effects of educational attainment on skills so that model 3 can be interpreted as showing the relationship between educational attainment and literacy skills 'net' of labor market experiences and cross-country differences therein.

2.8 Summary and discussion

We find considerable differences across countries in the average literacy skills associated with supposedly equivalent education levels, as well as in the strength of association of educational qualifications and skills. Our results suggest that some of these differences are due to differences across populations in characteristics that influence education and skill acquisition before achieving educational qualifications, such as family background, as well as experiences that occur after the completion of educational qualifications, such as daily reading practices and the job situation. However, even after adjusting for a wide range of correlates of education and literacy skills, substantial cross-country differences in average skills within education categories remain – and in some cases even become stronger. In contrast to Park and Kyei (2011), we do not find that the differences between countries are smaller at higher education levels than at lower education levels, which may be due to our more comprehensive set of controls as well as a broader set of countries covered in PIAAC than in IALS.

Furthermore, confirming results by Maehler et al. (2013) for Germany on an international scale, we find substantial heterogeneity in literacy within broad education levels across countries. This shows that it is in fact worth looking at detailed education categories rather than just broad heterogeneous levels. The

cross-country differences in skills by detailed education categories seem to be related to characteristics of the respective educational systems: In those countries where there are no substantial skill differences between vocational and non-vocational qualifications at the upper secondary level (Canada, Estonia, Ireland, Japan, Korea and the United States), vocational education is not very vocationally specific, which may mean that in such 'pseudo-vocational' programs literacy competencies are improved as much as in general programs. Another potential explanation, however, is that the results reflect sorting and educational choices by competency: In the above countries, skill selectivity may not differ between (pseudo-)vocational and non-vocational programs. In contrast, in countries with a strong vocational upper secondary system, such as Germany and Finland, people who initially have a higher literacy competency follow more general tracks while people with lower competencies engage in vocationally oriented programs.

This puts the validity of broad education levels as proxies for general skills into considerable doubt: In many countries, specifically those with distinct vocational training systems, graduates of vocational education and training have substantially lower literacy skills than graduates of non-vocational education at both the upper secondary and tertiary levels. Literacy skills are usually analyzed and reported in only three broad education levels (low, medium and high) and our results suggest that average literacy scores by broad education level for any given country seem to depend to a large degree on the prevalence of the vocationally educated groups within those levels.

Available comparative research on differences across countries in adult competencies for comparable education groups concentrate on differences in the organization of or resource inequality within educational systems (Heisig & Solga, 2015; Park & Kyei, 2011). Another explanation concerns differences between countries in the selectivity of specific educational categories. We cannot tell whether the skill differences that we find within broad education levels can be explained by selection effects or skill acquisition effects. This is due to the fact that variables such as prior learning experiences, cognitive ability and – relevant for differences at tertiary level - literacy skills at completion of secondary education cannot be accounted for with PIAAC.

There is, however, also an interpretation for these results that concerns the methodology of PIAAC, and specifically the measurement of educational attainment using ISCED. The ISCED classification criteria (UNESCO Institute for Statistics, 2006), which are admittedly proxy-criteria due to lacking direct indicators, may be ill-suited to capture the actual complexity of content of educational programs, the concept ISCED intends to measure. The complexity of content of an educational program should theoretically be quite strongly related to the average literacy skills that completers of the program show, because literacy skills highly correlate with other types of general skills. The most important classification criteria defined by ISCED are typical age of entry into an educational program and theoretical program duration, together forming the cumulative duration of education at the end of the program. Sometimes additionally a minimum entry requirement in terms of a level and/or type of program previously completed, or the level and/or type of program the program to be classified is designed to prepare for, are also defined. Obviously, these criteria exclusively refer to the structure of educational systems, not to the complexity of content and related demand placed on learners or even skill outcomes. In fact, we are not aware of any study evaluating the extent to which the ISCED criteria *do* capture complexity of content. Our results make us skeptical in this regard: Even though ISCED offers the tools to distinguish between general and vocational education, for the same duration of education, equal complexity of content is assumed for vocational and general programs, and thus they are assigned to the same main ISCED level. Our research however suggests that in terms of literacy, the complexity of content of vocational programs may be substantially lower, so they more strongly draw in participants from the lower end of the skill distribution at the completion of the previous level, especially in countries with highly occupationally specific vocational training. The current ISCED criteria seem, on their own, incomplete to well differentiate educational programs by their degree of complexity of content.

Limitations of the study are similar to those of previous studies using IALS, ALL or NALS data, because by and large, these surveys share some design weaknesses (see also Desjardins, 2003; Kerckhoff et al., 2001; Park & Kyei, 2011): incomplete measures of family conditions and post-school experiences as well as the absence of a measure of generalized cognitive ability or literacy skills at earlier time points lead to residual confounding, so that data better describing learning contexts during childhood, youth

and adulthood would improve the interpretability of results. Because these variables are not measured in PIAAC, the estimation of the net effect of level of education on literacy skills is problematic, as the influences of theses variables cannot fully be accounted for. Therefore the education effect is likely still overestimated in models 2 and 3. in the absence of panel (let alone experimental) data, it is impossible to correctly model causal relationships between formal education, adult competencies, and their mediators such as employment, occupation, adult training or reading practice and thus better understand the skill formation process and make public policy recommendations (Raudenbush & Kim, 2002). Basically, research based on cross-sectional surveys such as PIAAC cannot differentiate between the theoretically equally plausible causal mechanisms of literacy selection (i.e. students with higher literacy progressing further or to different types of programs in formal education) and literacy development (i.e. formal education *producing* higher literacy) distinguished by Reder (1998). This is especially relevant for the differences between vocational and non-vocational upper secondary education, as well as results at the tertiary level.

Another issue that needs to be considered when interpreting our results are differences in 'literacy related nonresponse' (LRNR) across countries. The number of literacy related non-respondents ranges between 0% (Finland, Poland and Sweden) and 5.2% (Flanders) in our sample (OECD, 2013a). Van de Kerckhove et al. (2013) show that a LRNR share of 2% has little impact on the overall score but that significant bias can be introduced with a share of 8% LRNR. This needs to be considered when interpreting the results of our analyses as it can be assumed that literacy related non-response is related to lower literacy skills in the interview language (Van de Kerckhove et al., 2013). This means that countries with a higher share of LRNR are likely to have lower literacy skills than reported. Furthermore, it is likely that LRNR occurs more often in lower educational groups in most countries.

2.9 Conclusion

We would like to offer two kinds of conclusions: one for researchers trying to proxy competencies with information on educational attainment, and one for future PIAAC studies. With respect to the first issue, looking at detailed ISCED categories reveals skill similarities across and differences within ISCED main levels, which means that for analyzing skills, ISCED levels show a low degree of validity. Therefore, analysts trying to use educational attainment data to proxy differences between individuals in literacy

(or other general basic) skills should not use ISCED main (or even broad) levels, but rather code detailed education categories according to their competency outcomes. This means that individuals with qualifications from vocational tertiary education should be aggregated with individuals with non-vocational upper secondary education (ideally ISCED level 4 only) rather than with individuals with academic tertiary qualifications, as is usually done, or, better still, be kept separate. Furthermore, given the strong differences between vocational and non-vocational upper secondary education in a large number of countries covered in PIAAC, these two categories should also be coded separately whenever possible, at least for those countries where skill differences are large. In many countries, the average competencies of the vocationally educated are closer to those of individuals with lower secondary education (ISCED level 2) than to those of individuals with non-vocational upper secondary education. Basically, when proxying competencies, in countries with strong vocational training systems the vocationally educated should be downgraded to the next lower ISCED level.[18]

Regarding recommendations for PIAAC, there are several points to make. Firstly, despite the fact that formal education is undisputedly the most important context of skill formation, educational attainment is treated in adult literacy surveys such as PIAAC as a mere 'background variable'. As a consequence, it is not as well measured as one might wish: For example, qualifications resulting from vocational and general programs, or between those preparing primarily for university and those preparing primarily for the labor market, are not easily distinguished even though these differences can be expected to be important for literacy skill formation. The variable on orientation was not specified ex-ante, apparently leading to ex-post coding problems for many countries. As another example, the differentiation between the Bachelor's and Master's level cannot be drawn in all countries due to limitations of the measurement instruments. In the UK, it cannot be drawn at all, and in Germany, there is a large element of misclassification in these categories of the variable. Therefore, we would strongly recommend 1) to give the relationship between educational attainment, basic skills and labor market outcomes more theoretical thought and thus specify more relevant and valid harmonized target variables, and 2) to put more quality control into place regarding the ex-ante output-harmonization of educational attainment in any future

[18] This does not imply that vocational education is generally less valuable than general education – only that, in terms of literacy skill outcomes, it is not comparable to general education at the same level of education.

PIAAC cycle (regarding the harmonization of education in comparative surveys, see e.g. Schneider, 2010; Schneider et al., 2016; Wolf et al., 2016).

Secondly, we do not know anything about the pathway an individual has taken through the educational system, i.e. *how* the highest qualification that is measured was achieved. Different pathways, especially in countries where multiple options are available at every transition point, are likely to provide different access barriers and learning environments, and thus result in different literacy skills. Fortunately, OECD is already investigating these issues for the upcoming PIAAC cycle. Thirdly, we would strongly suggest enriching the set of background variables to be more able to tease out different causal mechanisms concerning adult skill development and avoid conflating many different effects in the measure of parental education. Without going full-scale longitudinal, causal modeling more strictly speaking will of course remain impossible.

Finally, we would like to offer some ideas for further research: Firstly, it would be worthwhile to extend this study by also including the nine PIAAC round 2 countries for which data were collected in 2014. Given these countries are less developed than round 1 countries, we would expect to find even more variation in literacy skills by educational attainment. Secondly, we have ignored potential interaction effects in this study in order not to overcomplicate the models. Most importantly, it is quite plausible that the relationship between education and literacy skills changes across cohorts, mostly because younger generations have benefited from educational expansion (Shavit & Blossfeld, 1993) and formal education can be expected to be more relevant to the skills of younger individuals just because they have left education more recently. Thirdly, one could try to systematically scale educational attainment by directly assessed skills across countries to develop more comparable measures of skills, based on information on educational attainment coded in ISCED only, which could then also be applied to other data than PIAAC. One could also use PIAAC data for benchmarking specific ISCED categories for specific age groups across countries, following the approach taken by Steedman and McIntosh (2001). Finally, the obvious next step in substantive analysis would be to investigate contextual effects on cross-country differences in competencies at given education levels or gaps between specific education levels, building on prior research by Park and Kyei (2011) and Heisig and Solga (2015). In our view it is

important to learn more about the individual determinants of adult skills and how these differ across countries, since this could provide us with important lessons for the future: it is very clear that adults to a large extent transmit their competencies to their children in most if not all countries. Because of data constraints, prior sociological research has largely focused on inequality of educational opportunity in terms of educational attainment (for a review, see Breen & Jonsson, 2005). With PIAAC data, as limited as they may be in terms of background measures, it is possible to add to this the study of social inequality in competencies across countries.

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Appendix A Detailed regression results from study 1

Table A.1 Regression results for model 1

	AT	CA	CZ	DK	EN/NI[a]	EE	FI	BE	FR	DE	IR
Below ISCED 2	-20.6	-33.1	-57.8	-61.6	-34.6	-35.3	-25.2	-24.9	-35.2	-30.1	-24.0
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	20.3	40.2	24.2	20.5	9.1	19.5	10.6	6.2	18.3	25.6	26.4
ISCED 3/4 non-voc.	51.6	32.7	46.3	34.7	24.5	23.8	49.3	40.7	40.4	67.8	26.8
ISCED 5B	36.8	48.4	48.3	46.5	22.7	29.5	32.6	0.0	52.5	49.1	39.4
ISCED 5A BA	57.2	68.3	56.1	53.0	42.6	60.3	56.2	47.3	58.9	64.8	58.7
ISCED 5A MA 6	59.2	75.2	60.1	66.8	0.0	51.1	65.4	74.0	71.3	74.5	64.0
Constant	248.0	229.7	243.8	241.1	260.9	246.1	261.2	242.4	235.8	231.6	239.9
Adj. R^2	0.19	0.23	0.18	0.24	0.23	0.15	0.28	0.32	0.34	0.28	0.28

	IT	JP	KO	NL	NO	PL	SK	ES	SE	US
Below ISCED 2	-28.9	26.5	-20.7	-42.9	-77.34	-4.44	-64.68	-26.98	-43.15	-25.74
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	15.4	28.3	28.4	21.9	9.56	24.86	26.15	6.48	26.78	48.30
ISCED 3/4 non-voc.	28.2	25.7	24.0	45.2	27.61	38.89	41.38	20.80	29.89	39.48
ISCED 5B	0.0	43.4	43.2	36.5	29.88	0.00	0.00	28.11	47.11	64.12
ISCED 5A BA	42.5	57.7	56.2	51.5	42.61	59.27	49.31	39.55	60.65	80.37
ISCED 5A MA 6	50.0	73.6	66.9	66.6	53.91	70.76	55.05	57.88	61.64	92.18
Constant	237.91	260.44	239.05	257.53	257.14	228.22	241.14	238.30	250.11	217.45
Adj. R^2	0.24	0.22	0.31	0.34	0.23	0.22	0.22	0.31	0.24	0.31

Note. ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6.

Table A.2 Regression results for model 2 - adjusting for age, gender, parental education, migration background and books in the home at age 16

	AT	CA	CZ	DK	EN/NI[a]	EE	FI	BE	FR	DE	IR
Below ISCED 2	-13.1	-18.3		-36.4	-25.2	-32.0	-12.1	-17.1	-22.5	-23.3	-21.4
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	10.0	33.7	18.4	14.9	7.0	18.6	5.7	-1.2	11.2	13.9	22.8
ISCED 3/4 non-voc.	29.7	29.8	38.1	26.4	20.4	20.4	32.3	29.2	31.4	45.1	24.1
ISCED 5B	24.9	43.1	37.7	35.7	18.2	25.5	27.5	0.0	38.5	32.9	33.7
ISCED 5A BA	33.6	62.2	41.4	40.1	34.5	43.9	40.2	34.7	44.7	46.1	49.0
ISCED 5A MA 6	40.3	71.1	48.1	51.0	0.0	43.4	49.2	54.7	53.4	53.0	53.6
Age 26-30	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Age 31-35	-3.8	-2.5	1.1	-6.1	1.8	-4.2	0.9	-1.4	0.4	-4.3	2.1
Age 36-40	-3.1	-2.6	-5.6	-2.4	2.4	-7.7	-1.1	-6.8	-4.2	-2.9	2.9
Age 41-45	-7.0	-5.2	-10.1	-7.4	1.3	-11.7	-9.9	-7.4	-9.4	-3.6	0.3
Age 46-50	-13.8	-8.8	-11.2	-11.8	-2.4	-14.4	-12.3	-10.8	-12.0	-12.0	-5.8
Age 51-55	-15.1	-11.5	-17.2	-16.7	-0.4	-15.3	-20.2	-15.3	-12.0	-16.9	-0.2
Age 56-60	-22.2	-10.4	-13.1	-22.1	-2.0	-17.2	-28.7	-22.2	-14.4	-17.5	-4.7
Age 61-65	-27.1	-11.3	-15.4	-28.9	0.7	-14.3	-34.9	-22.0	-12.4	-25.7	0.2
Female	-2.2	-4.0	-1.9	-2.2	-4.4	-1.6	-1.7	-4.3	-2.1	-1.9	-5.9
Native born/native language	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Native-born/foreign language	-14.6	-0.1	22.7	-7.9	-18.4	-2.1	-27.2	-11.6	-12.6	-4.9	13.3
Foreign-born/native language	-4.3	-18.9	-26.8	-1.7	-16.4	-16.2	3.5	-6.9	-27.7	-9.1	-5.9
Foreign-born/foreign language	-23.0	-34.9	-2.3	-51.0	-41.0	-13.0	-68.9	-58.4	-43.5	-32.1	-35.4
Both parents ISCED <=2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
One parent ISCED 3 or 4	0.1	6.2	3.6	0.3	9.9	-1.5	1.1	4.5	2.6	5.8	4.3
Both parents ISCED 3 or 4	6.5	6.8	4.8	-0.6	13.1	0.6	2.8	8.8	4.3	9.4	8.8
One parent ISCED 5 or 6	3.2	7.4	3.6	3.3	12.3	-0.5	4.3	9.1	6.2	8.8	6.9
Both parents ISCED 5 or 6	2.7	9.0	4.2	8.3	20.8	7.3	7.8	11.9	7.1	8.9	8.4
Books in the home at age 16	8.6	8.4	7.2	7.1	8.8	8.4	6.2	5.6	5.9	7.7	7.2
Constant	269.9	246.1	252.5	261.4	260.3	258.6	282.7	265.4	254.0	251.2	249.3
Adj. R^2	0.30	0.36	0.23	0.38	0.33	0.24	0.40	0.41	0.41	0.39	0.35

Table A2. continued

	IT	JP	KO	NL	NO	PL	SK	ES	SE	US
Below ISCED 2	-23.7		-17.7	-26.5	-36.8	-7.3		-21.3	-12.6	-2.5
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	14.2	20.7	18.1	12.7	4.0	16.8	19.1	2.2	9.8	30.6
ISCED 3/4 non-voc.	20.9	17.4	16.1	37.6	21.1	24.7	29.4	16.7	18.8	26.1
ISCED 5B	0.0	27.5	27.8	27.6	25.7	0.0	0.0	19.2	32.6	44.3
ISCED 5A BA	29.7	41.5	38.3	39.4	31.9	41.2	33.3	30.0	40.4	56.3
ISCED 5A MA 6	34.3	51.9	51.4	52.3	39.9	50.6	37.8	43.7	45.9	69.5
Age 26-30	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Age 31-35	-3.3	0.3	-4.6	-1.9	-0.4	-7.9	-0.7	-0.3	-2.0	-2.8
Age 36-40	-1.8	0.0	-5.8	-2.7	-1.8	-4.2	3.7	1.6	-1.1	-2.0
Age 41-45	0.1	-1.7	-14.8	-1.2	-1.6	-4.1	-4.4	-2.5	-1.2	-4.2
Age 46-50	-1.0	-6.6	-17.8	-10.7	-5.1	-3.9	-1.7	-2.9	-4.5	-7.5
Age 51-55	0.0	-12.6	-21.5	-17.1	-11.5	-10.0	-3.0	-11.8	-9.3	-5.1
Age 56-60	-5.6	-18.1	-18.4	-22.7	-20.0	-9.0	-2.5	-18.8	-13.8	-9.8
Age 61-65	-6.0	-29.0	-23.1	-29.0	-25.5	-11.9	0.5	-18.9	-22.9	-6.6
Female	0.6	-0.2	-3.9	-5.7	-7.6	3.4	-0.6	-6.4	-6.0	-1.2
Native born/native language	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Native-born/foreign language	-3.6	24.0	-4.4	-27.4	-17.4	-11.5	-8.1	-1.4	-4.9	-2.2
Foreign-born/native language	-15.3	-73.1	-31.1	-31.0	0.2	0.0	-2.3	-21.8	-16.9	-7.7
Foreign-born/foreign language	-28.8	-87.0	-55.0	-48.0	-51.3	0.0	6.8	-39.4	-64.8	-30.3
Both parents ISCED <=2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
One parent ISCED 3 or 4	5.5	4.6	3.9	3.6	4.3	3.6	6.9	1.1	1.8	9.0
Both parents ISCED 3 or 4	2.4	4.4	1.3	4.5	7.0	6.9	7.8	-1.6	6.5	19.9
One parent ISCED 5 or 6	5.7	4.7	2.7	0.4	2.6	6.3	6.2	3.5	3.0	19.3
Both parents ISCED 5 or 6	-4.5	1.0	7.2	3.7	10.5	9.2	13.7	1.3	6.8	27.1
Books in the home at age 16	8.1	6.6	5.2	6.3	8.2	8.7	7.9	8.4	9.9	5.9
Constant	248.2	279.5	265.0	280.1	272.4	241.0	247.4	255.9	271.6	228.4
Adj. R^2	0.29	0.32	0.37	0.48	0.40	0.26	0.26	0.39	0.47	0.42

Note. ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6.

Table A.3 Regression results for model 3 - additionally adjusting for occupational group, reading at home, and participation in training activities in the last twelve months

	AT	CA	CZ	DK	EN/NI[a]	EE	FI	BE	FR	DE	IR
ISCED below 2	-9.7	-13.4	-51.6	-30.3	-20.3	-30.0	-9.2	-14.9	-21.2	-21.8	-18.2
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	6.4	27.2	13.8	9.7	4.4	15.2	2.1	-0.3	9.2	8.7	18.7
ISCED 3/4 non-voc.	22.2	24.7	29.2	19.0	15.7	17.1	25.4	23.4	26.7	34.4	21.2
ISCED 5B	17.0	32.4	26.8	22.4	11.3	18.6	19.2	0.0	31.2	21.1	26.2
ISCED 5A BA	23.4	46.7	30.8	24.9	23.2	34.5	28.8	25.2	35.3	29.9	40.1
ISCED 5A MA 6	28.3	52.5	36.8	34.2	0.0	33.0	36.6	44.3	43.7	36.0	43.4
Age 26-30	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Age 31-35	-3.4	-1.7	0.7	-6.7	0.3	-4.7	0.5	-1.5	-0.2	-4.3	0.8
Age 36-40	-2.7	-3.2	-6.0	-2.8	0.4	-7.2	-2.7	-7.2	-5.0	-2.1	1.7
Age 41-45	-7.3	-5.3	-10.4	-8.8	-1.7	-10.4	-10.8	-7.9	-10.5	-4.2	-0.6
Age 46-50	-13.2	-8.4	-11.2	-14.3	-5.3	-12.7	-13.5	-11.1	-13.1	-12.6	-7.0
Age 51-55	-14.6	-10.7	-17.7	-18.7	-2.9	-13.4	-20.8	-16.4	-14.0	-17.0	-2.1
Age 56-60	-19.3	-8.9	-12.4	-23.4	-4.0	-14.2	-28.7	-21.6	-15.2	-16.5	-6.2
Age 61-65	-22.0	-7.1	-12.0	-26.2	0.6	-9.4	-31.5	-19.2	-11.9	-21.4	0.2
Female	-1.8	-4.1	-0.9	-2.6	-2.3	-2.1	-1.2	-4.0	-1.5	-1.9	-5.1
Native born/native language	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Native-born/foreign language	-15.9	-1.4	17.4	-11.1	-19.9	-1.5	-24.8	-11.2	-12.9	-5.9	15.2
Foreign-born/native language	-4.3	-17.3	-23.8	3.2	-15.1	-14.3	-1.9	-5.4	-25.0	-5.7	-5.6
Foreign-born/foreign language	-23.0	-31.4	-1.9	-45.2	-35.6	-11.6	-64.8	-53.2	-40.1	-26.1	-33.7
Both parents ISCED <=2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
One parent ISCED 3 or 4	0.0	4.6	2.6	0.6	7.0	-2.4	0.8	2.6	2.2	4.5	2.9
Both parents ISCED 3 or 4	4.7	4.5	2.3	-0.6	9.5	-0.5	1.9	6.9	3.6	7.8	8.8
One parent ISCED 5 or 6	2.3	4.9	0.8	2.6	9.1	-2.3	3.6	5.9	6.0	7.3	6.5
Both parents ISCED 5 or 6	0.7	5.9	1.7	7.3	16.1	5.3	8.5	8.9	6.5	7.8	8.0
Books in the home	6.5	6.4	5.5	5.8	7.3	7.1	4.3	4.3	4.7	5.5	5.6
Training in last 12 months	5.7	7.6	2.6	5.0	6.1	4.2	3.8	1.3	3.2	5.8	1.7
Reading at home	3.1	5.7	4.0	6.0	4.8	3.2	6.2	3.6	3.7	4.8	4.6
Not currently working	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Skilled occupations	11.9	15.9	9.5	14.8	15.9	9.6	12.3	12.8	9.4	16.2	9.2
Semi-Skilled white-collar occupations	2.8	2.6	7.3	10.1	6.1	4.1	11.1	8.2	7.0	7.4	6.6
Semi-Skilled blue-collar occupations	-0.2	0.0	0.3	1.3	5.1	1.6	6.5	0.5	0.4	3.3	4.9
Elementary occupations	-4.8	-5.5	-9.9	0.0	-6.0	2.9	1.0	-5.3	-3.7	4.2	0.5
Constant	256.3	224.6	244.6	240.5	240.8	247.8	257.7	253.4	243.2	233.2	234.1
Adj. R^2	0.33	0.41	0.26	0.42	0.37	0.26	0.43	0.43	0.43	0.42	0.37

Table A3. continued

	IT	JP	KO	NL	NO	PL	SK	ES	SE	US
ISCED below 2	-21.8	24.8	-16.3	-21.7	-32.4	-7.9	-54.6	-18.7	-10.5	-0.6
ISCED 2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
ISCED 3/4 voc.	11.4	18.6	14.0	8.7	1.4	14.8	17.1	0.4	6.8	22.8
ISCED 3/4 non-voc.	16.2	15.7	12.1	33.0	16.0	21.2	26.4	12.9	12.9	21.3
ISCED 5B	0.0	23.9	19.7	19.2	16.3	0.0	0.0	13.7	23.4	33.5
ISCED 5A BA	19.1	37.0	29.0	30.8	20.0	30.5	27.9	21.3	28.8	42.9
ISCED 5A MA 6	21.7	45.5	38.2	42.6	26.5	36.7	33.0	33.1	33.3	52.9
Age 26-30	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Age 31-35	-3.5	0.4	-3.7	-1.1	-2.0	-7.5	-0.1	0.1	-3.8	-3.8
Age 36-40	-2.0	-0.3	-4.9	-2.7	-3.5	-4.9	3.6	1.5	-4.7	-2.0
Age 41-45	-0.5	-2.6	-14.0	-1.2	-4.3	-5.1	-4.2	-2.4	-4.2	-4.6
Age 46-50	-1.6	-7.5	-16.7	-10.9	-7.5	-4.1	-1.8	-3.1	-8.2	-8.3
Age 51-55	-1.3	-13.6	-20.4	-17.0	-13.4	-9.7	-2.7	-11.4	-13.1	-5.5
Age 56-60	-6.3	-18.9	-17.5	-22.3	-21.8	-7.9	-1.5	-17.6	-17.3	-10.0
Age 61-65	-5.0	-29.4	-21.3	-27.2	-25.4	-9.4	3.2	-15.5	-21.5	-5.9
Female	2.2	0.8	-3.6	-4.7	-5.4	3.0	0.7	-4.6	-4.4	-0.8
Native born/native language	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Native-born/foreign language	-2.0	21.2	-6.2	-26.8	-13.9	-13.5	-7.3	-2.5	-6.5	-0.8
Foreign-born/native language	-12.7	-78.9	-26.8	-27.4	-4.4	0.0	0.2	-21.0	-16.5	-7.6
Foreign-born/foreign language	-26.3	-90.1	-52.8	-43.4	-46.5	0.0	6.3	-36.6	-60.3	-28.3
Both parents ISCED <=2	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
One parent ISCED 3 or 4	5.3	4.3	3.3	3.0	3.1	2.5	6.3	0.2	1.7	7.4
Both parents ISCED 3 or 4	1.9	4.1	0.0	3.4	4.1	5.0	7.2	-2.1	4.8	17.8
One parent ISCED 5 or 6	5.1	4.0	1.9	-0.3	1.7	4.5	5.6	3.5	2.3	17.0
Both parents ISCED 5 or 6	-3.8	0.2	5.5	2.8	8.6	7.4	13.0	1.0	5.5	24.4
Books in the home at age 16	5.9	5.4	3.8	4.9	6.6	6.3	7.1	7.0	7.8	5.0
Training in last 12 months	5.7	1.9	5.8	1.1	1.6	4.8	7.2	3.6	-0.6	3.5
Reading at home	3.7	3.0	3.2	5.1	5.2	3.2	1.5	4.4	4.7	3.8
Not currently working	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Skilled occupations	7.8	2.0	3.5	9.7	15.5	12.5	0.8	7.6	23.2	15.7
Semi-Skilled white-collar occupations	4.2	-1.7	-0.5	7.9	3.7	3.7	1.3	3.2	16.1	4.8
Semi-Skilled blue-collar occupations	0.5	-1.8	-1.4	0.9	3.5	-0.1	4.1	3.3	10.5	3.2
Elementary occupations	-2.2	-8.0	-7.3	-9.3	-10.9	0.8	0.8	3.2	9.3	-2.9
Constant	238.2	274.0	257.6	260.9	252.8	233.5	241.8	240.8	249.9	215.3
Adj. R^2	0.31	0.33	0.39	0.50	0.43	0.28	0.27	0.41	0.50	0.44

Note. ISCED 5A BA for England/Northern Ireland includes both BA and MA, as well as ISCED 6

3 Study 2: Training participation and gender: Analyzing individual barriers across different welfare state regimes[19]

3.1 Abstract

Lifelong learning is becoming increasingly important in today's societies. Individuals need to develop their skills through training in order to be successfully integrated in the labor market. We use data from the Programme for the International Assessment for Adult Competencies (PIAAC) to investigate gender differences in training across twelve countries. We analyze participation and perceived barriers to training for women in comparison to men and control for family structure and employment. As institutional framework, we use four different welfare state regimes to show how policies can affect the decision to participate.

Our results show that different welfare regimes have an impact on the extent adults take part in training and on perceived barriers. In all countries except the Nordic states, men are more likely to participate in training. However, this inequality disappears once controlling for further individual characteristics. Our research provides insights why adults are deterred from engaging in training.

3.2 Introduction

Lifelong learning is becoming increasingly important in today's societies. Individuals have to maintain and develop their skills in order to cope with changing demands. Structural and technological changes on the labor market increase the need for specific skills and make it more important to adapt skills regularly. Analyses by the OECD indicate that training increases the probability to work and has a strong impact on individual productivity (OECD, 2004).

Previous research found large differences of training incidence across countries and also between different socio-demographic groups within countries (Boateng, 2009; OECD, 2003; Rubenson & Desjardins, 2009). Analyses by the OECD (2003) show that in almost all countries, women receive less training. Some studies confirm this gender training gap, showing that women's participation in training is significantly lower than men's participation (Dieckhoff & Steiber, 2011; Evertsson, 2004;

[19] This was published by Natascha Massing and Britta Gauly, in *Adult Education Quarterly* 67 (4): 266–285.

Fitzenberger & Muehler, 2015). Other studies, however, find the opposite (Arulampalam et al., 2004; Jones et al., 2008). This suggests that there are other factors that influence the training participation by men and women.

Most of the previous studies rely on data based on job-related training, relating to firm-sponsored training or training taking place during working hours. However, training can also take place outside of the occupational context, mostly based on personal interest. This may have positive effects both on work-related and everyday characteristics, such as general competencies and soft skills (Thurow, 1976).

We contribute to the existing literature by combining job-related training with training that took place mainly because of personal interest and outside the occupational context. We do not restrict our analysis on participants in training but our primary focus is on adults who are discouraged from or demotivated by participating in further training activities. In our analyses, we differentiate between countries with different welfare state regimes and thus different institutional frameworks. We analyze participation rates as well as perceived barriers to training, considering gender differences and family structure.

The paper is structured as follows. In Section 1.1 we give an overview on the theories of gender differences in training. Section 1.2 characterizes the barriers individuals face when deciding on participation in further training activities while Section 1.3 places the decision-making in wider context. Section 1.4 defines the research questions. Section 2 introduces our methods and the data we use for the analysis. Our empirical results are presented in Section 3. Finally, Section 4 sums up our results with a conclusion.

3.3 Theoretical framework

Following the OECD (2011b p. 31), we define training as "any organized and sustained educational activities" that do not lead to a formal educational qualification. Those activities may be work-related or not and may be offered by educational institutions. Informal learning, such as reading textbooks, is not considered as training.

3.3.1 Gender differences in training participation

There are several explanations for differences in training participation between men and women. One of the most prominent ones follows the Human Capital Theory (Becker, 1962; Mincer, 1958): Training is seen as an investment into human capital. If individuals invest in training, they expect to gain from it, for example by earning more money. As women are less involved in the labor market, they have fewer opportunities for training and might have lower expected outcomes when investing in it. This issue is further intensified because women are more likely to hold a part-time or temporary job than men.

The second explanation draws on gender roles. Becker (1985) argues that there is labor division between men and women, in order to be more efficient. Traditionally, men take part on the labor market as they often earn more money while women invest more in family responsibilities. Research has shown that this intensifies after a child is born: couples acquire more traditional gender and family roles (Miranda, 2011). Furthermore, men with children become more risk averse because they are responsible for a family, and therefore have a higher attachment to their jobs. This higher job attachment might increase the willingness for employers to invest in (firm-specific) training as their investment will more likely benefit the company if the employee stays on the job.

Directly linked to gender roles is a third explanation: women receive less support for training because of statistical discrimination (Arrow, 1971; Phelps, 1972). Statistical discrimination relates to discrimination based on stereotypes. Thus, inequality between different socio-demographic groups persists although there are no rational motives for this discrimination. Gender is taken as a predictor for productivity by employers. They assume that women are less attached to their jobs. Furthermore, women are less likely to achieve higher positions (Maume, 1999; Smith, 2002), and because these are associated with higher training incidence, also fewer opportunities to train (Pfeffer & Ross, 1990).

3.3.2 Barriers to education from a gender perspective

The European Union and national governments see a necessity to increase the training participation by adults European Commission, 2011). Therefore, it is important to understand individuals' subjective barriers to participation in lifelong education in order to implement policies that allow more individuals to receive training. Unfortunately, literature on how barriers to training are related to gender is rather

scarce. Lower participation in the labor market and the reconciliation between work and family was mentioned as some of the possible reasons why women participate less in training then men. However, there may be other reasons which may be related to gender. In an early work, Cross (1981) distinguishes between situational, institutional and dispositional barriers in participation to training. Situational barriers are due to the personal situation or environment (e.g. cost of training, lack of time, no childcare available), institutional barriers are practices and procedures that discourage adults from participating in adult learning (e.g. no suitable courses available/reachable) and dispositional barriers are related to attitudes and self-perceptions (e.g. not confident that one can fulfill the requirements needed). Looking at situational barriers, lack of time and cost issues are given as the most prominent reasons for non-participation in previous research (Desjardins et al., 2006) whereas problems with scheduling or finding appropriate courses are reported as institutional barriers (Rubenson & Desjardins, 2009). Across countries, women report work-related barriers less often than men but family related barriers more often than men and furthermore, women report institutional barriers more often but dispositional barriers less often than men (Rubenson & Desjardins, 2009). Merriam (2005) concludes that the importance of barriers depends on the situation of an individual, such as their family situation and their career status.

3.3.3 Institutions/Welfare state regimes

Decisions on training participation, and thus also on barriers, are not only based on individual preferences but can also be shaped by the structural conditions and institutions in which educational decisions take place. Depending on the welfare state regime, institutions and policies deliver a certain amount of social provision. This affects the material situation of men and women and has an influence on gender relationships, for example on the labor market and the family (Orloff, 1993). In 1990, Esping-Andersen developed his theory on different types of welfare state regimes. He distinguished three different types: the Conservative, the Anglo-Saxon and the Nordic welfare state (Esping-Andersen, 1990). Those can be distinguished by three important factors: 1) the level of offered support, 2) the coverage of benefits, and 3) the eligibility for benefits. This classification was extended by several other authors who introduced a new regime, the Southern welfare state (Bonoli, 1997; Ferrera, 1996; Leibfried, 1993).

Table 3.1 gives an overview on how the different welfare state regimes can be distinguished on a two-dimensional scale, namely the level and the access to benefits. The access can be directed at each individual (universal) or be based on status (e.g. insurable employment). For example, in the Continental system, benefits are connected to labor market participation. Individuals who are not working are only eligible when their family cannot take care of them. In the Liberal system, everyone can receive benefits, but these are means-based in comparison to the Nordic countries. Concerning, the levels, the table shows that e.g. in der Nordic and the Continental system, the benefits that can be acquired are higher than in the Liberal and the Southern system. The access can be directed at each individual (universal) as in Nordic and Liberal states or be based on status (e.g. insurable employment) as in Continental and Southern welfare states.

Table 3.1 Differentiation between welfare states

		Access to benefits	
		Universal access	Access dependent on status
Level of benefits	High benefits	Nordic	Continental
	Low benefits	Liberal	Southern

Note. Adapted from information in Esping-Anderson (1990), Bonoli (1997); Ferrera (1996) and Leibfried (1993).

One of the main points of criticism in the classic typology of welfare states is their gender blindness and that unpaid work is not valued (Knijn & Kremer, 1997; Lewis, 1992; Orloff, 1993). However, ameliorating the situation for both men and women is now on the agenda in many European countries (Abrahamson & Wehner, 2006).

Welfare policies shape the structural conditions, such as social structures and adult educational systems, and through this have an influence on individual life chances. Welfare policies can encourage women to stay active in the labor market and can influence the decision to re-enter the labor market after a child is born, for example by introducing policies on paternity leave and by providing childcare. Rubenson and Desjardins (2009) argue that welfare policies directly affect situational and institutional aspects of opportunity structures, and thus influence educational decisions. Furthermore, individual consciousness and dispositions can indirectly be affected by them because structural conditions limit the alternatives

individuals can chose from. According to Rubenson and Desjardins (2009, 192) “individuals have a degree of agency with regard to their learning behaviors, they are also bounded by structures and contexts and by features of the self that constrain choices.”

We argue that welfare policies have an impact on educational decisions, including subjective barriers. They can be seen as the overarching theoretical framework for our analyses. We assume that participation in training as well as perceived barriers to training differ between different welfare states as institutional conditions can influence the relevance of barriers.

3.3.4 Research questions

We analyze countries that belong to the three “classical” types of welfare states, according to Esping-Andersen , and in addition extend it by the “Southern type” (Leibfried, 1993). These types differ in the role of family and state (Abrahamson & Wehner, 2006) and are therefore estimated to have a different impact on the (direct and indirect) support in training.

We contribute to ongoing research on barriers to lifelong learning with the following research questions: 1. Are there gender differences in participation in training when controlling for family structure and employment status? 2. How are barriers to participation in training related to being employed and having young children? We analyze this in light of different welfare states regimes, with the aim to find out how different welfare state regimes shape opportunities related to training.

3.4 Data & methods

Our data is drawn from the Programme for the International Assessment of Adult Competencies (PIAAC) that was developed by the Organization for Economic Co-operation and Development (OECD). The study provides internationally comparable data on the basic skills of the working age population (16-65 years) as well as extensive information on their educational attainment, participation in the labor market, as well as social and civic life. The first round of PIAAC was conducted in 2011/2012 and included 24 countries. Nine countries took part in the second round of the assessment in 2014/2015. In each country, data was collected employing complex survey sampling design to ensure the representativeness of the resident population in each country (OECD, 2013). A representative sample

of respondents between 16 and 65 years was interviewed at home in the language of their country of residence. The default survey mode was to answer the questions on a computer, but respondents who had no computer experience were offered the option of a pencil-and-paper interview.

The PIAAC data is especially suited for our analyses as it includes information on further training activities in the last twelve months as well as information on individual perceived barriers to training across different countries. Furthermore, the PIAAC questionnaire included various background variables, such as age, gender, educational attainment, work history and family structure.[20] We use data for eleven countries that participated in the first round of data collection (Austria, Belgium, Canada, Denmark, Germany, Italy, Norway, Spain, Sweden, UK, and US) as well as Greece who took part in the second round. We chose these twelve countries because they can unambiguously be assigned to the four different welfare state regimes mentioned above.[21]

We distinguish between participants and non-participants in training. Participants are defined as those individuals who stated that they took part in any training activities in the twelve months preceding the survey. They were further asked about the form, length and context of these activities. Our definition of non-participants, follows the conceptualization that barriers lower the extent of participation but may not entirely prohibit participation (Rubenson & Desjardins, 2009). Non-participants are thus defined as those individuals who did not take part in any training in the twelve months preceding the survey and those who had taken part in some training activities, but stated that they would have liked to attend even more training. All non-participants were asked about the subjective most important barrier that deterred them from participating in training. PIAAC surveys eight different barriers, see Table 3.2.

[20] Some respondents did not reply to all questions in the survey and thus had missing information on one or more variables that were fundamental in our analysis of participation or barriers. Instead of dropping these respondents, we used Multivariate Imputation by Chained Equations (MICE) by Fully Conditional Specification (FCS) in order to impute the missing values, see Buuren and Groothuis-Oudshoorn (2011).

[21] The data we used in our analysis is available as public use files at: http://www.oecd.org/skills/piaac/publicdataandanalysis.htm. In Belgium data was only collected for Flanders and for the United Kingdom data was collected for England and Northern Ireland.

Table 3.2 Question on barriers to education and training in PIAAC

	Which of the following reasons prevented you from participating in education and training? Please indicate the most important reason.
1	I did not have the prerequisites
2	Education or training was too expensive/I could not afford it
3	Lack of employer's support
4	I was too busy at work
5	The course or programme was offered at an inconvenient time or place
6	I did not have time because of child care or family responsibilities
7	Something unexpected came up that prevented me from taking education or training
8	Other

In the next section, we present two types of multivariate analyses: logistic regressions and multinomial logistic regressions. These are especially suited for our analysis as they measure the relationship between categorical dependent variables and one or more control variables by estimating probabilities using logistic function (for more information see: Wooldridge, 2010). In the first part we apply multivariate logistic regressions to analyze the determinants of training participation across countries. Our binary dependent variable in these models indicates participation in training. To simplify interpretations, our regression results are reported as odds ratios. An odds ratio above one indicates a higher chance of participation in training in comparison with the reference group. An odds ratio below one signifies a lower chance. In the second part of our analysis, we focus on barriers to training. The categorical dependent variable in our model measures barriers to training participation in four categories: High workload, family responsibilities, financial reasons, and other.[22] In order to estimate the probability of the four different outcomes categories, we apply multinomial logistic regressions. Results are reported as relative risk ratios that give the probability to report one barrier compared to the reference barrier which is "financial reasons" in our case.[23]

[22] We chose "workload", "family responsibilities" and "financial reasons" as distinct categories because these were mentioned most frequently. We aggregated the other reasons into the category "other".
[23] We use "financial reasons" as reference category because "workload" and "family responsibilities" were mentioned more often, and using "financial reasons" as reference facilitates interpretation of results for the other barriers.

To analyze gender differences while controlling for other characteristics that might affect participation, we included several control variables in our models:

- age (measured in years)
- highest level of formal educational attainment (measured in ISCED, represented through 6 levels)
- employment status (binary variable; respondents working more than 20 hours per week are defined as employed)
- presence of a spouse or partner in the household (binary variable)
- having young children below the age of 13 (binary variable)[24]

As theoretical considerations from Section 2 suggest that young children affect the training participation of women to a greater extent than they affect the participation of men, we additionally included an interaction term of the gender variable and the indicator variable for having young children in our model. This term particularly allows distinguishing the effect of young children on men and women's training participation. A value above 1 indicates that the training participation of women is more heavily affected by the presence of young children than the training participation of men. A value below 1 indicates the opposite.

All of our analyses are based on respondents aged 25 and above because in many countries, respondents are still in initial education at age 24 and lower. Complex survey design was taken into account in all subsequent analyses and sampling weights provided by the OECD were used.

3.5 Results

3.5.1 Participation in training

Figure 3.1 gives the unadjusted probabilities for participation in training for men and women. In line with previous research (Desjardins, 2015) we find that adults in Nordic countries participate more in

[24]The PIAAC data from the public use files distinguishes between children who are younger than three years, younger than six years, younger than 13 years and children who are older than 13 years. We concentrate on children who are below 13 years old, as parents are more involved with care responsibilities for them, and therefore those children reduce the amount of time parents have, e.g. for further training activities.

further training than in other countries. Participation in training is especially low in the Southern countries (e.g., 21.54 % in Italy in comparison to 60.34 % in Sweden).

First descriptive results indicate that only in Belgium and in all countries with a Nordic welfare state system, women have a higher unadjusted probability to participate in training than men. In all other countries men are more likely to participate in training activities, with varying distributions: While the participation is almost equal in Canada, we find the largest differences for Germany, Italy and the United Kingdom.

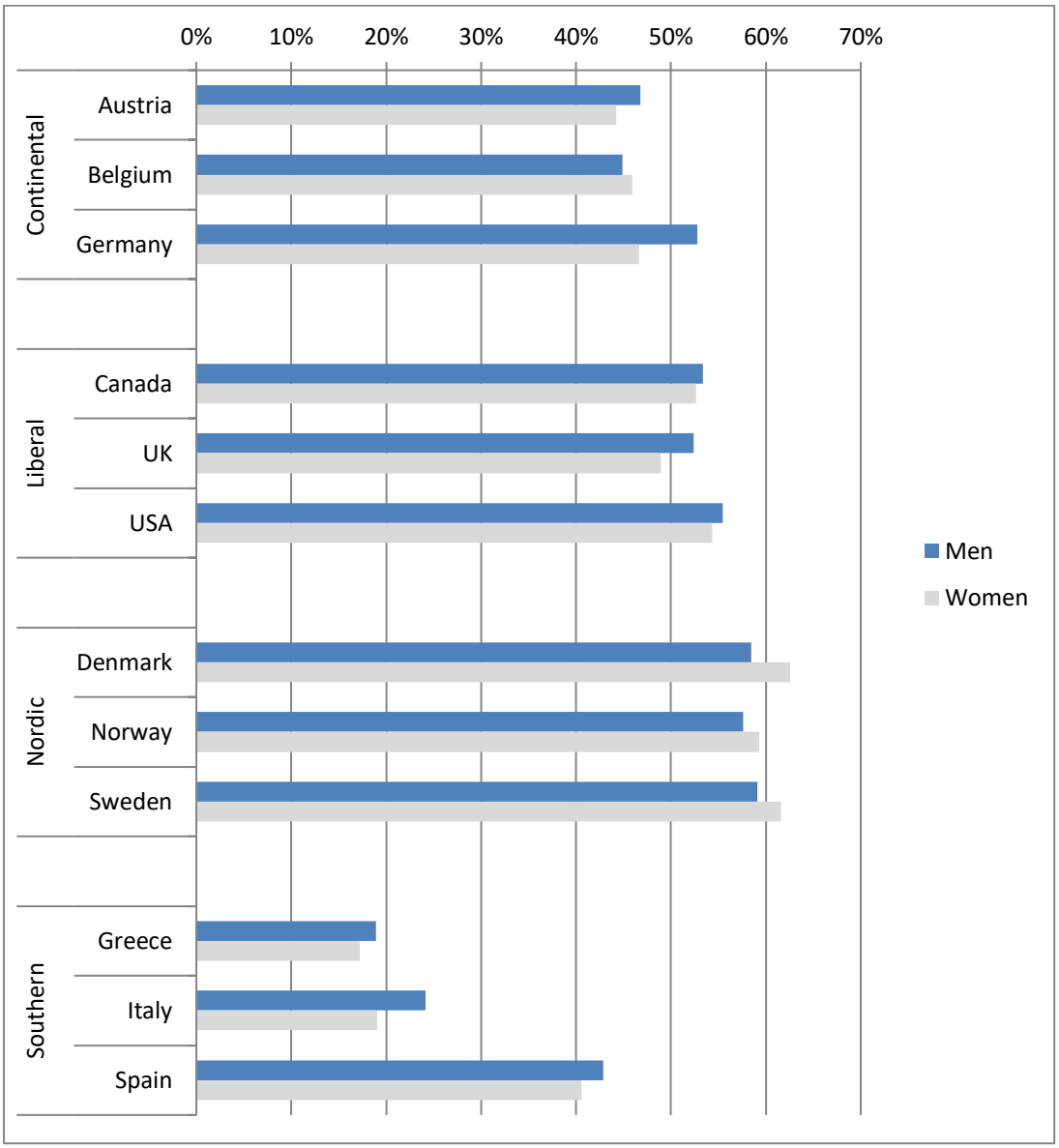

Figure 3.1 Participation in training, by gender and country

With the help of logistic regression analysis, we want to investigate whether part of this gender imbalance is significantly related to other factors. We estimate two different logistic regression models to investigate which factors determine the participation in training and how the chance for participation for women changes when we control for employment status and family characteristics.

In Model 1 we estimate the chance to participate in training and include gender and employment status as control variables. Model 2 is extended by the dummy variable, indicating whether respondents have young children, the dummy variable, indicating whether a partner is living in the household, and the interaction term between gender and young children.[25]

Table 3.3 gives the odds ratios for Model 1. As stated before, an odds ratio above 1 indicates a higher chance to participate in training. For example, looking at the Belgian sample in Column 3, an odds ratio of 1.216 for the gender variable indicates that - controlling for other factors – the odds for women in Belgium to participate in training compared to men are 1.126 times higher. In contrast, an odds ratio of 0.848 for the gender variable in the Italian sample (Column 12) indicates that the odds for women compared to men are 0.848 times as high to participate in training.

[25] We estimated the model fit. The results are reported at the bottom of Tables 3.3 and 3.4. The results show that the model has a good fit in most countries.

Table 3.3 Odds ratios showing the likelihood of participating in training – controlling for gender, age, and employment – Model 1

	Austria	Belgium	Germany	Canada	UK	USA	Denmark	Norway	Sweden	Greece	Italy	Spain
Gender												
Gender (female = 1)	1.043	1.216**	1.103	1.095*	1.206**	1.143	1.343***	1.264***	1.250**	1.114	0.848*	0.928
Age												
25 – 29 years (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30 – 34 years	0.801	1.403**	0.913	0.830*	1.115	1.157	0.915	1.116	0.767	0.839	0.818	1.039
35 – 39 years	0.830	1.176	0.989	0.860	1.100	0.865	0.817	1.015	0.606***	0.586***	0.847	1.006
40 – 44 years	0.846	1.154	1.267	0.834*	1.454**	1.006	0.866	0.951	0.666**	0.851	0.951	0.892
45 – 49 years	0.858	1.190	1.005	0.840	1.283	0.814	0.737**	0.972	0.825	0.489***	1.009	1.030
50 – 54 years	0.726*	1.192	0.883	0.783**	1.240	0.905	0.846	0.702**	0.710*	0.468***	1.059	0.751*
55 - 59 years	0.427***	0.922	0.597***	0.710***	1.134	0.987	0.710**	0.603***	0.596***	0.258***	0.834	0.630***
60 - 65 years	0.225***	0.869	0.447***	0.495***	0.919	0.726*	0.496***	0.376***	0.486***	0.393***	0.470***	0.404***
Education												
Lower secondary or less (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upper secondary	1.903***	1.971***	2.418***	1.824***	2.018***	2.242***	1.741***	1.546***	1.787***	1.986***	2.440***	2.069***
Post-secondary, non-tertiary	3.268***	2.711***	4.128***	2.672***	4.386***	4.248***	2.470***	1.955***	3.356***	3.001***	4.448***	3.071***
Tertiary - professional degree	4.868***	5.537***	4.915***	3.586***	2.941***	5.674***	3.737***	2.867***	2.853***	4.655***	0.962	3.072***
Tertiary - bachelor degree	3.225***	5.143***	6.421***	5.179***	4.520***	7.193***	3.462***	3.106***	4.022***	6.139***	7.123***	4.680***
Tertiary – master/research degree	5.388***	6.927***	7.707***	5.950***	n/a	13.425***	4.366***	3.028***	4.488***	13.264***	15.590***	6.841***
Employment												
Employed (> 20 hours/week)	2.723***	2.828***	3.438***	4.281***	4.046***	4.012***	3.988***	4.215***	4.450***	2.642***	3.072***	2.105***
F	0.63	0.32	0.38	0.55	0.80	0.88	1.43	1.18	0.74	0.51	2.71◊◊	0.73
Prob > F	0.7648	0.9656	0.9414	0.8303	0.6177	0.5486	0.1925	0.3220	0.6747	0.8624	0.0090	0.6805
N	4133	4052	4316	22063	7587	4085	6222	3983	3627	4235	4065	4979

Notes. The table shows results of a multivariate logistic regression (exponentiated coefficients); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; F-statistics: ◊ significant at 5 percent level, ◊◊ significant at 10 percent level; Ref. = Reference category.

Summing up our results for Model 1, we find that - irrespective of welfare state regimes - being employed has a strong positive effect on the chances of participation in training. This is in line with research indicating that most training takes place in the work context (Desjardins, 2015; Dieckhoff & Steiber, 2011). Controlling for employment status also affects the results on gender: unlike the unadjusted results in Figure 3.1, women show a higher chance to participate in training in almost all countries. In the Nordic countries, this effect is stronger than in the other countries. However, the results are only significant in all of the Nordic countries and only in some countries among the Liberal and Continental welfare states. On the other hand, even when controlling for employment, women in Spain and Italy have a smaller chance to participate in training.

Model 2 (Table 3.4) contains further variables regarding the family and household structure. With the exception of Italy, women have a higher chance to participate in training when adding further controls.

In all countries, except the US, we find a negative or non-significant effect of young children on the chance of participating in training. In contrast, in the United States having young children has a positive, significant effect on the chances of participating in training. These results are consistent with previous results on the effect of young children on the participation in training for the United States (Elman & O'Rand, 2002; Simpson et al., 2002).

The presence of a partner in the household has a positive and significant effect on participation in training in Belgium, Germany, Canada, Greece and Spain. For the other countries, we do not find a significant effect of a partner.

Independent of the welfare state system, the interaction term between gender and having young children shows that women with young children have lower chances to participate in training compared to men with young children. The results for Austria and Denmark are outstanding as they are especially low (odds ratios of 0.514 and 0.591) and significant.

Table 3.4 Odds ratios showing the likelihood of participating in training – controlling for gender, age, employment and family structure – Model 2

	Austria	Belgium	Germany	Canada	UK	USA	Denmark	Norway	Sweden	Greece	Italy	Spain
Gender												
Gender (female = 1)	1.280**	1.222**	1.154	1.214***	1.201*	1.234**	1.446***	1.526***	1.304**	1.292*	0.869	1.071
Age												
25 – 29 years (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30 – 34 years	0.841	1.298	0.905	0.835	1.100	1.107	0.930	1.159	0.834	0.816	0.870	1.110
35 – 39 years	0.893	1.074	0.980	0.873	1.078	0.824	0.835	1.090	0.674**	0.572**	0.949	1.124
40 – 44 years	0.845	1.075	1.224	0.813*	1.422**	0.971	0.876	0.963	0.717*	0.786	1.071	0.981
45 – 49 years	0.817	1.100	0.938	0.783**	1.247	0.814	0.717**	0.932	0.812	0.410***	1.093	0.995
50 – 54 years	0.677**	1.091	0.796	0.710***	1.185	0.924	0.809	0.646***	0.658**	0.370***	1.100	0.675**
55 - 59 years	0.396***	0.833	0.533***	0.638***	1.078	1.017	0.668***	0.545***	0.541***	0.198***	0.867	0.546***
60 - 65 years	0.206***	0.777	0.392***	0.440***	0.865	0.744	0.463***	0.342***	0.438***	0.299***	0.485***	0.345***
Education												
Lower secondary or less (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upper secondary	1.939***	1.975***	2.388***	1.832***	2.004***	2.230***	1.742***	1.559***	1.774***	2.015***	2.448***	2.085***
Post-secondary, non-tertiary	3.385***	2.723***	4.091***	2.685***	4.287***	4.247***	2.486***	2.017***	3.333***	3.121***	4.654***	3.122***
Tertiary - professional degree	5.026***	5.591***	4.873***	3.584***	2.921***	5.699***	3.747***	2.929***	2.800***	4.746***	0.992	3.167***
Tertiary - bachelor degree	3.140***	5.277***	6.349***	5.171***	4.448***	7.179***	3.468***	3.202***	3.959***	6.289***	7.103***	4.757***
Tertiary – master/research degree	5.506***	6.962***	7.649***	5.929***	n/a	13.414***	4.393***	3.105***	4.547***	13.32***	15.577***	6.904***
Employment												
Employed (> 20 hours/week)	2.646***	2.790***	3.314***	4.162***	4.027***	3.974***	3.966***	4.203***	4.463***	2.602***	3.057***	2.081***
Family Structure												
Children below 13	1.133	0.997	0.950	1.016	0.959	1.275**	1.011	1.042	0.794*	0.899	0.880	0.828*
Partner in household	0.949	1.443***	1.289**	1.176**	1.124	1.075	1.159	0.895	1.062	1.413**	0.915	1.165*
Gender * Children below 13	0.514***	0.974	0.839	0.724***	1.023	0.800	0.804	0.591***	0.887	0.607*	0.904	0.675**
F	0.51	0.64	0.36	1.60	0.57	1.26	1.01	2.26◊◊	0.67	1.52	1.18	1.68
Prob > F	0.8635	0.7592	0.9489	0.1319	0.8179	0.2935	0.4436	0.0276	0.7317	0.1569	0.3226	0.1110
N	4133	4052	4316	22063	7587	4085	6222	3983	3627	4235	4065	4979

Notes. The table shows results of a multivariate logistic regression (exponentiated coefficients); * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; F-statistics: ◊ significant at 5 percent level, ◊◊ significant at 10 percent level; Ref. = Reference category.

Summing up our results on participation in training, we find that the likelihood to participate for men and women, as well as for individuals with or without family responsibilities varies across countries. Italy and Spain, classified by the Southern welfare state system, are the only countries where we find a lower chance to participate in training for women, even when controlling for employment and family structure.

3.5.2 Subjective barriers to training

Our second and main contribution to the existing literature is a deeper analysis of the barriers to training. As mentioned above, all adults who reported that they wanted to participate in any further learning activity but did not, were asked about the most important reason which discouraged them from participation.

First descriptive results in Table 3.5 show that the most important barriers reported by both men and women are high workload, having family responsibilities and financial reasons. In the following analysis we compare the probability to report high workload, family responsibilities or any other reason compared to reporting financial reasons as the subjective most important barrier to training. Our focus is on the effects of gender, employment status, having young children, and having a partner on these reported barriers. We control for age and education in all regressions.

Table 3.5 Barriers to training (in %)

	Workload	Family Responsibilities	Cost Issues	Other Reasons
Austria				
Men	43.51	7.70	9.91	38.88
Women	27.83	21.42	12.50	38.42
Belgium				
Men	37.34	10.55	5.33	46.79
Women	27.26	28.13	5.12	39.50
Germany				
Men	44.70	5.12	7.59	42.60
Women	21.72	23.16	11.31	43.80
Canada				
Men	37.22	11.42	15.98	35.38
Women	24.05	20.65	21.13	34.17
United Kingdom				
Men	38.85	6.76	18.15	36.23
Women	21.66	20.58	20.49	37.28
United States				
Men	34.47	11.16	20.66	33.70
Women	22.74	22.17	24.70	30.39
Denmark				
Men	34.70	3.83	13.34	48.13
Women	19.52	7.07	15.09	58.32
Sweden				
Men	31.56	11.15	11.43	45.86
Women	20.71	14.59	13.34	51.36
Norway				
Men	40.16	8.74	7.11	44.00
Women	24.40	14.47	11.53	49.60
Greece				
Men	28.33	8.79	23.30	39.58
Women	10.78	25.75	33.00	30.47
Italy				
Men	55.25	7.73	12.02	25.00
Women	27.07	27.79	16.75	28.39
Spain				
Men	36.36	10.1	9.91	43.63
Women	23.02	32.61	10.40	33.97

Table 3.6 Barriers to training (relative risk ratios)

	Austria			Belgium			Germany		
	Workload	Family	Other	Workload	Family	Other	Workload	Family	Other
Gender (female = 1)	0.538**	2.517***	0.573**	1.077	3.431***	0.979	0.430***	3.094**	0.570**
	(-2.13)	(2.68)	(-2.23)	(0.18)	(2.89)	(-0.05)	(-3.28)	(2.60)	(-2.36)
Children below	0.906	6.773***	1.522	0.925	2.533*	0.842	0.847	5.613***	1.073
13 years	(-0.26)	(4.52)	(1.30)	(-0.21)	(1.94)	(-0.45)	(-0.57)	(4.94)	(0.29)
Employed	11.539***	2.609**	1.764*	18.033***	2.803*	2.820**	7.820***	0.923	1.337
(> 20 hours/week)	(4.54)	(2.45)	(1.87)	(5.65)	(1.96)	(2.18)	(5.51)	(-0.28)	(1.12)
Partner in household	0.919 (-0.22)	1.568 (1.12)	1.092 (0.27)	0.897 (-0.14)	0.913 (-0.13)	0.597 (-0.75)	1.274 (0.85)	1.626 (1.32)	1.512 (1.64)
N	4133	4133	4133	4052	4052	4052	4316	4316	4316

	Canada			UK			USA		
	Workload	Family	Other	Workload	Family	Other	Workload	Family	Other
Gender (female = 1)	0.522***	1.326	0.557***	0.645**	2.419***	0.831	0.669***	1.562**	0.639***
	(-5.04)	(1.61)	(-5.38)	(-2.09)	(2.95)	(-1.14)	(-2.75)	(2.49)	(-3.94)
Children below	0.636***	5.413***	0.799	0.645*	4.692***	0.880	1.393*	5.745***	1.133
13 years	(-2.72)	(9.05)	(-1.64)	(-1.84)	(4.06)	(-0.65)	(1.72)	(6.75)	(0.85)
Employed	6.052***	0.767	1.117	9.513***	0.780	1.182	4.777***	0.683**	1.057
(> 20 hours/week)	(6.12)	(-1.51)	(0.78)	(8.23)	(-1.06)	(0.98)	(6.49)	(-2.16)	(0.45)
Partner in household	1.775*** (3.40)	2.026*** (2.84)	1.763*** (4.39)	0.726 (-1.13)	0.754 (-0.97)	0.723 (-1.29)	1.769*** (3.19)	1.811** (2.68)	1.169 (1.05)
N	22063	22063	22063	7587	7587	7587	4085	4085	4085

	Denmark			Norway			Sweden		
	Workload	Family	Other	Workload	Family	Other	Workload	Family	Other
Gender (female = 1)	0.591***	1.744**	0.851	0.382***	0.959	0.578**	0.624**	1.245	0.903
	(-2.98)	(2.37)	(-1.04)	(-3.86)	(-0.14)	(-2.57)	(-2.18)	(0.87)	(-0.56)
Children below	0.988	5.150***	1.066	0.951	4.317***	1.062	1.068	6.961***	0.872
13 years	(-0.06)	(3.80)	(0.37)	(-0.19)	(3.76)	(0.25)	(0.22)	(5.55)	(-0.54)
Employed	9.305***	1.647	1.505**	8.390***	1.684	1.593*	22.358***	3.495***	2.504***
(> 20 hours/week)	(6.23)	(1.55)	(2.29)	(5.97)	(1.52)	(1.81)	(8.14)	(4.29)	(4.68)
Partner in household	1.676** (2.21)	2.481* (1.90)	1.467* (1.80)	1.201 (0.52)	0.907 (-0.24)	1.004 (0.01)	1.536 (1.44)	1.793 (1.60)	1.729** (2.45)
N	6222	6222	6222	3983	3983	3983	3627	3627	3627

	Greece			Italy			Spain		
	Workload	Family	Other	Workload	Family	Other	Workload	Family	Other
Gender (female = 1)	0.359***	2.130**	0.379***	0.464**	2.916**	0.621*	0.710	3.293***	0.746
	(-3.33)	(2.13)	(-4.72)	(-2.16)	(2.54)	(-1.68)	(-1.53)	(4.86)	(-1.59)
Children below	1.390	9.157***	1.698**	1.875	7.026***	2.551**	0.963	6.382***	1.768**
13 years	(0.81)	(6.77)	(2.13)	(1.55)	(4.68)	(2.47)	(-0.14)	(7.97)	(2.61)
Employed	6.192***	0.774	0.567*	5.267***	1.208	1.251	6.304***	1.450*	1.350
(> 20 hours/week)	(3.46)	(-0.79)	(-1.70)	(4.08)	(0.55)	(0.73)	(8.76)	(1.74)	(1.59)
Partner in household	1.267 (0.67)	2.690 (2.10)	1.009 (0.04)	0.815 (-0.55)	0.999 (-0.00)	0.997 (-0.01)	1.096 (0.38)	1.208 (0.75)	0.842 (-0.87)
N	4235	4235	4235	4065	4065	4065	4979	4979	4979

Notes. The table shows relative risk ratios for all reasons relative to the reference category (financial reasons); exponentiated coefficients; *z* statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; controlled for age and education.

As an example interpreting Table 3.6, a relative risk ratio of 0.538 for the gender variable and the category “workload” in the Austrian sample indicates that for women compared to men there is a 0.46 percent lower probability to report workload than financial reasons as the main barrier. In contrast, a relative risk ratio of 2.517 for the gender variable and the category “family” (Austrian sample again) indicates that women compared to men have a 2.517 times higher probability to report family responsibilities than financial reasons.

Looking at the countries with a Continental welfare state system, we find that in Austria and in Germany women compared to men have a significant lower probability to report high workload as a barrier to training than reporting financial reasons (reference category). There is no significant effect in Belgium. In all three countries, women compared to men have a significant higher probability to report family responsibilities as a barrier than reporting financial reasons. Having children below 13 increases the probability to report family responsibilities more often than reporting financial reasons, whereas being employed increases the probability to report high workload more often than financial reasons.

The results concerning gender in the Liberal welfare state regimes point into the same direction: Having young children increases the probability to report family responsibilities compared to financial reasons and being employed increases the probability to report high workload compared to financial reasons. However, compared to the latter the results suggest greater gender equality in the reported barriers. For the UK, having a partner has no significant effect, whereas in Canada and in the US having a partner increases both, the probability to report family responsibilities and high workload, compared to reporting financial reasons.

When looking at the Nordic countries, we find greater gender equality compared to the other countries. Only in Denmark, women compared to men have a significant higher probability to report family responsibilities than reporting financial reasons. Nevertheless, the probability to report high workload for women compared to men is still lower than reporting financial reasons. As before, having young children, increases the probability to report family responsibilities, whereas being employed increases the probability to report high workload compared to financial reasons as a barrier to participation in

training. For Sweden we find outstanding results as being employed increases the probability to report high workload compared to financial reasons by 22 times.

For the Southern countries, the results on differences in reported barriers between men and women are very similar to those of the Liberal and Continental countries. However, having young children increases the probability to report family responsibilities compared to financial reasons to a greater extent than in the other countries. Furthermore, being employed increases the probability to reporting high workload compared to reporting financial reasons to a lesser extent than in the Continental and Nordic countries. This suggests that financial reasons play a larger role in the Southern welfare states.

Summing up, we find differences in the effects of gender, employment status, having young children, or having a partner across different welfare state regimes. Not surprisingly, having young children increases the probability to report family responsibilities compared to financial reasons as barriers and being employed increases the probability to report a high workload compared to financial reasons. However, there are differences in the probabilities across welfare state regimes. The presence of young children increases the probabilities to report family responsibilities to the larger extent in the Southern countries and, surprisingly, to the lowest extent in Belgium.

Being employed increases the probability to report high workload compared to financial reasons to the lowest extent in the Southern countries and to the highest extent in Sweden and Belgium. In the Nordic countries, there seems to be less gender inequality as the probability to report any other barriers compared to financial barriers differs only slightly between men and women.

3.6 Conclusion

Our descriptive results show that in most of the countries, men are more likely to participate in training. Exceptions to this are countries characterized by a Nordic welfare state. These results are not very surprising given that previous research has pointed into this direction (Boeren, 2011; Desjardins et al., 2006). Although this has been known for several decades, substantial training inequalities related to gender, employment status and family structure remain.

In the subsequent analyses we investigated which factors affect the gender differences in participation across countries. Controlling for socio-demographic characteristics, it becomes obvious that some of the gender imbalance is due to employment rates that differ between men and women. Nordic countries show greater gender equality on the labor market. In contrast, the male breadwinner model is still present in the Southern countries. Figures on female employment in Greece, Spain and Italy show that women traditionally work less compared to other European countries and carry out more unpaid work (OECD, 2011a). As training is mostly linked to employment, this gives fewer opportunities for educational activities (Desjardins et al., 2006).

Having young children is related to less participation in training in all countries but the United States. Having children reduces time one can spend on educational activities and additionally could be related to the fact that fewer adults with young children have fulltime jobs, and therefore face fewer opportunities for training. The results for the United States are consistent with previous research (see i.e., Elman & O'Rand, 2002; Simpson et al., 2002). One possible explanation for this effect is that especially fathers tend to invest more time in their careers to create more security for their families once they are responsible for children.

These observed country differences suggest that welfare policies have an impact on the participation in training for both, men and women, through their institutional framework. As an example, in the Nordic countries, where women are given more flexibility concerning the reconciliation of work and family responsibilities (Abrahamson & Wehner, 2006), we find greater participation rates for women than for men.

Going beyond participation rates and factors that might influence them, our main contribution to the existing literature lies in the detailed investigation of barriers to training. We find that the most important barriers reported are being too busy at work, family responsibilities, and financial reasons. The reported frequency differs across welfare state systems as cost issues are most present in the Liberal welfare states, whereas Southern countries report family responsibilities more often. Analyzing the probability to report certain barriers by gender, we find that in almost all countries women compared to men have a higher probability to report family responsibilities and a lower probability to report high workload

than financial reasons. Exceptions are Sweden and Norway, where we find no significant effect for women compared to men, which is in line with previous findings on greater gender equality in the Nordic countries.

It is important that the barriers to training are reduced in order to enable all adults who want to participate in training to actually do so. Knowing the respective barriers is a first step to change the organization and provision of training opportunities in order to encourage participation. Depending on the welfare states the conclusions drawn from our results differ: in Liberal states reducing financial burden could be effective, for example through training investments by the state or employers, whereas in Southern states improving childcare opportunities could be supportive in reducing gender inequalities on the labor market and in training. Furthermore, one could find innovative ways to organize training activities or improve ways in which informal learning opportunities can be formally recognized.

Our results suggest that the institutional framework, in this case welfare state regime, has an impact on individual decisions concerning participation in training. Further research could look into the role of other context variables as explanatory factors, such as labor market characteristics, differences in the educational system or differences in school-to-work-transitions.

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4 Study 3: Participation of migrants in non-formal training: An international comparison using PIAAC data

4.1 Abstract

Migrants in OECD countries have lower chances on the labor market, lower educational attainment, their qualifications from other countries are often not recognized in the host country, or their skills sometimes do not match with the local labor demands. Non-formal education or 'lifelong learning' is a possible way to mitigate these problems and address existing inequities. This paper thus analyzes the following key questions: Does training participation vary between migrants and natives? Is it possible to distinguish any patterns across countries? Do the same kind of barriers prevent migrants in comparison to natives from participation in training? Using data from the Programme for the International Assessment of Adult Competencies (PIAAC), I confirm previous findings that migrants participate less in training than natives. These disadvantages, however, tend to disappear in the second generation. I also show that formal educational attainment cannot explain lower training participation of the first generation. A possible explanation is that, compared to those who completed their formal education in the host country, migrants who obtained a comparable degree abroad exhibit lower levels of literacy, which is an important driver of access to training. First generation migrants also more often tend to report financial reasons as barrier to obtaining training. All these findings are relatively robust across different countries and welfare regimes.

4.2 Introduction

After compulsory education, lifelong learning opportunities are important to maintain or to update skills. This is true for all individuals, but it can be assumed that lifelong learning is especially important for individuals who were educated outside their current country of residence. Educational qualifications and knowledge gained through these educational qualifications vary between different countries. Furthermore, resources that are important in each country might also differ between countries. This leads to a certain specificity of knowledge and skills within each country and qualifications and resources are thus not fully transferable to other countries. Lifelong learning enables individuals educated abroad to

update their skills and to adapt them to the needs of their new country of residence. Moreover, they can obtain certificates to demonstrate the skills they have.

Many countries are shaped by a history of immigration, which affects the lives of individuals and society as a whole. Reasons for migration differ: For example, some countries are influenced by their colonial history, others by their history of "guest worker" programs put in place in order to fill vacant positions on the labor market. According to the OECD and European Union (2015), settlement countries, such as the United States and Canada, consider anyone born abroad an immigrant while there are a range of different concepts in Europe, that reflect different factors, such as current citizenship, citizenship at birth or self-reported ethnicity. The process by which migrants become accepted into society is called integration.[26] Integration "refers to a two-way process of adaptation by migrants and host societies…[and implies] consideration of the rights and obligations of migrants and host societies, of access to different kinds of services and the labour market, and of identification and respect for a core set of values that bind migrants and host communities in a common purpose" (IOM, 2011). Integration is influenced by several factors, such as length of residence, gender, country of origin, and socio-economic factors. Integration usually improves with the duration of residence in a country (Huddleston et al., 2013).

However, integration policies for migrants differ across countries. Integration policies can be more related to integration into the labor market, civic integration (e.g., through language courses), or in education measures. Furthermore, naturalization – which also comes with more rights – is also seen as an integration policy. The conditions for obtaining citizenship in different countries vary, however: in some countries – such as the United States and Sweden – most foreign nationals naturalize after several years of residence, while in other countries it is more difficult to receive the citizenship of the host country, and thus less foreigner naturalize (OECD & European Union, 2015). These different policies may impact on migrants' access to lifelong learning policies and specific barriers to training encountered. Beyond the integration policies, institutions and welfare regimes differ between countries

[26] Other definitions of integration exist of course. For a broader discussion of integration, see Esser (2004).

and may also shape differences in the way opportunities for non-formal training are presented and used by different groups in society.

Research shows that, on average, migrants in most countries have worse outcomes in respect to educational attainment (e.g. Dustmann & Glitz, 2011; Heath et al., 2008; Heckmann, 2008; Jonsson & Rudolphi, 2010; Kristen & Granato, 2007; OECD & European Union, 2015). Furthermore, migrants are more often unemployed than natives (Eurostat, 2020). Qualifications of individuals educated in another country are often not recognized (Huddleston et al., 2013) or skills and qualifications may not fit the local labor requirements (Guo, 2015; Huddleston et al., 2013). UNESCO (2015) argues that global migration is a new challenge for lifelong learning because "new ways of recognizing, validating and assessing learning" (UNESCO, 2015, p. 10) become necessary.

Against this background, lifelong learning opportunities seem to be an important possibility to upgrade migrants' skills or to formalize their knowledge. This might be even more important for first generation migrants educated abroad. Following OECD (2004), training opportunities indeed increase the probability to work and reduce the risk of unemployment. Access to lifelong learning might therefore have a positive effect on the employability of migrants and their integration into society. It can also help highly qualified migrants to formalize their skills (Huddleston et al., 2013). Having their skills formally recognized could enable them to find work that actually fits their skills set.

Lifelong learning can encompass different aspects of learning. Usually, three different types of learning are distinguished: formal, non-formal and informal learning. According to the Classification of Learning Activities (Eurostat, 2016), formal education includes "education that is institutionalised, intentional and planned through public organisations and recognised private bodies" (Eurostat, 2016, p. 14). Examples of formal education are secondary education and university education. Non-formal education is defined in distinction to formal education. It includes "education that is institutionalised, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an addition, alternative and/or complement to formal education within the process of lifelong learning of individuals." (Eurostat, 2016, p. 15). In comparison to formal education, it is usually shorter and less intensive and often provided through courses or workshops. According to the Conceptual Framework

for the PIAAC Background Questionnaire (OECD, 2011, p. 31) "[d]epending on country context, it may cover educational programmes to impart adult literacy, basic education for out of school children, life-skills, work-skills, and general culture." Examples for non-formal education are language classes and worked-based workshops, such as a software course or communication training. Non-formal training also needs to be distinguished from informal learning which is unintentional (e.g., reading books as a leisure activity). Informal learning is not considered as training.

For migrants who have already completed some formal education, non-formal education may the best option, since it takes less time and is more accessible than formal education. Huddleston et al. (2013, p. 27) argue that training helps (newly arrived) migrants to "develop their potential, adapt to the local labour market, and improve their social participation." For migrants, job-related training is especially important because their labor market position is often more vulnerable (Støren & Børing, 2018). This claim is supported by the fact that in many countries, migrants are more likely to work part-time and in less secure jobs (Huddleston et al., 2013; OECD & European Union, 2015). This might decrease the chances for migrants to participate in training because participation rates are lower for part-time workers (Arulampalam & Booth, 1998).

The discussion above shows that lifelong learning and training are important on the labor market and a potential way to mitigate (or exacerbate) disadvantages of migrants. This critically depends on their participation. Therefore, this paper contributes to the literature by investigating the relationship between migration status and participation in training (research question 1). It further examines how different welfare regimes are related to training participation by migrants (research question 2) and which reasons prevent different groups from participation in training (research question 3). Section II explores the theoretical background behind the assumptions in this paper in relation to the relevant literature on the topic. After describing the data and analytical methods in Section III, Section IV presents the results of the analyses. Section V discusses the findings and concludes.

4.3 Theoretical background and literature

Adult learning systems "lie at the intersection of a nation's education and training system, labour market and employment system, and welfare system" (Saar et al., 2013, p. 213). Adult learning is thus not

isolated from other institutional and structural frameworks. Non-formal education is part of the adult learning system and is one form of human capital.

4.3.1 Training as one form of human capital

According to Blundell et al. (1999) there are three different aspects of human capital: innate ability, formal qualifications, and training (on the job). Human Capital Theory (Becker, 1962; Mincer, 1958); assumes that individuals invest in education if they are convinced that this will bring them advantages in the future, such as increased future earnings or better employment opportunities. The most important investments in human capital are investments into (formal) education and training (Becker, 1993). For individuals, human capital is important in order to fully participate in society (Sum et al., 2004). Although they have an incentive to invest in their own human capital, it is more difficult to evaluate human capital investments when they are not as familiar with the institutions, educational opportunities, and the expected gains.

When thinking about differences between migrants and natives in human capital investment, it is important to acknowledge that different aspects of human capital are related: For example, (Leuven & Oosterbeek, 2000) find that training participation is related to educational attainment, meaning that higher educated individuals participate more often in training than less educated. Furthermore, Støren and Børing (2018) show that adults with high education levels (ISCED 5–6) participate roughly three times as much in employer-sponsored job-related training than those with low education levels (ISCED 0–2). This finding is also supported by numerous other studies (for example, Boeren et al., 2010; Desjardins & Rubenson, 2013). Although this applies to both migrants and natives, migrants educated in another country might be at a disadvantage because their qualifications are not always recognized. Moreover, research by Knipprath and De Rick (2015) show for Belgium that social capital can be beneficial for individuals who do not have high educational qualifications. Assuming that social capital from the country of residence are more important, this puts migrants at an disadvantage again.

4.3.2 Training participation of migrants

Countries with policies fostering lifelong learning, the general population has higher labor market and educational outcomes, migrants tend to participate in training more often, and have better outcomes as

well (Huddleston et al., 2013), suggesting that general policies (i.e. policies not targeting migrants in particular) in a society affect chances for migrants. Therefore, adult learning policies need to be put in place that offer opportunities for all. This needs to have an impact on the institutional structures so that everyone has equal access to adult learning, e.g. by providing incentives for individuals and employers (European Commission, 2015, p. 39). However, it is not only important to create learning opportunities but to have useful training activities. This is especially important in light of the findings by Kogan (2016): Participation in training is not always related to positive outcomes. She finds a positive effect on the occupational status of migrants in Italy whereas participation in training had negative effects of finding employment in Ireland. This means that there need to be training opportunities tailored to the needs of migrants.

Research from Germany shows that individuals with a migration background are half as likely to participate in employer-led training than individuals without such a background (Speckesser, 2013). Also, Offerhaus (2014) finds relatively large differences in training rates between immigrants and non-immigrants in Germany, showing that immigrants participate less. Among the socio-demographics analyzed, not being a German native has the largest negative impact on training participation. This is supported by findings from Canada among employees: Canadian-born employees were more likely to receive job-related training than immigrant employees (35% vs. 31% for men and 37% vs. 33% for women) (Park, 2011). Previous research on migrants using data from the International Adult Literacy Survey (IALS) compared Canada, the Netherlands, Switzerland, and the United States, and found that in all countries but the Netherlands, immigrants were less likely to participate in training – when controlling for a number of factors such as gender and level of education (Leuven & Oosterbeek, 2000). Similarly, Desjardins (2020) finds for OECD-countries that foreign-born individuals participate less in training as well. However, he concludes from his findings that this is to a large part explained by socio-demographic factors, such as age, level of education and literacy skills.

Two factors that contribute to differences in training participation seem to be the country of origin and language skills. Barrett et al. (2013) find in a study in Ireland that immigrants from the new EU member states (i.e., from East-European countries) were most disadvantaged and employees from non-EU/non-

English-speaking countries also experienced lower incidence of training than immigrants from Western EU countries or English-speaking non-EU countries. The authors assume that this is partly due to the fact that the disadvantaged immigrants fail to find training-oriented employers, related to disadvantages they face on the labor market. Previous research has shown that training often takes place at the workplace and/or is sponsored by employers (e.g. Desjardins, 2015; Dieckhoff & Steiber, 2011; Leuven & Oosterbeek, 2000). Furthermore, opportunities for training differ depending on the type of job (Schindler et al., 2011) and training opportunities differ across sectors of the economy (Barrett et al., 2013; Offerhaus, 2014; Schindler et al., 2011). Especially jobs for which higher educational qualifications are required often offer more opportunities for training, as do jobs in the civil services sector (Hubert & Wolf, 2007; Kuckulenz, 2006; Schömann & Leschke, 2004). Furthermore, individuals with higher working hours and more tenure are also more likely to participate in training (Hubert & Wolf, 2007; Kuckulenz, 2006; Schömann & Leschke, 2004). Migrants are often at a disadvantage when it comes to these job features: Employed migrants are more likely to work part-time and in less secure jobs in Europe and highly-qualified migrants in the US are more likely to be overqualified for their job (Chiswick & Miller, 2009; Huddleston et al., 2013).

Another reason putting migrants at a disadvantage might be related to the fact that the skills of foreign-trained immigrants and their qualifications do not fit current labor demand (Huddleston et al., 2013). Migrants who acquired their education outside the country might lack official credentials (Guo, 2015), or their educational qualifications may not be officially recognized (Huddleston et al., 2013; Webb, 2015). Research on OECD countries shows that first-generation migrants in most countries have on average worse outcomes than the native-born population in areas such as education attainment and labor market participation (OECD & European Union, 2015).

4.3.3 Barriers to training

Although training has positive effects in terms of economic outcomes, such as wage and employment, and other opportunities (OECD, 2004), there are quite a few individuals who do not participate in training activities. The reasons for this non-participation are varied, including lack of interest, time, or opportunities. According to (Cross, 1981) there are different types of barriers to learning. She

distinguishes between situational, institutional, and dispositional barriers. These different barriers are summarized in Table 4.1.

Table 4.1 Types of barriers according to Cross (1981) and examples

Type of barrier	Situational barrier	Institutional barrier	Dispositional barrier
Reason	Personal situation or the environment	Practices, structures or policies that do not promote training	Attitudes and perceptions about self
Examples	• Lack of time • Cost of training	• No suitable training available • Training takes place at inconvenient location • Requirements/recognition of prior learning	• Lack of confidence in skills • Negative perceptions about own situation

Note. Based on Cross (1981) and adapted to PIAAC (own adaptations).

As Merriam (2005) points out, the chances of participating in learning activities increase when there are learning opportunities in the immediate environment. This environment enabling educational qualifications and training participation is shaped by institutions (Saar et al., 2013). This is in line with the bounded agency model (Rubenson & Desjardins, 2009), which posits that structural and institutional conditions affect the potential to participate in learning opportunities. These structures and institutions in turn are defined by policy measures. The effectiveness of policies to translate into training participation might differ between different groups, though. It is possible that different factors have an influence on training participation of migrants than of natives. Familiarity with the system, language skills, formal requirements, and employment opportunities are possible important so-called barriers that differ between migrants and natives. Furthermore, expected gains from training can differ between these two groups. Overall, this means that migrants might not be able to optimally invest into training, i.e., human capital, under policies not adapted to their specific needs. This would constitute an inefficiency because the potential of migrants is not fully exploited. Against this background, the State has an important role in setting incentives for migrants to reduce possible inefficiencies through targeted policies.

Research focusing on migrants' barriers to training participation indicates that foreign-born adults mostly report family responsibilities and financial constraints as obstacles to participating in training activities (Desjardins, 2020; Park, 2011).

4.3.4 Reasons for participation in training across countries and welfare state regimes

As shown in previous research (Massing & Gauly, 2017) which analyses the whole population, the main reasons for not participating in training differ across countries and different welfare state regimes. This is also likely to be the case for migrants because integration and training policies as well as institutions differ between countries and are related to welfare policies. The exploration of the impact of welfare states and their policies goes back to a theory developed by Esping-Andersen. In his theory, he distinguished three different types of welfare states: Conservative, Liberal, and Social-democratic (Esping-Andersen, 1990). This theory has been extended by introducing other welfare state regimes, such as the Southern Welfare state (Bonoli, 1997; Ferrera, 1996; Leibfried, 1993). Welfare states provide for people in need and provide benefits for certain group of people. Examples for Conservative welfare states are Germany and Austria, for Liberal welfare states the United States and the United Kingdom, for Social-democratic welfare states Sweden and Denmark and for Southern welfare states Italy, Spain and Greece. Conservative welfare states are to a high extent insurance-based and target certain status groups. This means that individuals cover their risks by taking up insurance which can be mandatory. One example is unemployment insurance through which previous labor market participation entails certain benefits. The system is based on labor market participation because it relies on the participation in the labor market to qualify for later entitlements. The welfare benefits of such systems, on the other hand, target the family as a whole and not individuals. This means that needs are assessed on the family and not the individual level, so that other family members are first responsible for providing for other family members before benefits can be taken into account. Liberal regimes have means-based benefits and rely more on individual engagement which means that individuals have more obligations to care for themselves. The level of benefits individuals can rely on are generally low in liberal systems. The benefits in Social-democratic regimes are universalistic and each individual can benefit from them. Many benefits are not related to labor market participation but are services provided by the state. Southern welfare states are characterized by low benefits targeted at the family level. It can be assumed

that the way welfare states are organized may also impact on the integration policies. For example, in the USA and the UK integration is based more on individual engagement (Webb et al., 2016). This means that migrants have to be active themselves, and this might also impact finding training or labor market opportunities, and to integrate socially. In countries belonging to Conservative and Social-democratic regimes, the government takes a much more active role in providing training opportunities, e.g. language and cultural classes, with the specific aim of improving the integration of migrants. Rubenson and Desjardins (2009) suggest that Nordic welfare states are able to create conditions that make it easier for individuals to overcome barriers, such as not having the necessary qualifications. This is also supported by Støren and Børing (2018) who argue that the social policies in Nordic countries incentivize skill development for all employees, and thus, independent of gender and migrant status.

Overall, the literature in line with human capital theory suggests that investments in training have generally positive effects on the labor market, even though evidence is more mixed for migrants (Kogan, 2016; OECD, 2004). Existing evidence also indicates that migrants participate less in training in several countries (e.g. Barrett et al., 2013; Leuven & Oosterbeek, 2000; Offerhaus, 2014). Many important aspects remain unclear, though. Many of the existing studies do not distinguish first- and second-generation migrants to assess longer-term integration prospects. It can be assumed that second-generation migrants can overcome some of the disadvantages of first-generation migrants because they have been educated in the country and are more familiar with the system. However, some disadvantages might still remain because they have less social capital, are sometimes less proficient in the language or face discrimination. Further, a systematic assessment across countries from different welfare state regimes is not yet available. Datasets used for the prior research also lack measures of skills beyond educational attainment, which limits the analysis of prerequisites needed for successful training participation. This paper aims to address these limitations.

4.4 Data & methods

For this research, I use data from the first cycle of the Programme for the International Assessment of Adult Competencies (PIAAC). The study was commissioned by the Organization for Economic Cooperation and Development and carried out in over 40 countries around the world in three different

rounds (2011-12/2014-15 and 2017). In every country, data were collected using complex survey sampling design in order to obtain a representative sample of the resident population aged 16-65 (OECD, 2013). The PIAAC data allows comparative analyses on the working age population (ages 16-65). The sample size in each country was about 5000 respondents. Respondents were asked questions from an extensive background questionnaire by an interviewer using computer-assisted interviewing. The background questionnaire gathers extensive information on educational activities (formal and non-formal education), migration background, work as well as other information on activities by respondents. The interview was carried out in one of the official country languages. After that, respondents had to carry out an assessment of their basic skills (literacy, numeracy and in some countries problem-solving in technology rich environments[27]); this means that they completed tasks on the computer on their own. For this paper, data from Austria, Belgium (Flanders), Germany, Denmark, Norway, Sweden, the United Kingdom (UK), the United States (USA), Spain, Italy and Greece are analyzed. These countries were chosen because they have an immigrant population (first and second generation) of at least 10 %, and the sample sizes are large enough to carry out the analyses (n between 482 and 1,866 in different countries). Furthermore, these countries cover the different welfare states regimes (see Table 4.2). To exclude respondents who were still in initial education, all analyses are based on respondents aged 25 and above.

[27] For more details on the skill assessment, see OECD (2013).

Table 4.2 Welfare state regimes and countries

Welfare state regime	Countries
Conservative	Austria Belgium Germany
Social-democratic	Denmark Norway Sweden
Liberal	UK USA
Southern	Spain Italy Greece

Note. Based on Esping-Anderson (1990), Bonoli (1997); Ferrera (1996) and Leibfried (1993).

The central dependent variable for the analyses is participation in non-formal education in the last 12 months[28] (referred to as *participation in training*). Respondents who reported that they participated in any kind of non-formal training are considered as participants while the others are defined as non-participants. The central explanatory variable is migration background. The PIAAC questionnaire assesses the country of birth and, for those who were not born in the country of residence, the age at which individuals migrated, as well as whether parents were born in the country or abroad. From this, the migration groups can be derived: first generation migrants are migrants who migrated to their host country themselves.[29] Second-generation migrants were born in their country of residence but at least one of their parents was born in another country. Natives are individuals who were born in the country, as well as their parents. The PIAAC questionnaire furthermore includes various other background variables, such as age, gender, educational attainment and employment status which can be used as additional control variables.

Another central control variable is literacy skills. Literacy skills are seen as an important prerequisite for the acquisition of further skills. In the conceptual framework for PIAAC, literacy is defined as "[…]

28 In PIAAC, training participation was measured using this reference period. Although previous participation in training might also be relevant, it is difficult for respondents in surveys to remember activities that took place long time ago. Furthermore, participation during the last 12 months is seen as a good indicator for general training participation.
29 This does not distinguish between individuals who migrated before school age and attended school in their host country. In some research, they are called the 1.75 generation (Rumbaut, 2004). This is due to the fact that the number of migrants who migrated before the age of six is very small. According to the (United Nations Department of Economic and Social Affairs, 2020), only 12% of all migrants were younger than 18 years old in 2010. In the PIAAC sample of the countries investigated, about 12% migrated before the age of 6. Adding them to the group of second-generation migrants would however also be imprecise, also because school age varies between countries.

understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential." (PIAAC Literacy Expert Group, 2009). Literacy skills were measured through an assessment of competencies and scores were subsequently estimated using item-response theory. Plausible values – which are multiple imputations – were estimated for the literacy skills score.[30] The international mean for the literacy scale in PIAAC was set to 250 with a standard deviation of 50 (OECD, 2013).

In order to obtain information on barriers to participation through the background questionnaire, respondents who had not participated in non-formal education were asked whether they would have liked to participate in training activities and, if so, which reasons prevented them from doing so. Similarly, respondents who had participated in training were asked whether they would have liked to participate in training. They were all asked about the reasons that prevented them from participating in education. Table 4.3 shows the wording of the question on barriers to training and the response categories (first column). The reasons for not participating in training are classified into different groups for the analyses: work-related, financial, family, dispositional, and other. These thematically grouped barriers of participation are displayed in the second column.

Table 4.3 Reasons preventing from participation in education and training as measured in the PIAAC BQ

	Which of the following reasons prevented you from participating in education and training? Please indicate the most important reason.	Grouped reasons
1	I did not have the prerequisites	Dispositional reasons
2	Education or training was too expensive/I could not afford it	Financial reasons
3	Lack of employer's support	Work-related reasons
4	I was too busy at work	Work-related reasons
5	The course or programme was offered at an inconvenient time or place	Other
6	I did not have time because of childcare or family responsibilities	Family reasons
7	Something unexpected came up that prevented me from taking education or training	Other
8	Other	Other

Note. Reasons grouped by author.

[30] For more information on plausible values, see von Davier et al. (2009).

The analyses in Section IV are related to my three main research question formulated in Section I:

1. How much do different migration groups participate in training across the countries analyzed?
2. Are there differences across different welfare state regimes?
3. Which are reasons preventing the different groups from participation in training?

Section IV starts with a descriptive perspective on research questions 1 and 2, showing participation in training activities across different groups (first-generation migrants, second-generation and natives) and across different countries of residence belonging to different welfare state regimes.

After that, I present results from different multivariate analyses. Given the dichotomous nature of the outcome variable, I use multiple logistic regressions. Logistic regressions are suitable for dichotomous dependent variables, describing the relationship between the dependent variable and one or more independent variables by estimating probabilities using logistic function. The dichotomous dependent variable in my analyses is participation in training (yes or no). The results of the analyses are presented in odds ratio: an odds ratio above 1 means that the chances to participate in training are higher in comparison with the reference group, while an odds ratio below 1 means that the chances are lower. Several control variables were included into the models as these might explain participation in training and correlate with migration status: gender (female=1), age (measured in years), and highest level of formal educational attainment (measured in ISCED, represented through 6 main levels). I also examine the role of literacy skills in the language of the country of residence and working more than 20 hours a week.

Related to research question 3, I analyze whether respondents who did not participate would have liked to join training activities and show the reasons preventing these different groups from participating, again across different countries. Similar to the analyses of research questions 1 and 2, I present results from multiple regressions as a second step. As the outcome is categorical, I use multinominal logistic regressions. Results are presented as relative risk ratios, showing the probability to report one category compared to a reference category. The dependent variable in the model measures barriers to training participation in four categories: work-related reasons, family responsibilities, financial reasons, missing

prerequisites, and others (as an aggregate of all other categories measured). The reference category is "work-related reasons" in the analyses which is the category that was mentioned most frequently.

4.5 Results

4.5.1 Participation in training

Figure 4.1 shows the participation in training across different countries and migration status. In this figure, participation in training includes all training activities, whether they were work-related or general, meaning that participation in training was taken up because of other reasons than work. The descriptive results show that the participation in training is highest in Nordic countries, thus with a social-democratic welfare state regime. For natives in all Nordic countries, participation rates are above 50% and even above 60% in Denmark and Sweden for natives. Participation is lowest in Southern countries, especially in Greece and Italy (18% or 22% respectively for natives). Countries with conservative and liberal welfare systems range in between. Participation of migrants follows this general trend: In countries with higher participation rates, migrants also participate more often in training than in other countries. However, the gap between natives and first-generation migrants is quite large in Sweden and Denmark in the Nordic countries and large in Germany, and also large in Italy (at least relative to the low participation rates). In all countries, second-generation migrants participate more often in training than respondents with own migration experience. Interestingly, in Spain and the United States the participation rate of second-generation migrants is higher than for natives.

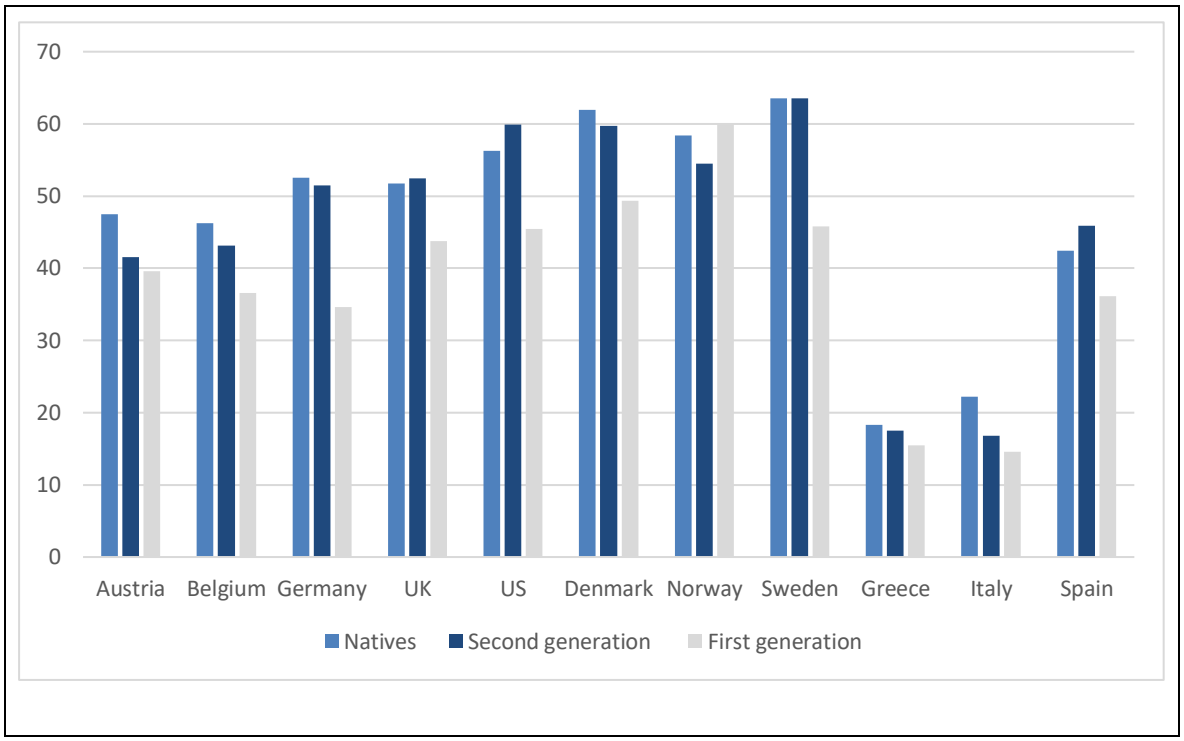


Figure 4.1 Participation rate in training (in %), by country and migration status

In the following, multivariate regression results are presented. The aim of the analysis is to explain the participation in training activities for natives, second- and first-generation migrants when controlling for several other factors that might be related to training. Model 1 reproduces the descriptive statistics by estimating the participation in training activities, only including migrant generation as explanatory variable. Besides specific estimates, this also provides significance levels for the descriptive differences observed before. Table 4.4 gives the odds ratios for the first model. In all countries, irrespective of their welfare state regime, being a first-generation migrant decreases the chances of participation in training activities. This effect is significant in nine out of 11 countries, but not in Norway and Greece (using 5% as a minimum level of significance). The chances to participate in training for first-generation migrants relative to natives are lowest in Sweden, Denmark, Germany, and Italy. Austria is the only country in which second-generation migrants have a significantly lower chance to participate in training, in all other countries second-generation migrants do not have a significantly higher or lower chance than natives to participate in training activities.

Table 4.4 Odds ratios showing the likelihood of participating in training – Model 1

	Austria	Belgium	Germany	UK	USA	Denmark	Norway	Sweden	Greece	Italy	Spain
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd gen.	0.788**	0.879	0.961	1.031	1.160	0.911	0.855	1.001	0.949	0.709	1.150
	(-2.54)	(-1.03)	(-0.50)	(0.28)	(1.33)	(-0.65)	(-0.95)	(0.01)	(-0.26)	(-0.90)	(0.62)
1st gen.	0.727***	0.670***	0.479***	0.728***	0.646***	0.598***	1.074	0.486***	0.817	0.596**	0.769***
	(-3.28)	(-3.10)	(-6.84)	(-3.33)	(-4.07)	(-8.32)	(0.75)	(-8.83)	(-1.01)	(-2.47)	(-2.82)
N	4133	4045	4312	7566	4081	6219	3980	3625	4233	4065	4975

Notes. The table shows results of a multivariate logistic regression (exponentiated coefficients); *z* statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Model 2 (see Table 4.5) includes formal educational qualifications (measured in ISCED) as control variables in addition to gender and age to assess whether these patterns can already be explained by educational achievement. When using these controls, the results remain very similar to model 1. Again, first-generation migrants have a significantly lower chance to participate in training than natives, once again with the exception of Norway and Greece, where the results show no significant differences. For second-generation migrants, the odd ratios do not change much, even though the only result that was significant before (in Austria) is not significant anymore. The results across all countries show that individuals between 60 and 65 have significantly lower chances to participate in training. In some countries (e.g., Austria, Greece, and Spain) this effect already becomes visible at the age of 55. Furthermore, the higher the educational level, the higher the chances to participate in training. Interestingly, although formal education is an important driver of training participation, it does not explain the difference in training participation between first-generation migrants and natives.

Table 4.5 Odds ratios showing the likelihood of participating in training – controlling for age, gender, and education – Model 2

	Austria	Belgium	Germany	UK	US	Denmark	Norway	Sweden	Greece	Italy	Spain
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd generation	0.901	1.041	1.034	0.858	1.043	0.719*	0.793	0.901	0.918	0.517*	1.039
	(-0.96)	(0.28)	(0.38)	(-1.35)	(0.34)	(-1.92)	(-1.30)	(-0.85)	(-0.35)	(-1.68)	(0.17)
1st generation	0.644***	0.692**	0.548***	0.514***	0.674***	0.495***	0.859	0.452***	0.786	0.561**	0.701***
	(-4.03)	(-2.58)	(-5.12)	(-6.03)	(-3.76)	(-9.35)	(-1.55)	(-8.36)	(-1.17)	(-2.62)	(-3.27)
25 – 29 years (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30 – 34 years	0.810	1.442**	0.973	1.043	1.211	1.074	1.197	0.969	0.892	0.956	1.119
	(-1.28)	(2.43)	(-0.18)	(0.33)	(1.22)	(0.49)	(1.41)	(-0.21)	(-0.56)	(-0.24)	(0.85)
35 – 39 years	0.857	1.227	0.997	1.054	0.940	1.001	1.154	0.856	0.685**	0.984	1.051
	(-1.12)	(1.47)	(-0.02)	(0.39)	(-0.43)	(0.01)	(1.00)	(-0.94)	(-2.14)	(-0.10)	(0.37)
40 – 44 years	0.895	1.167	1.362*	1.404**	1.013	1.112	1.102	0.922	0.998	1.159	0.931
	(-0.76)	(1.05)	(1.86)	(2.21)	(0.07)	(0.76)	(0.70)	(-0.55)	(-0.01)	(0.95)	(-0.54)
45 – 49 years	0.872	1.153	1.089	1.237	0.877	0.936	1.087	1.145	0.555***	1.178	1.078
	(-1.03)	(1.05)	(0.59)	(1.54)	(-0.76)	(-0.56)	(0.58)	(0.93)	(-3.34)	(0.87)	(0.58)
50 – 54 years	0.725	1.135	0.942	1.239	0.916	1.040	0.791	0.971	0.497***	1.152	0.762*
	(-1.98)	(0.84)	(-0.42)	(1.63)	(-0.46)	(0.29)	(-1.60)	(-0.17)	(-3.08)	(0.61)	(-1.88)
55 - 59 years	0.358***	0.700***	0.590***	0.975	0.910	0.816*	0.609***	0.792	0.240***	0.844	0.597***
	(-6.58)	(-2.75)	(-3.36)	(-0.18)	(-0.63)	(-1.76)	(-3.30)	(-1.30)	(-5.93)	(-0.71)	(-3.63)
60 - 65 years	0.128***	0.456***	0.308***	0.505***	0.520***	0.343***	0.305***	0.405***	0.289***	0.312***	0.315***
	(-11.05)	(-4.70)	(-7.93)	(-5.28)	(-4.03)	(-9.82)	(-8.15)	(-5.47)	(-4.87)	(-5.06)	(-6.78)
Gender (female=1)	0.995	1.028	0.844**	0.870*	0.913	1.144**	1.044	1.071	0.887	0.655***	0.827***
	(-0.06)	(0.34)	(-2.44)	(-1.92)	(-0.93)	(2.15)	(0.60)	(0.77)	(-1.18)	(-4.98)	(-3.06)
Lower second. or less (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upper secondary	1.999***	2.173***	2.703***	2.344***	2.151***	1.902***	1.751***	1.959***	2.048***	2.753***	2.275***
	(5.92)	(6.38)	(5.66)	(10.55)	(7.72)	(7.88)	(4.91)	(6.02)	(3.09)	(7.54)	(8.69)
Post-secondary, non tertiary	3.608***	3.069***	4.743***	4.310**	3.840***	2.732***	2.121***	3.462***	3.029***	5.157***	3.268***
	(9.45)	(5.35)	(8.84)	(2.57)	(8.69)	(3.72)	(5.42)	(7.01)	(4.37)	(4.55)	(4.05)
Tertiary – professional degree	5.281***	6.409***	5.991***	3.464***	5.494***	4.471***	3.448***	3.311***	5.041***	0.985	3.380***
	(10.42)	(12.70)	(10.45)	(10.75)	(11.36)	(15.57)	(7.71)	(7.64)	(6.62)	(-0.04)	(11.11)
Tertiary - bachelor degree	3.614***	5.977***	7.872***	6.036***	7.399***	3.892***	3.975***	4.803***	6.861***	8.156***	5.323***
	(4.15)	(6.73)	(7.93)	(16.31)	(20.50)	(9.66)	(12.69)	(11.05)	(8.89)	(14.10)	(18.78)
Tertiary – master/ research degree	6.496***	8.341***	9.655***		15.169***	6.155***	4.095***	6.134***	15.990***	17.643***	8.028***
	(11.64)	(13.69)	(12.25)		(17.09)	(12.97)	(13.46)	(12.74)	(9.81)	(9.68)	(19.00)
N	4133	4045	4312	7566	4081	6219	3980	3625	4233	4065	4975

Notes. The table shows results of a multivariate logistic regression (exponentiated coefficients); z statistics in parentheses; * $p < 0.05$, ** $p < 0.01$; Ref. = Reference category.

While at first sight it appears counter-intuitive that formal education contributes so little to explaining this gap, there might be good reasons for this phenomenon. Although educational qualifications are often used as a proxy for skills, previous research shows that equivalent educational qualifications are not always related to equivalent literacy skills across different countries (Massing & Schneider, 2017). This means that individuals with the same educational qualification do not always have the equivalent skills across different countries. This can also be expected across different migration groups within a country, meaning that although migrants might have equivalent qualifications, they are not linked to equivalent skills. First-generation migrants who have not completed their educational career in their country of residence are likely to have lower literacy skills in the country language. Fortunately, the PIAAC data allows to test this hypothesis. Appendix Figure B.1, compares the literacy skills (following Massing & Schneider, 2017) between migrant groups at specific levels of educational qualification. The results show that in general natives have higher literacy skills than first generation migrants in all countries. The differences are quite substantial (e.g., in Austria natives with an upper secondary or post-secondary, non-tertiary education (ISCED level of 3 or 4) have a literacy score of 275 and migrants with the same education a literacy score of 243). In contrast, second-generation migrants even achieve higher literacy skills than natives in some countries, e.g., individuals with a master's degree or higher (ISCED of 5A Master or ISCED 6) in Norway. The differences between natives and second-generation migrants are never substantial. This indicates that educational qualifications with regard to literacy are only comparable if they were obtained in the host country. One way to address this lack of comparability is to explicitly include literacy skills in the regression analysis in addition to educational qualifications.

Model 3 (presented in Table 4.6) contains literacy skills in line with the above discussion. When including literacy skills as control variable, first-generation migrants are still at a disadvantage when it comes to participation in training activities in most countries. Again, the results are not significant in Norway and Greece, but now also become insignificant in Belgium and the US. In fact, all odd ratios increase relative to the previous specification. This confirms that literacy skills on top of formal education can explain some of the gap in training participation for first generation migrants. The effect of literacy skill is highly significant and positive in all countries.

Table 4.6 Odds ratios showing the likelihood of participating in training – additionally controlling for literacy skills – Model 3

	Austria	Belgium	Germany	UK	USA	Denmark	Norway	Sweden	Greece	Italy	Spain
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd generation	0.930	1.064	1.062	0.925	1.101	0.736*	0.803	0.921	0.885	0.525	1.067
	(-0.67)	(0.43)	(0.56)	(-0.70)	(0.78)	(-1.77)	(-1.21)	(-0.66)	(-0.50)	(-1.58)	(0.29)
1st generation	0.741**	0.845	0.692**~	0.632***	0.850	0.690***	1.095	0.714***	0.814	0.679*	0.787***
	(-2.56)	(-1.14)	(-2.98)	(-4.18)	(-1.50)	(-4.30)	(0.90)	(-3.11)	(-0.98)	(-1.68)	(-2.14)
25 – 29 years (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30 – 34 years	0.846	1.468**	1.014	1.035	1.242	1.131	1.205	0.992	0.871	0.957	1.130
	(-1.00)	(2.51)	(0.09)	(0.26)	(1.35)	(0.85)	(1.43)	(-0.05)	(-0.60)	(-0.23)	(0.91)
35 – 39 years	0.881	1.291*	1.045	1.042	0.956	1.030	1.180	0.857	0.662**	0.991	1.067
	(-0.93)	(1.86)	(0.25)	(0.30)	(-0.31)	(0.20)	(1.16)	(-0.88)	(-2.29)	(-0.05)	(0.48)
40 – 44 years	0.938	1.227	1.448**	1.422**	1.052	1.187	1.143	0.935	0.969	1.167	0.966
	(-0.44)	(1.39)	(2.19)	(2.26)	(0.29)	(1.25)	(0.96)	(-0.42)	(-0.18)	(0.98)	(-0.26)
45 – 49 years	0.932	1.236	1.262	1.283*	0.936	1.036	1.138	1.247	0.527***	1.189	1.120
	(-0.52)	(1.55)	(1.57)	(1.76)	(-0.36)	(0.29)	(0.87)	(1.44)	(-3.61)	(0.91)	(0.86)
50 – 54 years	0.786	1.250	1.144	1.299*	0.960	1.183	0.856	1.087	0.491***	1.182	0.818
	(-1.48)	(1.48)	(0.92)	(1.94)	(-0.21)	(1.24)	(-1.04)	(0.47)	(-3.12)	(0.71)	(-1.37)
55 - 59 years	0.410***	0.795*	0.725**	1.040	0.996	0.964	0.687**	0.907	0.231***	0.917	0.667***
	(-5.55)	(-1.72)	(-2.03)	(0.28)	(-0.02)	(-0.32)	(-2.45)	(-0.52)	(-5.98)	(-0.35)	(-2.80)
60 - 65 years	0.151***	0.524***	0.410***	0.527***	0.571***	0.426***	0.356***	0.507***	0.282***	0.351***	0.356***
	(-10.31)	(-3.93)	(-5.95)	(-4.83)	(-3.24)	(-8.07)	(-6.87)	(-4.02)	(-5.01)	(-4.51)	(-5.83)
	1.006	1.057	0.851*	0.881*	0.926	1.159**	1.075	1.124	0.875	0.662***	0.852***
Gender (female=1)	(0.07)	(0.68)	(-2.30)	(-1.69)	(-0.77)	(2.35)	(0.97)	(1.28)	(-1.29)	(-4.92)	(-2.50)
Lower secondary or less (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upper secondary	1.790***	1.942***	2.106***	1.935***	1.689***	1.618***	1.638***	1.625***	1.893***	2.295***	2.019***
	(5.07)	(5.34)	(4.11)	(7.67)	(4.55)	(5.92)	(4.23)	(4.21)	(2.67)	(5.70)	(7.00)
Post-second., non-tertiary	2.805***	2.623***	2.699***	3.005*	2.920***	2.186***	1.938***	2.446***	2.739***	3.931**	2.826***
	(7.14)	(4.60)	(5.29)	(1.69)	(6.71)	(2.93)	(4.69)	(5.07)	(3.79)	(3.76)	(3.46)
Tertiary – prof. degree	4.258**	4.998***	3.868***	2.665***	3.714***	3.308***	2.967***	2.295***	4.408***	0.812	2.955***
	(9.15)	(10.54)	(7.37)	(7.94)	(8.05)	(11.59)	(6.72)	(5.21)	(5.82)	(-0.49)	(9.45)
Tertiary - bachelor degree	2.686***	4.685***	4.885***	4.086***	4.496***	2.793***	3.275***	3.011***	5.808***	6.163***	4.369***
	(2.94)	(5.58)	(5.77)	(11.60)	(12.60)	(6.98)	(10.95)	(7.14)	(7.62)	(11.37)	(15.19)
Tertiary - master/	4.529**	5.899***	5.179***		8.342***	3.999***	3.180***	3.657***	12.713***	12.701***	6.161***
research degree	(9.30)	(10.74)	(8.07)		(11.50)	(9.59)	(10.75)	(8.33)	(8.58)	(7.99)	(15.21)
Literacy Skills	1.006***	1.005***	1.009***	1.007***	1.007***	1.007***	1.005***	1.009***	1.004***	1.007***	1.004***
	(5.12)	(5.83)	(8.59)	(7.56)	(7.40)	(8.40)	(5.76)	(8.37)	(2.74)	(4.77)	(5.21)
N	4133	4045	4312	7566	4081	6219	3980	3625	4233	4065	4975

Note: The table shows results of a multivariate logistic regression (exponentiated coefficients); *z* statistics in parentheses; $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$; Ref. = Reference category.

Summing up, it becomes evident that even when controlling for educational qualifications and age, first-generation migrants are at a disadvantage when it comes to participation in training. For second-generation migrants, however, the model including education and age as control variables no longer yields a significant disadvantage in their training participation compared to that of natives. This indicates that second-generation migrants seem to be successful in overcoming barriers that prevent first-generation migrants. Further results show that first-generation migrants are still at a disadvantage in most countries when controlling for important variables, such as educational attainment and literacy skills. Literacy skills seem to be an important aspect: respondents with higher literacy skills have higher chances of participating in training activities.

4.5.2 Barriers to training

As a next step, I assess whether individuals who have not participated in training in the past twelve months would have wanted to participate in training. As mentioned further above, there are various reasons why individuals do not participate in training, some of them being unfamiliar with the system, missing language skills or formal requirements, and employment opportunities. Table 4.3 in the theory section, lists the classification of barriers into different groups and possible examples.

Figure 4.2 shows that, while there is an unmet need among all groups (natives, second- and first-generation migrants), it is highest for first-generation migrants and lowest for natives in almost all countries. Differences between first-generation migrants and natives tend to be very large. Also, second-generation migrants are more likely than natives but less likely than first generation migrants to report a willingness to participate in training. Only in Austria the second generation even mentions a higher willingness to participate in training and in Belgium and Germany, second-generation migrants report less willingness than natives.

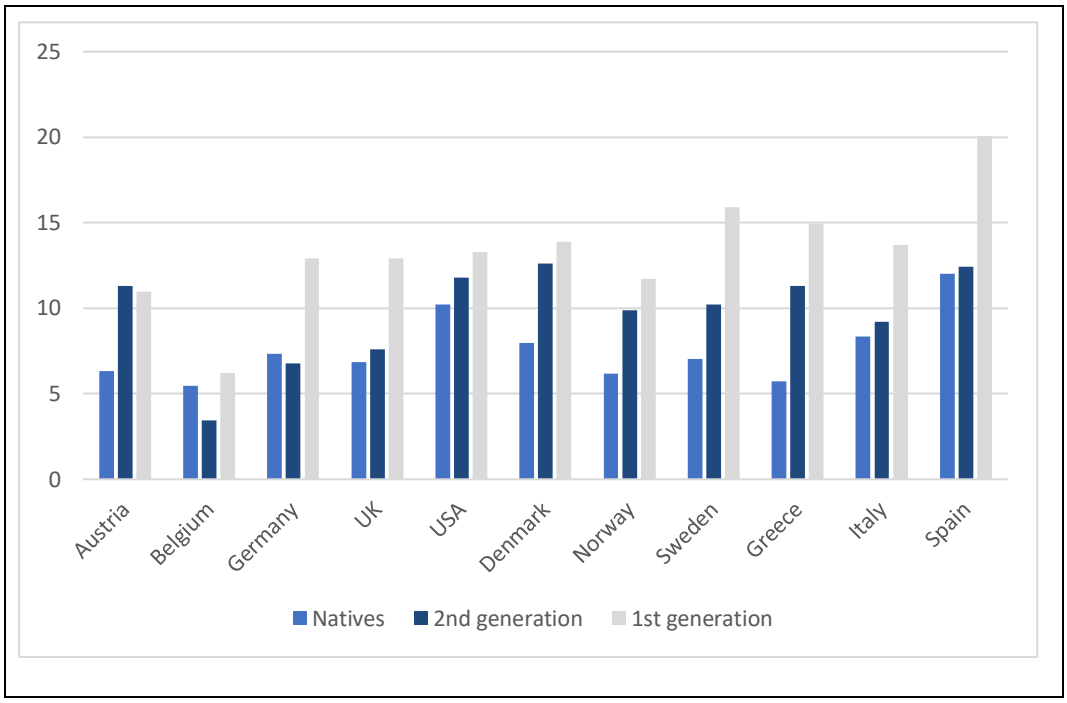
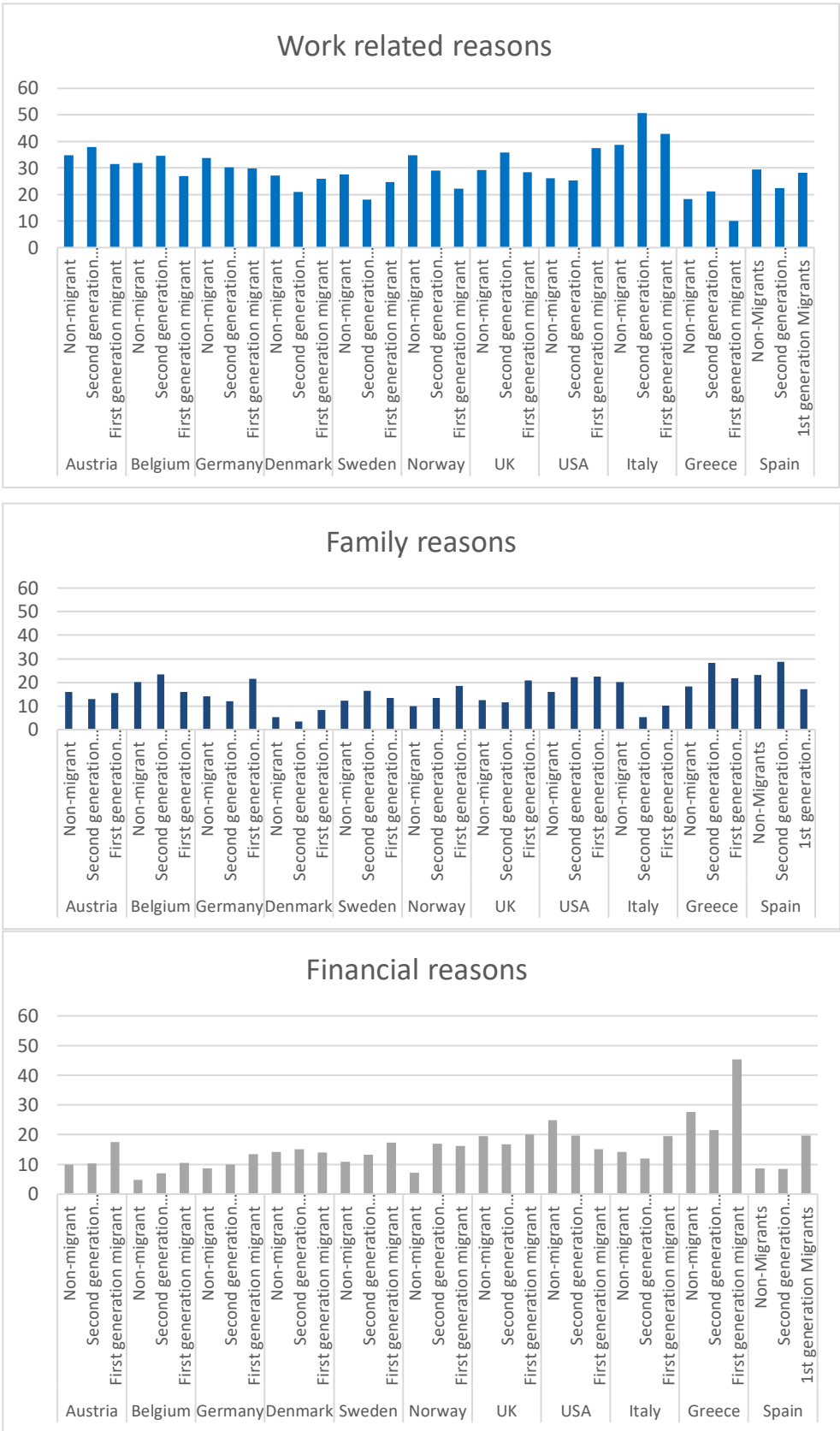


Figure 4.2 Share of non-participants who would have liked to participate in training (in %)

Figure 4.3 shows the different reasons preventing individuals from participating in training activities, distinguishing different migration status. There are three substantive reasons shown in detail.

For all groups, **work-related reasons** are mentioned most frequently across all countries for not being able to participate in training activities, with the exception of Greece, where financial reasons are mentioned more often, especially by respondents with own migration experience. In all countries but the United States, Greece and Italy, work-related reasons are mentioned slightly more often by natives than by first-generation migrants. The gap between these two groups is highest in Norway (34.8% vs. 22.2%), the US (37.5% vs. 25.0%) and Greece (45.4% vs. 27.7%). Looking at second-generation migrants, there is no clear pattern across the different countries: In some countries, second-generation migrants mention work-related reasons more often than natives (e.g., Austria, Belgium, UK), whereas in others, second-generation migrants mention it less often (e.g., Denmark, Sweden, Norway, Greece, US) and in yet others the two groups mention it almost equally often (e.g. Spain, Italy, Germany).



Note. The figure restricts attention to those not participating in training but who would have liked to do so. It shows percentages of respondents mentioning the above reasons for non-participation.

Figure 4.3 Reasons preventing training participation in different migration groups across countries

Financial reasons seem to be more important for first-generation migrants than natives, with only few exceptions: In the United States, first-generation migrants choose this reason less often (15.1% vs. 25.0%). In Denmark and the UK, first-generation migrants mention it with a similar frequency than natives (DK: 14.0% vs. 14.3% and UK: 20.1% vs. 19.6%).

Family reasons are least mentioned in Denmark, and this across all migration groups. In seven countries (Germany, Denmark, Sweden, Norway, UK, US and Greece) first-generation migrants mention this reason more often than natives, although differences are small in three of these countries (Denmark, Sweden, Greece) and almost non-existent in Austria (15.6% vs. 16.0%).

Missing prerequisites (not shown in graph below) are generally mentioned very rarely; however, this reason seems to be slightly more relevant for first-generation migrants, especially in Denmark where 8.6% of first-generation migrants mention this barrier whereas only 1.3% of natives do.

Table 4.7 Barriers to training (relative risk ratios)

	Austria			**Belgium**			**Germany**		
	Financial reasons	**Family reasons**	**Missing prerequisites**	**Financial reasons**	**Family reasons**	**Missing prerequisites**	**Financial reasons**	Family reasons	Missing prerequisites
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd generation	0.845 (-0.40)	0.598 (-1.27)	0.000*** (-4.55)	1.299 (0.41)	1.111 (0.43)	1.145 (0.01)	1.422 (1.17)	1.111 (0.43)	0.809 (-0.19)
1st generation	1.810* (1.85)	1.017 (0.05)	1.437 (0.33)	2.881* (1.97)	1.619 (1.57)	1.622 (0.50)	1.511 (1.18)	1.619 (1.57)	0.757 (-0.38)
	Denmark			**Sweden**			**Norway**		
	Financial reasons	**Family reasons**	**Missing prerequisites**	**Financial reasons**	**Family reasons**	**Missing prerequisites**	**Financial reasons**	Family reasons	Missing prerequisites
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd generation	0.845 (-0.40)	0.728 (-0.38)	4.102 (1.38)	1.785* (1.77)	2.059* (1.81)	1.910 (1.09)	2.445** (2.09)	1.641 (0.85)	2.027 (0.67)
1st generation	1.810* (1.85)	1.607* (1.76)	7.238*** (4.33)	1.813* (1.97)	1.027 (0.10)	1.766 (1.03)	3.653*** (4.26)	2.797*** (3.50)	4.139*** (2.71)
	UK			**US**					
	Financial reasons	**Family reasons**	**Missing prerequisites**	**Financial reasons**	**Family reasons**	**Missing prerequisites**			
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000			
2nd generation	0.743 (-1.09)	0.792 (-0.56)	0.019 (-0.22)	0.795 (-0.85)	1.409 (1.40)	2.303 (0.91)			
1st generation	1.200 (0.78)	1.880** (2.00)	0.831 (-0.23)	0.460** (-2.68)	0.939 (-0.23)	1.545 (0.84)			
	Italy			**Greece**			**Spain**		
	Financial reasons	**Family reasons**	**Missing prerequisites**	**Financial reasons**	**Family reasons**	**Missing prerequisites**	**Financial reasons**	**Family reasons**	**Missing prerequisites**
Natives (Ref.)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2nd generation	0.459 (-1.13)	0.195 (-0.07)	0.000*** (-5.97)	0.834 (-0.26)	1.429 (0.53)	0.790 (-0.27)	1.113 (0.10)	1.896 (1.03)	0.000*** (-3.48)
1st generation	1.136 (0.30)	0.362 (-1.54)	3.599 (1.38)	2.156 (1.41)	1.863 (1.14)	1.124 (0.13)	1.797** (2.12)	0.731 (-1.37)	1.319 (0.77)

Notes: The table shows relative risk ratios for all reasons relative to the reference category (work-related reasons); exponentiated coefficients; z statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Ref. = Reference Category.

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The multinomial logistic regression in Table 4.7 estimates the relative risk of mentioning one reason preventing training participation between different migration groups. In the relative risk analyses, different reasons for participation are compared to a reference category. The reference category in these analyses is work-related reasons. The results show that compared to work-related reasons, first-generation migrants are more likely than natives to report financial reasons for non-participation in training in all countries but the United States. The results are only significant in Norway and Spain, though. The United States are the only country, where first-generation migrants are less at risk of reporting financial reasons. In two countries (UK and Norway), family reasons are significantly more important obstacles for first-generation migrants compared to work-related reasons. Interestingly, none of the second-generation migrants in Austria, Italy, and Spain reports missing prerequisites. However, given the low frequency of responses, I do not give too much weight to results in this category.

4.6 Discussion and conclusion

In this paper, I investigate how migrants' opportunities for training differ across different countries. One of the underlying hypotheses of this cross-national research is that different welfare state regimes have a different impact on the way migrants have access to training opportunities. Similar to previous findings (e.g., f, this paper shows that across all countries investigated, first-generation migrants participated less often in training, even though the gap between first generation migrants and natives varies from country to country. In line with Huddleston et al. (2013), migrants participate more often in training in countries with high training participation in general (e.g., Sweden). A positive "learning culture" thus seems to be helpful to empower all residents of a country to participate in training. In other words, if lifelong learning is part of everyday life and there are opportunities that are easy to access, this increases chances to participate for all groups considered in this analysis. Policies fostering such a positive learning culture might include the availability of information about learning opportunities, the appreciation of learning, and the absence of financial barriers to training. Besides these considerations, however, there is no clear pattern suggesting that one of the welfare state regimes would be better suited to reduce inequalities between first generation migrants and natives than others. Interestingly, the level of education obtained in the home country, is no important factor explaining this gap. There rather seem to be factors

hampering the usefulness of education acquired abroad, with possible candidates being the quality of education, language barriers and acquired social or cultural capital.

In most countries, second-generation migrants participated more often in training than first-generation migrants, which can be seen as a positive development. This means that being educated in the host country may be related to overcoming disadvantages of the first generation. The analyses do not show whether this is related to specific skills or (also) to social and cultural capital that is acquired in the country of residence, as the latter is difficult to measure and control for in quantitative analysis. However, the analyses show that – when controlling for formal education – second-generation migrants have almost the same training opportunities as natives. So besides catching up in terms of average education, education acquired in the host country seems to be as useful for migrants as for natives.

One important additional finding is that literacy skills seem to be key for participation in training. Individuals need literacy skills in order to participate in training activities (once they go beyond basic literacy courses). In contrast, individuals – natives and migrants - with lower literacy skills are at a disadvantage because they cannot benefit fully from learning opportunities. This means that investing in language skills is important, not only for individuals but also for a society which maximizes opportunities for human capital development over the life course. The lack of skills required for successful training might be one factor explaining both the more mixed returns of training on the labor market (Kogan, 2016) and lower participation in training for migrants. Investing less in training seems like a rational decision if returns are lower.

Another focus in this paper is the reasons preventing individuals from participating in training. Financial reasons were generally mentioned more frequently among first-generation migrants than by natives. This could also be due to the working environment of first-generation migrants: it is possible that they work more in jobs which are not as training-oriented and that first-generation migrants thus benefit less from employer-sponsored training. Migrants who have been educated in another country might lack skills and prerequisites for certain training opportunities. However, the results show that missing prerequisites were only mentioned very rarely, also by migrants. In general, the results do not show very strong patterns across countries and between migration groups.

This research naturally faces some limitations. First, it was not possible to include some countries that would have been interesting from a theoretical perspective, as not all relevant data was available. Second, the case numbers for answering research question 3 are relatively low in the migrant sub-groups. For this research question on barriers to participation, I had to restrict the sample to non-participants in training who would have liked to participate which is only a fraction of the overall population. This of course limits the precision of the estimates and, hence, the ability to derive conclusions. Related to this, the categories to capture barriers are not always very specific. "Missing prerequisites", for example, can be very diverse, making it difficult to interpret this answer category. Finally, the quantitative nature of the data is not well suited to better understand the process of decision-making regarding training participation.

This paper indicates several avenues for further research. A comparison of specific migration policies (such as entry regulations) could be subject of a new study in order to compare how these policies relate to learning opportunities for migrants. It can be assumed that countries mostly allowing immigration of highly skilled individuals will also have more first-generation migrants who participate in training. Related to this, an analysis by country of origin could also shed light on possible selection and differences among the migrant population. Furthermore, it could also be interesting whether the way education systems are organized and produce inequalities within the host country influences the way lifelong learning opportunities are available. Financing of educational systems could be one driver, as countries' expenditures in different educational branches (e.g. primary education vs. non-formal training) vary considerably.

On a final note, this paper documents lower participation rates in training as a sign of disadvantages in either access or returns to training. A better understanding which type of training is beneficial for whom under which circumstances, however, is key to evaluate the desirability of training participation and to derive robust policy recommendations.

4.7 References - Study 3

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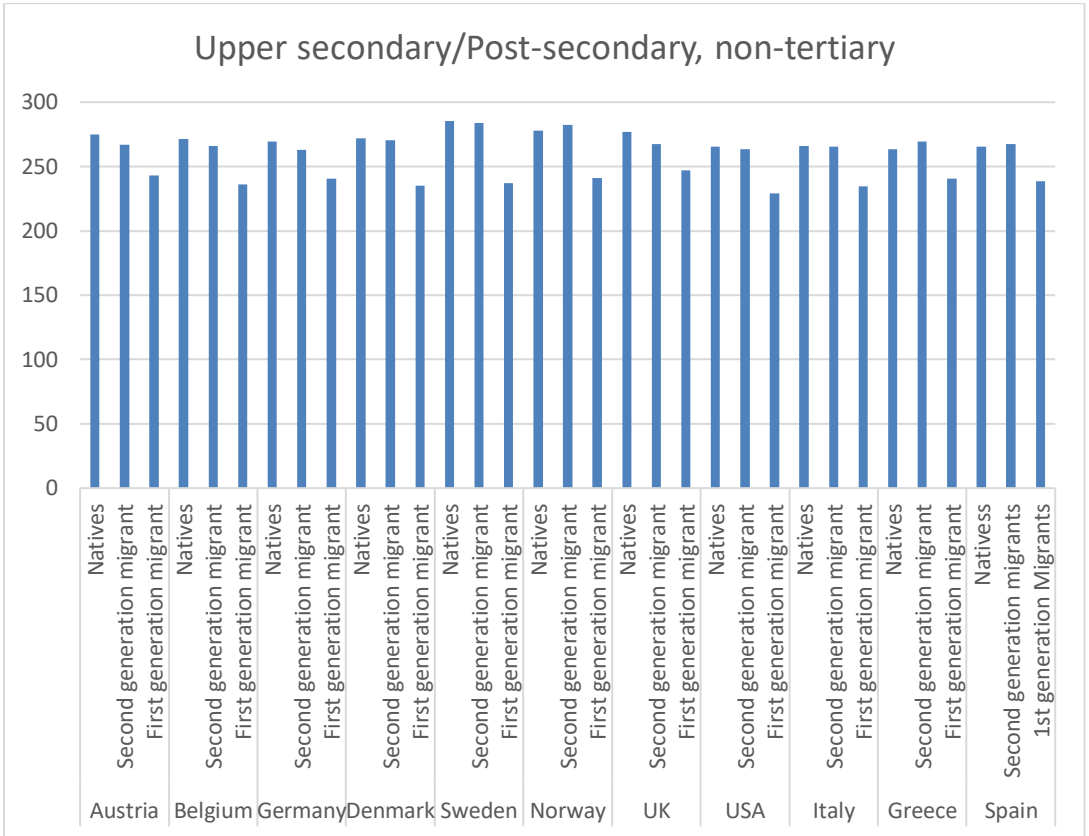
Appendix B Results of for literacy skills by education in different migration groups (study 3)



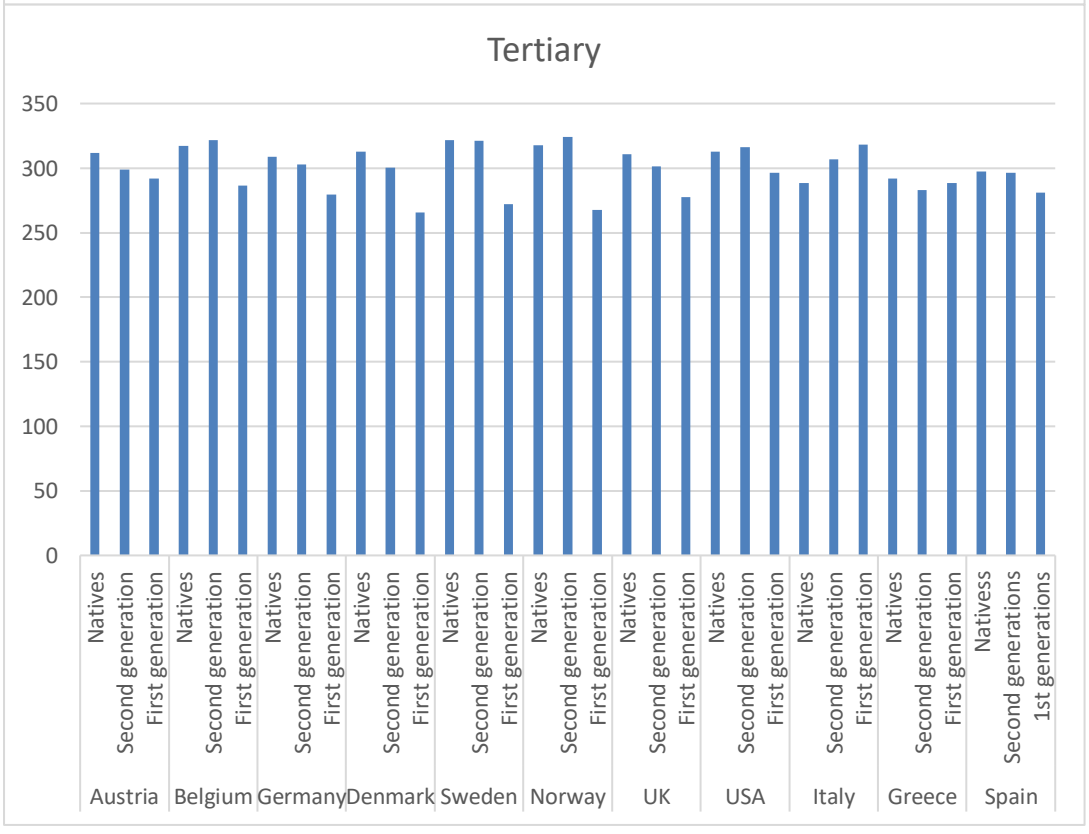


Figure B.1 Literacy skills by educational qualification across migration groups

5 Data availability

The datasets used in the analyses for this dissertation are available on the OECD website (http://www.oecd.org/skills/piaac/publicdataandanalysis.htm) and at the GESIS data archive (doi:10.4232/1.12385 at https://dbk.gesis.org/dbksearch/sdesc2.asp?no=5845), with the exception of some data from Canada for Study 2 which was made available by the OECD.