



What is the relationship between language proficiency and earnings among immigrants in the Nordic countries?

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Abstract: This thesis examines the relationship between language skills and earnings among immigrants in the Nordic countries with data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC). Adapting a modified human capital earnings function for the analysis, literacy skills in the host language are associated with higher earnings, though the magnitude and significance vary across countries. Native-born in Finland, Sweden and Norway received higher and more consistent returns to increases in literacy skills, while immigrants received significantly lower returns for host language skills in Denmark. Background characteristics – including education and working experience – contribute significantly to the wage levels for both native-born and immigrant populations across countries. The results suggest that, while language skills are an essential part of labor market integration among immigrants, they do not fully account for the earning differences observed between native-born and immigrant workers.

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1 Introduction

Many developed countries are facing issues regarding their aging population and low fertility. Many countries have been seeking answers from migration to save their dependency ratio. As these economies become more reliant on migrant workers, it is necessary to understand the role of social integration of such groups. Familiarity with the local language has multi-dimensional benefits for immigrants, as it helps with daily social interactions and building networks. Additionally, fluency in the local language is a strong signal in the labor market, which can help improve the employment outcomes. Language skills are thus considered an important part of the integration process of immigrants (OECD, 2018).

Migration to OECD countries has been sharply increasing in the recent years, consistently reaching new record numbers. A large share of the rapid rise is due to the increasing share of asylum seekers among the immigrants (OECD, 2024).

Thousands

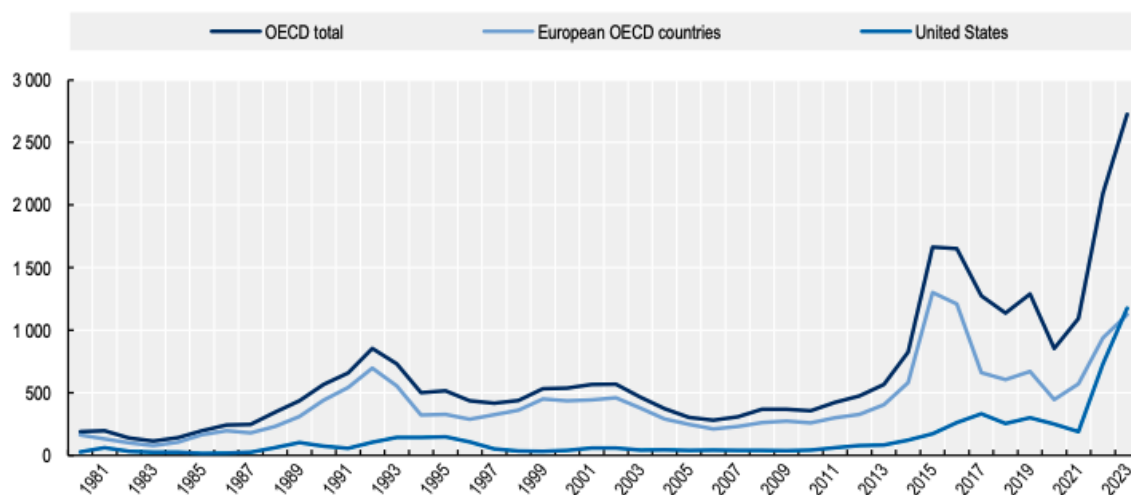


Figure 1: New asylum applications since 1980 in the OECD, Europe and United States (OECD, 2024)

With the increasing inflow of immigrants, the share of immigrants in OECD countries has risen to 14%, with large variation between countries depending on the immigration policies and other factors (OECD, 2024). The population increase between

1990 and 2020 in the Nordic Countries has been largely due to immigration (roughly two-thirds of the growth), becoming the major source by a fair margin after 2007 in Finland, Sweden, Norway and Denmark. The diversity of the immigrants arriving to the Nordic countries has similarly increased, which affects the integration process of immigrants significantly (Heleniak, 2020).

Although the labor market outcomes for immigrants have improved in the last decades, a large unemployment gap still persists in the Nordic countries in 2023, reaching 10% in Sweden and 7.3% in Finland. The gap can be mostly explained by the large share of humanitarian migrants in comparison to work-related migration, as humanitarian migrants have delayed entries to labor market and have poorer outcomes in terms of employment rate, overqualification and wage level (OECD, 2024).

The increase in the influx of immigrants has led to policy changes in many OECD countries reducing the number of immigrants and/or improving the integration processes. Programs, such as the Adult Migrant English Program in Australia, focus on teaching necessary language skills required for working. Within the Nordic countries, Denmark has made multiple policy changes in the recent decades, including the 1999 Integration Act, that included lengthy language courses for immigrants. Similarly, the Norwegian Introduction Act passed in 2004 made integration programmes obligatory for immigrants (Hernes et al., 2019). The various programmes have a significant focus on the labor force participation and employment of immigrants. Most of the integration programmes recognize the value of the local language skills in the integration process.

The aim of this study is to estimate the effect of destination-language skills on labor market outcomes in Finland, Sweden, Norway and Denmark using data from OECD. The Program for the International Assessment of Adult Competencies (PIAAC) provides micro-level data on individual background characteristics, cognitive skills and labor market outcomes. The human capital earnings function has been widely used to study the link between destination language skills and earnings (see e.g. Chiswick and Miller (2002), Berman et al. (2003)), finding a positive link between destination-language skills and earnings. In the following section, the human capital theory and economics of language are introduced with evidence from previous studies conducted

with the human capital earnings function. The PIAAC framework and data are then introduced with the methodology for the analysis. Results and discussion will cover the rest of the study with closing conclusive thoughts.

2 The Economic Value of Destination Language Fluency

2.1 Language Skills in Economic Integration

Language skills are a core component of human capital and play a vital role in integration process of immigrants. In an increasingly interconnected world, fluency in the destination language enhances migrants' ability to access public services, navigate everyday life, and build social connections. More importantly, destination language fluency is strongly linked to better economic outcomes, including the probability of employment and higher income levels. Language skills enhance skill transferability, increase productivity, and improve the quality of job matches. As such, migrants with strong language skills are more likely to find jobs that match their skills and experience, and be more successful as an employee (Chiswick & Miller, 2015).

Acquiring a new language requires an investment of time, effort and financial resources. According to the human capital theory, the decision to acquire a new language is based on the assessment on the expected returns – including social and economic benefits – against the costs required to acquire the language (Isphording, 2014). The framework applies to the level of proficiency, as higher proficiency is generally linked to higher returns (Chiswick & Miller, 2001).

The different benefits related to language proficiency are multidimensional, and are received simultaneously. The economic gains – such as higher wages and employment status – are more easily quantified, social benefits are much more difficult to measure. Such examples can include lowered search costs and social integration (Chiswick & Miller, 2015). As a direct consequence, most previous research has focused on the measurable economic outcomes related to language acquisition.

To further develop language acquisition framework, Chiswick and Miller (1995) identify three key determinants of dominant language fluency: exposure to the language, efficiency in acquisition, and economic incentives. Their conceptual model incorporates various background and individual factors that influence the adaptation process and overall fluency. The LANG-equation they propose measures an immigrant’s proficiency in the destination language based on several factors, including individual expectations, marital status, number of children, linguistic distance between native and destination language, age at migration, and level of education. These variables help explain both the supply-side factors (such as learning ability and prior exposure) and demand-side incentives (such as wage premiums and employment opportunities), providing a structured approach to understanding language acquisition as an economic decision.

$$\begin{aligned}
 LANG = f[& \text{expected wage increment for language fluency}(+), \\
 & \text{expected future duration}(+), \text{duration in destination}(+), \\
 & \text{married to the native of destination}(+), \text{married to native of origin}(-), \\
 & \text{children}(?), \text{minority language concentration}(-), \text{destination language} \\
 & \text{instruction}(+), \text{linguistic distance}(-), \\
 & \text{age at migration}(-), \text{education}(+), \text{refugee status}(-)]^1
 \end{aligned}
 \tag{1}$$

2.2 Empirical Evidence on Literacy and Language Skills on Labor Market Outcomes

The economic returns related to increases in human capital – including language acquisition – are most often estimated with the human capital earnings function (Mincer equation), first introduced by Mincer (1974). The equation estimates earnings as a

¹LANG conceptual equation from Chiswick and Miller (1995), where LANG is the measure for destination language fluency. The mark in the parenthesis after each variable estimates the direction of effect on fluency. Note that some of the variables cannot be measured objectively at all, or on an individual level.

function of different measures of human capital – education and working experience in its most basic form. To include the language skills as a form of human capital has been done by merging the LANG-framework to the function. Chiswick and Miller (1995) adapt the extended model to census data from four countries, yielding positive results on the effect of language skills on earnings. The model has been then adapted to various studies in different settings.

The common finding of distinguishable wage premium related to language proficiency arises from various studies. Studies are often based on surveys, where language skills are reported on some scale (such as 1-5) and then the effects are estimated using OLS and IV regressions. Self-reporting language proficiency can cause the estimates to be both over or under estimated and the balance of these may fluctuate between each data set used in studies (Chiswick & Miller, 2015). Other approaches use language tests as the measure of proficiency to counter the bias of self-reporting.

The censuses from Australia, Canada, Israel and the United States used for analysis in Chiswick and Miller (1995) indicate positive and significant returns to immigrants' destination-language fluency in all countries. The magnitude of the effect varies between countries, reaching the highest estimate of 17% in the United States and the lowest of 5% in Australia. The language skills are not exogenous to earnings, as the expected returns to language skills increase the likelihood to become fluent in the destination language (Chiswick & Miller, 1995).

A more detailed approach to estimate the effect of destination-language fluency among immigrants in the United States by Chiswick and Miller (2002) adapts a more detailed extension to the human capital earnings function. Extending the original Mincer equation to include years in the destination country and language fluency allows measurement of the effect of language skills and exposure on earnings. The 1990 Census of Population measures fluency in English on a self-reporting scale, ranging from 'not at all' to 'very well'. Being fluent in English ('well' or 'very well') increased earnings by 14% among the non-aged immigrant male population in the simplest form of analysis. Of the different measures of human capital, an additional year of education affects earnings positively by roughly 5% for the whole sample. Notably, after separation by

English language fluency, the estimates indicate complementarity with language skills and education, as the estimates for fluent and non-fluent shift to 6.6% and 1%, respectively. Similarly, working experience prior to migration is found to yield higher returns among those fluent in English. This finding suggests that fluency improves the transferability of previously acquired human capital to the labor market. For the migrants reaching near-native levels of English fluency, additional language skills – in the form of bilingualism – are rewarded in the labor market. The analysis finds suggestive evidence of endogeneity between language skills and earnings, as economic incentives to learn the language affect language learning and income simultaneously (Chiswick & Miller, 2002).

The determinants of language proficiency related to the LANG-model have been further examined in Chiswick et al. (2006). Their study on the different background variables effect on English-language among immigrants in Australia find rapidly diminishing differences in proficiency between different visa categories, that serves as a screen for human capital. Their model also adapts more background variables compared to previous studies, adding measures for former colonies, linguistic distance and physical distance to the LANG-model. The estimates indicate that speaking proficiency decreases with age at migration, increases with linguistic and physical distance, also diminishing with the duration of stay. The overall results suggest that efficiency factors and economic incentives have a delayed effect on proficiency compared to other factors such as age and level of schooling (Chiswick et al., 2006).

Most studies measure language proficiency as a single variable but different aspects of language skills can yield different benefits. Learning to speak can be more useful for social integration and help with everyday activities by lowering search costs and expanding social networks. Written language has often more value in the labor market, and may have a larger impact on economic outcomes for that reason. Estimates from the United Kingdom show that employment effect (increase of probability of employment) of only spoken knowledge was 4% among migrants, while the ability to write (and speak) increased the probability by 14%, indicating that written language is valued higher when signaling skills to the labor market. Out of the two variables, the ability to write requires higher investments, as it often requires more time and effort

than spoken language, which leads to higher correlation with educational variables (Dustmann & Fabbri, 2000). This type of separation might be increasing with more digitalized working environments, where the amount of manual labor is diminishing. Similarly, the language use at work can contribute significantly to the language skills.

Specific policy changes, such as Soviet Union's policy shift in 1989 removing migration restrictions of Jews to Israel, can provide more detailed information about the returns to language acquisition, as the immigrants faced lower costs for migration, reducing the self-selection bias in the sample. Using survey data, Berman et al. (2003) compare two sets of survey data with human capital earnings function to estimate the effect of Hebrew skills on wage growth among Soviet immigrants. In comparison to studies on English-skills, the study estimated substantially large effect of Hebrew proficiency on earnings. On the reporting scale of 1-5 (5 as the most proficient), a one level increase predicts a 6.5% increase in earnings. The difference between the Hebrew level of 1 - "not at all" and 5 - "very well" results to 31.4% increase in earnings in the simplest form. The difference in returns to Hebrew between high-skilled and low-skilled occupations shows that language skills increases earnings more in high-skilled occupations, where the language skills have little to no effect in low-skilled occupations. Notably, the difference in the proficiency level between occupations upon arrival did not differ significantly, indicating evidence of skill complementarity in high-skilled occupations (Berman et al., 2003).

In addition to the returns to fluency in the official local language, bilingualism is considered as an asset in the labor market as it contributes to human capital. Canada has a long history of linguistic division, where the French-speaking provinces (most notably Quebec) have reluctantly resisted the expansion of English use in the area. Using the 1971 Canadian Census, Carliner (1981) examine the wage differences between different language groups in different areas (English- and French-speaking) in the country. According to the theory of language markets, the premium for acquiring English as a native French speaker is positive but not vice versa, as the majority of economic power is held by English speakers in both English- and French-speaking provinces of the country. In line with the theory, he find that native French speakers who spoke English received higher wages than monolinguals but still could not achieve the wage level

of monolingual English speakers. The results indicate that people respond significantly to economic incentives regarding language acquisition, which was seen in the portion of French bilinguals (Carliner, 1981). The study also provides insights to the valuation of minor languages in the labor market, which show that the economic importance of a language contributes to the probability of learning the language as a second language.

In OECD countries, immigrants face significant challenges regarding labor market outcomes and literacy skills compared to their native counterparts. The Survey of Adult Skills data shows that immigrants lag the native-born by 24 points in literacy, which is equivalent to roughly 3.5 years of education. The extent of the gap varies widely across countries due to different factors, such as immigration policies, education systems and linguistic distance to the countries of birth. In the Nordic countries – Finland, Sweden, Norway and Denmark – the gap in literacy scores between natives and immigrants is substantially large. The familiarity with the host country language and different immigration policies (regarding language skills and/or training) might explain some of the variation in literacy skills. Speaking the language at home or at school accounted for two-thirds of the gap in Finland and about half in Norway. Similarly, age of arrival matters for the language adaptation, as those who arrived to the country before the age of six received close to native-level scores in literacy in Finland and Norway, but not in Denmark and Sweden (OECD, 2017).

English fluency among immigrants in the United States has been studied by Batalova and Fix (2015) in their analysis with PIAAC data from the first round of the survey. Their analysis show that foreign-born adults lagged the natives by 36 points in literacy, that translated to roughly five years of formal education. In an international comparison, the adults in the United States scored lower in literacy than the OECD average, which was partially due to the low level of literacy in the foreign-born subgroup. In terms of the employment outcomes, higher literacy skills increased the employment rates for the natives but did not statistically differ for the foreign-born. Immigrants with low literacy skills were employed with a higher probability than their native counterparts. The overall wage difference between natives and immigrants was significant, but diminished and became statistically insignificant after controlling for literacy and numeracy skills. Their findings indicate that immigrants require fluency

in English to receive similar wages to their native counterparts (Batalova & Fix, 2015).

Extending the first round (2011-2012) PIAAC data for cross-country analysis, Hanushek et al. (2015) estimate the effect of cognitive skills on wages using a modified human capital earnings equation. Their analysis focus mostly on the numeracy skill measured in the survey, leaving less emphasis on literacy and problem-solving. Their version of the Mincer equation replaces education by cognitive skills. The baseline results across the large sample of 23 OECD countries indicate returns to one standard increase in numeracy skills to be 17.8% on average, falling below 15% in all Nordic countries. Adding years of schooling to the equation reduces the returns to numeracy by 43%, which indicates correlation between skills and education. The correlation between the different skill measures is also substantially large, reaching 87% between numeracy and literacy. The returns to literacy are lower at 6.8% compared to numeracy at 12.0%, when both are added to the pooled sample. The returns to numeracy skills were lower among the immigrant subgroup, but the mechanisms behind it are not assessed. To address the main concerns regarding measurement of returns to skills – reverse causation and omitted variable bias – the study uses other skill measures as instruments and extends the model to include more background characteristics. The results of the IV-approach suggest that the baseline regression model might underestimate the returns to skills. (Hanushek et al., 2015).

The study provides limited insights to literacy (and language) skills in the Nordic countries. The baseline regression results with literacy as the skill measure estimate returns to be below 12.5 % in all Nordic countries, which is noticeably lower than in the pooled sample. The differences between different subgroups and background characteristics regarding literacy skills are not included in the analysis (Hanushek et al., 2015).

The labor market integration of immigrants in Finland before the large increase in asylum applications from 2014 has been studied by Sarvimäki (2017) with register data between 1990 and 2013. The results show a gap in employment between natives and immigrants that varied by region and country of origin. The employment gap converged during the first ten years after arriving to Finland but settled then to roughly 20 to 25 percent in the total sample. Immigrants from OECD countries had

the highest employment rate, but even after 10 years in the country the gap remained at 14%. Immigrants from Middle East had lowest employment rates on arrival. Their employments rates rose rapidly at first, but the gap settled after a decade in Finland, indicating persisting challenges regarding employment. In terms of earnings, the pattern is similar as the gap between natives and immigrants persists even after 10 years in the country.

Sweden experienced the sharp rise in immigration before Finland, largely due to humanitarian immigration. The social integration of immigrants and country-specific skills do not explain the large employment gap between immigrants and natives (Duvander, 2001). Earning the highest educational level in Sweden or being fluent in the Swedish language held limited effect on the probability of employment for immigrants. However, both variables contributed to the conditions among the employed immigrants, decreasing the risk of overqualification close to the native level. Closer culture to the host country improved the labor market outcomes slightly, which indicates that some sort of discrimination persists even after achieving Swedish education and/or language skills.

The study by Hayfron (2001) analyses the effect of language training program on language fluency and earnings among Third World immigrants residing in Norway using survey data. Participating (and completing) language programs increases proficiency in Norwegian significantly in both written and spoken language. In contradict to the expectations, the investment in the language proficiency did not increase earnings in the analysis with the human capital earnings function. The result suggests that language proficiency does not affect wage determination but might play a more pivotal role in the hiring process.

The International Adult Literacy Survey (IALS) measures literacy in three domains – Prose, Document and Quantitative – using a similar scoring scale to PIAAC. In the study by Garrouste (2008), data for native-born individuals in Finland, Norway and Denmark revealed that bilingualism is more strongly associated with higher wages than literacy skills in the official national language. For foreign-born individuals in Norway, the language proficiency did not explain the variation in wages, suggesting that other

factors accounted for larger share of the variation.

3 Data

The OECD Programme for the International Assessment of Adult Competencies (PIAAC) evaluates the cognitive skills of adults, focusing on literacy, numeracy, and problem-solving in technology-rich environments. It provides valuable insights into the relationship between language proficiency, employment outcomes, and broader socio-economic factors. Similar to other large-scale surveys, PIAAC relies on self-reported data and is designed for individuals aged 16 to 65 residing in participating countries (OECD, 2019).

The first cycle of the survey was conducted between 2008 and 2017, consisting of three separate rounds, involving 39 countries in total. Unlike assessments that classify competencies into fixed categories (e.g., ‘low’ or ‘high’ proficiency), PIAAC measures skills along a continuum, offering a more nuanced understanding of skill levels. Each of the three main elements (literacy, numeracy and problem-solving) are measured through carefully designed domains. A comprehensive description of the design and measurement is provided in (OECD, 2019).

In addition to the assessments, the survey includes a detailed background questionnaire that collected information in demographics and background, educational attainment, labor-force status, social outcomes and skill use. These elements complement the human capital measured by the assessments, offering a more complete analysis of human capital. Although PIAAC consists of individual-level data, it is primarily designed for subgroup analysis rather than assessing individuals in isolation (OECD, 2019).

The first round data for the Public Use Files (PUF) for Finland, Sweden, Norway and Denmark was collected between 2011 and 2012. The data sets include 5646 total answers from Finland, 4469 from Sweden, 5128 from Norway and 7328 from Denmark. After excluding the 1% extremes in earnings, the data includes 3750 observations for

Finland, 3772 for Norway and 4858 for Denmark. The Swedish data has the income measured in deciles, leaving 3188 observations left for analysis after excluding missing values. The main dependent variable for the analysis is monthly earnings ('earnmthall' in the data), that captures the total monthly income for both employees and self-employed. The earnings are reported in the local currency in each country (Euro in Finland, Swedish krone, Norwegian krone and Danish krone). For the Swedish data set, the monthly earnings are estimated as the mean for each decile according to Statistics Sweden.² The different skill domains are measured in 500-point scale, standardized for the regression analysis to a mean of zero and standard deviation of one. Experience, education and years since migration are all measured in years.

Country	BornInCountry	N	Females	Literacy	Numeracy	Problem.solving	Earnings	Education	Experience
Finland	YES	3,421	0.497	297.995 (0.61)	293.720 (0.66)	292.505 (0.69)	2933.919 (19.53)	12.990 (0.04)	19.631 (0.16)
Finland	NO	147	0.518	256.970 (4.88)	251.365 (4.56)	277.867 (4.18)	2423.071 (132.40)	12.774 (0.26)	14.211 (0.91)
Sweden	YES	2,730	0.486	297.995 (0.61)	288.029 (0.68)	292.442 (0.67)	25234.90 (189.83)	12.067 (0.02)	19.922 (0.13)
Sweden	NO	456	0.526	256.970 (4.88)	231.816 (1.67)	259.504 (1.91)	23146.51 (531.26)	11.721 (0.08)	16.510 (0.42)
Norway	YES	3,312	0.488	288.731 (0.65)	291.916 (0.74)	291.386 (0.61)	34258.89 (268.73)	14.359 (0.03)	19.838 (0.16)
Norway	NO	460	0.441	252.931 (2.83)	247.578 (3.19)	272.651 (2.49)	29126.76 (626.38)	14.598 (0.14)	14.556 (0.47)
Denmark	YES	3,962	0.476	281.194 (0.73)	289.780 (0.83)	287.511 (0.83)	30002.19 (257.28)	12.933 (0.04)	22.335 (0.14)
Denmark	NO	895	0.468	245.531 (2.58)	252.538 (2.59)	272.858 (2.26)	24728.89 (631.43)	13.302 (0.12)	15.133 (0.36)

Table 1: Descriptive statistics for each country

In all of the countries, foreign-born lag the natives in all the measured skill domains, earnings and work experience. Following the OECD's guidelines for levels in proficiency (ranked 1-5), foreign-born rank on level 2 on both literacy and numeracy, where natives surpass the cut-score of 276 in both categories.³ The education level between the subgroups is relatively similar in all countries, the mean varying between 11.7 and 14.6 years, with the highest means found in Norway.

In all countries, the earnings rise with age at the lower end but diminish for the oldest subgroups divided into 10 year intervals. The natives scored highest in literacy between the ages of 25 and 34, where the pattern for foreign-born had more fluctuation.

²Statistics Sweden database for income distribution in deciles based on disposable income excluding capital gains holds the mean values in SEK thousands from the year 2011, which is used for the analysis. The dataset can be found on the Statistics Sweden website (StatisticsSweden, 2025).

³For the detailed description of the proficiency levels based on the literacy and numeracy scores, see OECD (2019)

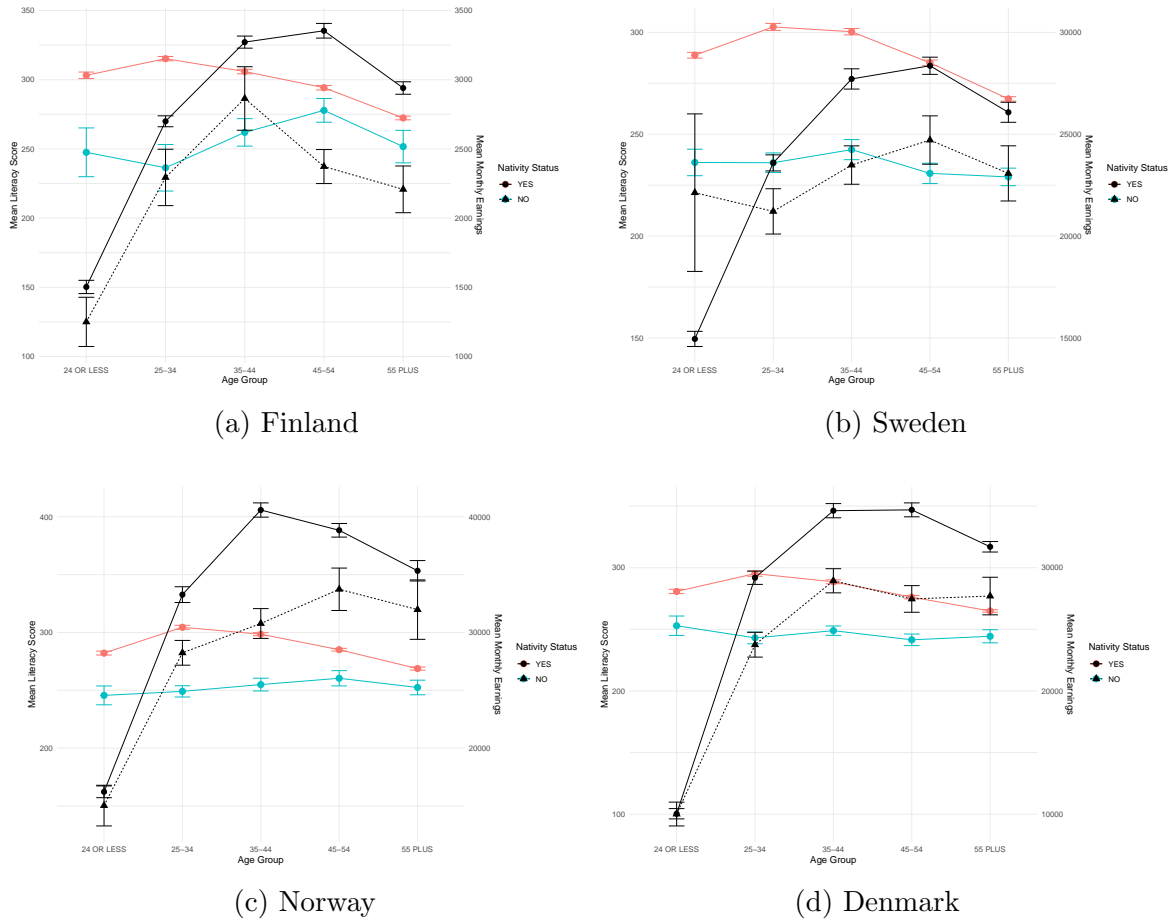


Figure 2: Literacy and Earnings by Age Group and Nativity in Finland, Sweden, Norway, and Denmark. Black line indicates the earnings and the colored indicate the mean literacy score.⁴

The dispersion between countries of birth varied heavily between Finland and Denmark. The foreign-born in Finland were from Estonia ($N = 23$), Russian Federation (31) and Sweden (41). Additionally, there were 52 observations missing this information. From the Danish data, few countries of birth (for the foreign-born) had more than 40 observations (Bosnia and Herzegovina 43, Germany 61, Poland 54, Sweden 42 and Turkey 47), having combined 99 different countries of birth in the data. The birth countries were not available in the Swedish or Norwegian data, but recorded by region. In both countries, the majority of immigrants have arrived from Europe or North America. The other regions with over 40 observations include Arab states, and

⁴The monthly earnings are reported in the local currency.

South and West Asia, with 54 and 42 observations respectively. In Norway, the next most common regions of birth include the poorer countries in East Asia and South Pacific ($N = 47$), and South and West Asia ($N = 40$).

In Finland, natives received higher scores in literacy and earnings than those born in Estonia or Russia. Those born in Sweden scored the highest in literacy (310.7) but did not surpass native-born in earnings. There were only small variation in education, but the differences in experience were larger. The variations in all main variables were much higher in the Denmark when looking at the countries of birth with larger amount of observations. Out of the countries with more than 10 observations, the lowest literacy score (160.1) was scored by those born in Thailand, and no country of birth exceeded the score of 300. The gaps in earnings between different countries of birth exceeded 100 % in some cases. For the regression analysis, the Danish immigrant population is divided by region of birth. The division by region instead of individual countries shows similar patterns, as the natives received highest literacy scores, followed closely by immigrants from North America and Western Europe. The gaps in earnings remained relatively large with most of the regions.

The Swedish and Norwegian data allow only separation by the region of birth instead of country-level specification. The richer countries in East Asia and the Pacific received the highest earnings and literacy scores, and people born in North America and Western Europe exceeded the native-born in earnings. Other regions lagged the native-born in both literacy and earnings. Education and experience showed larger variation between the different regions. In Norway, the native-born received the second highest scores in literacy, only falling behind those born in the richer countries of East Asia and the Pacific (mean score of 312.4). In earnings, those born in East Asia received the highest monthly earnings by a large margin, native-born and those born in North America and Western Europe following closely. Work experience had the most variation between the subgroups.

3.1 Limitations of PIAAC Data

Although the PIAAC provides compatible data between OECD countries, it also has its own limitations. Surveys generally try to have as representing sample of the targeted population as possible, but response rates (especially low) can create biases (OECD, 2019). In the case of analysis of a particular subgroup (e.g. immigrants from a particular country), the sample size is limited and the analysis of sub-populations in such groups is not adequate (Batalova & Fix, 2015).

The subgroups in the analysis are limited in some areas, which may provide inaccurate results. Some countries have only a handful of observations, where individual variation might affect the results heavily. The samples from Finland, Norway and Sweden have similar levels of foreign-born compared to their shares of the total population. The foreign-born are over-represented in the Danish sample by over 10 percentage-point difference (18.4% in the sample and 7.9% in OECD (2014)). The data from Finland only include immigrants from neighboring countries, leaving a large share of other countries of birth outside the analysis.

4 Methodology

The human capital earnings function introduced by Mincer (1974) estimates earnings Y as a function of working experience in its simplest form. The function was further expanded to include other investments to human capital, which could be expressed in the function form as

$$\ln Y = \ln E_0 + r s_i + f_i(t) + u_i$$

where E_0 denotes experience, s_i schooling (or education) and $f_i(t)$ is a function of post-school investments. Further expansion of the function added other dimensions of human capital into it, which includes the adaptation of a language skills. The LANG framework was introduced in a modified human capital earnings function by Chiswick and Miller (2002). In their approach, they modified the function to be expressed as

$$\ln Y_i = b_0 + b_1 S_i + b_2 T_i + b_3 T_i^2 + b_4 (YSM_i) + b_5 (YSM_i)^2 + b_6 LANG_i + v_i$$

which includes education S_i , work experience T_i , years since migration YSM_i and measure of destination language fluency $LANG_i$.

Previous adaptations of the human capital earnings function on the PIAAC-survey have primarily focused on other skill domains measured in the survey. For example, Hanushek et al. (2015) modified the human capital earnings function to estimate the effect of various skill components—such as numeracy and problem-solving—on hourly earnings. Their approach also incorporated work experience and a gender dummy as explanatory variables.

In this study, the main focus is in the estimation of the effect of literacy skill on earnings with other variables included for more detailed analysis. The main equation used for analysis is:

$$\ln Y_i = b_0 + b_1 Lit_i + b_2 S_i + b_3 T_i + b_4 T_i^2 + b_5 F_i + v_i$$

where Lit_i is the literacy skill measure, standardized to mean of zero and standard deviation of one; S_i is the years of education, T_i is years of work experience; and F_i is a dummy for gender. The analysis aims to compare the returns to literacy between

native-born and immigrants, while controlling for relevant background characteristics.

The analysis is conducted with the R package *EdSurvey*, which includes tools designed for the analysis of survey data, such as PIAAC. The package accounts for the use of plausible values and replicate weights to enable comprehensive and statistically valid analysis. In PIAAC, the literacy score is represented by ten plausible values; however, only the first plausible value is used in this study for simplicity. The regression coefficients are averaged using the formula:

$$\hat{\beta}_k = \frac{1}{P} \sum_{p=1}^P \beta_k^{(p)}$$

where P represents the number of plausible values. Likewise, the variances are computed using the jackknife method. For a detailed description of the weighting methodology and variance calculation, see Bailey et al. (2020).

5 Results

5.1 Baseline Differences by Nativity and Age

The baseline regression results indicate significant positive returns to education and experience, varying between 3.7% and 10.0% increase in earnings for additional year in each domain. Sweden had the smallest coefficients in both, receiving 5.6% increase in earnings for additional year of education and 3.7% for a year of working experience. The highest increases were in Denmark, with Finland and Norway falling in between. The gender wage gap was large and significant in all countries, reaching as high as -34.2% for females in Norway. The foreign-born earned less than their native-born counterparts in Finland (10.5%) and Denmark (7.9%). The coefficients were negative in both Sweden and Norway as well, but remained insignificant. The returns to literacy were positive and significant in Finland, Sweden and Norway. An increase of one standard deviation in literacy scores increased earnings by 4.1% in Finland, 6.4% in Sweden and 8.4% in Norway. The coefficient was slightly positive (1.1%) in Denmark, but not significant. The difference in returns to literacy between native-born and foreign-born was captured in the interaction term, indicating lower returns to literacy for foreign-born. The estimates were not accurate, the only statistically significant difference was found in Denmark, reaching -5.8% for the foreign-born.

	Finland	Sweden	Norway	Denmark
Intercept	6.510*** (0.054)	9.039*** (0.047)	8.491*** (0.073)	7.946*** (0.056)
Literacy	0.041*** (0.012)	0.064*** (0.012)	0.084*** (0.014)	0.011 (0.015)
Foreign-born	-0.105* (0.046)	-0.027 (0.025)	-0.047 (0.030)	-0.079* (0.031)
Education	0.072*** (0.003)	0.056*** (0.003)	0.087*** (0.005)	0.100*** (0.004)
Experience	0.053*** (0.002)	0.037*** (0.002)	0.065*** (0.003)	0.084*** (0.003)
Experience ²	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Female	-0.298*** (0.016)	-0.249*** (0.016)	-0.342*** (0.016)	-0.268*** (0.017)
Literacy:Foreign-born	-0.034 (0.039)	-0.001 (0.023)	-0.031 (0.026)	-0.058* (0.026)
R ²	0.332	0.301	0.404	0.446
N obs.	3568.000	3182.000	3769.000	4854.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and std dev 1.

Table 2: Standard regression results for Finland, Sweden, Norway and Denmark

When focusing specifically on the migrant population, the coefficients for education and experience remained significantly positive, varying between 3.1% and 8.1%. The gender wage gap remained negative and significant in other countries, except Finland. The gap varied between -20.5% and -30.9% across countries. Estimating the effect of adaptation to the host country by years since immigration did not have an effect on earnings. This suggests that the length of stay in the destination country does not significantly affect wages. The main drivers for wage growth among immigrants appear to be educational background and experience (both prior and post-migration).

Extending the model to include the literacy scores, the returns to literacy scores were only significant in Sweden (8.4%) and Norway (7.7%). In Finland the estimate was insignificant but positive, and negative in Denmark.

In the Nordic countries, it is common to study beyond the age of 18, which might affect the returns to literacy between different age groups. In the data samples, the shares of people aged 24 or less that stated their status as student varied between 30 and 62 percent between the countries. The returns to literacy were negative and significant in Finland and Denmark among the native-born within the youngest subgroup. The individuals aged between 45 and 54 received significantly positive returns to one standard increase in literacy in all countries. The only significant difference in literacy between natives and foreign-born was in Denmark with the individuals aged 35-44. The overall trend indicated that the returns to literacy rise with age among the native-born but diminish for the oldest in other countries apart from Norway. The pattern for foreign-born was not so clear. The variation between the countries was relatively large. Although the individuals aged 25-34 seemed to receive higher returns to literacy compared to their native counterparts, this result did not hold statistical significance.

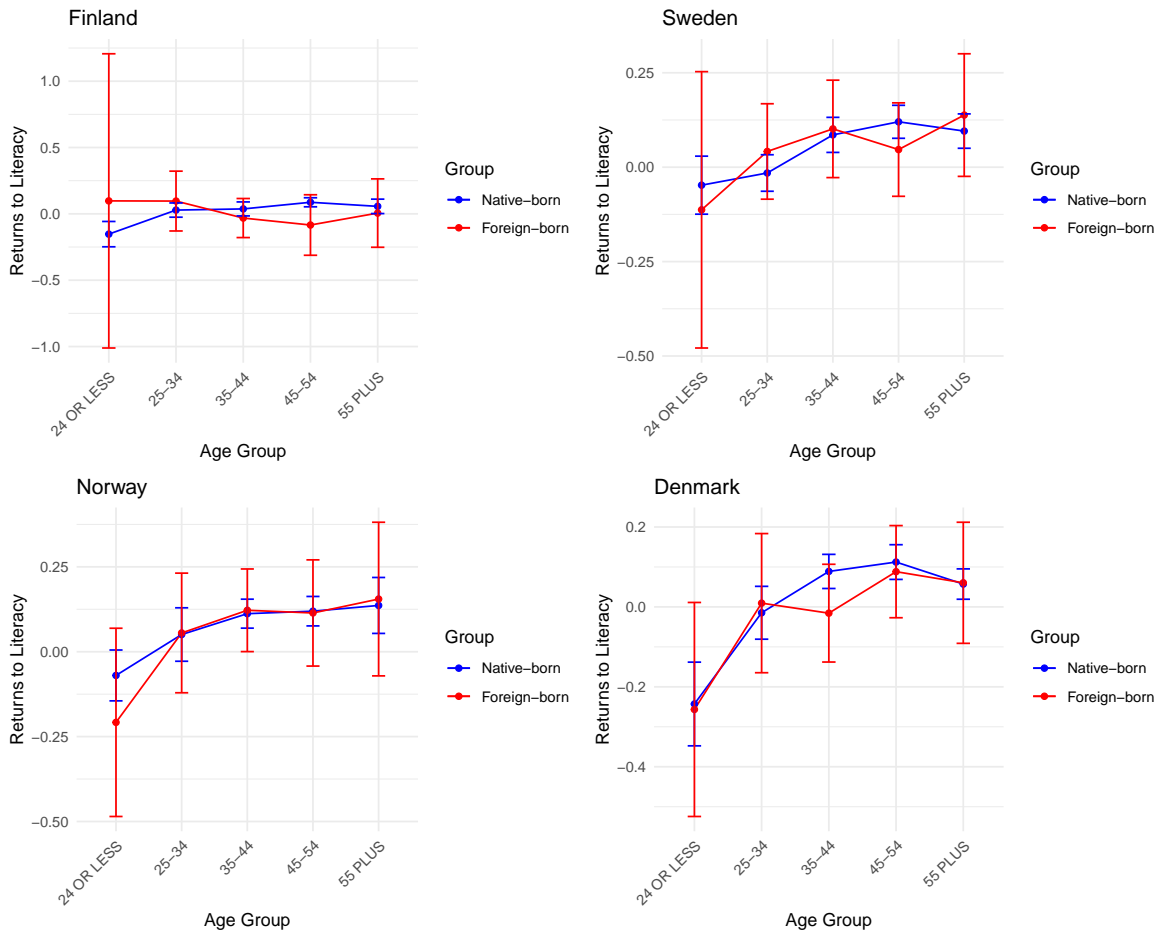


Figure 3: Returns to literacy by age group in different countries by foreign-born status

5.2 Earnings by Immigrant Origin

The Finnish data includes immigrants from Estonia, Sweden, and Russia, limiting the analysis of foreign-born to these countries. Native-born received significant positive returns to literacy, with a 4.2% increase for one standard-deviation increase in literacy score. Estonian-born immigrants show negative but insignificant returns to literacy, and face a significant wage penalty of 23.5% compared to natives. This suggests that the wage gap may be driven by factors beyond language skills. Russian-born received negative returns to literacy (-9.3%) and a wage penalty of -19.1%. Swedish-born immigrants received slightly positive but insignificant returns to literacy, and a small but insignificant wage penalty of -8.6%. These results may reflect easier labor market in-

tegration for Swedish-born, possibly due to the official status of the Swedish language or other factors. Education and experience both have positive and significant effects on wages, while females face a substantial wage penalty of 30.3%.

In contrast to the Finnish data, the other countries include observations from wider variety of birth regions, allowing for a more detailed analysis by region of birth. Among the native-born, the returns to literacy were positive and statistically significant in Sweden (6.1%) and Norway (8.5%). In the Swedish sample, only individuals born in Central and Eastern Europe received a significant wage penalty. However, the interaction terms for literacy were not statistically significant across regions, indicating that the returns to literacy for foreign-born groups did not differ significantly from those of the native-born population in Sweden. In Norway, individuals from richer countries in East Asia and the Pacific earned substantially more than their native-born counterparts. However, they exhibited significantly negative returns to literacy, suggesting that their higher earnings are not driven by literacy skills. Similarly, individuals from Central and Eastern Europe in Norway experienced small but significantly negative returns to literacy. By contrast, those born in Latin America and the Caribbean saw a significant and positive interaction with literacy, indicating that improved literacy skills are associated with higher earnings than their native counterparts in Norway. In Denmark, individuals from Latin America and the Caribbean faced a double disadvantage: they earned significantly less than native-born Danes and also experienced negative returns to literacy. Additionally, individuals from Sub-Saharan Africa in Denmark received significantly lower wages overall.

Intercept	6.513*** (0.053)
Literacy	0.042*** (0.011)
Education	0.072*** (0.003)
Experience	0.053*** (0.002)
Experience ²	-0.001*** (0.000)
Female	-0.303*** (0.016)
Estonia	-0.235** (0.085)
Russia	-0.191* (0.088)
Sweden	-0.086 (0.091)
Literacy x Estonia	-0.182 (0.099)
Literacy x Russia	-0.135** (0.045)
Literacy x Sweden	0.054 (0.089)
R ²	0.330
N obs.	3516.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and std dev 1.

Table 3: Returns to literacy by country of birth in Finland

	Sweden	Norway	Denmark
Intercept	9.030*** (0.045)	8.501*** (0.071)	7.949*** (0.058)
Literacy	0.061*** (0.012)	0.085*** (0.014)	0.011 (0.015)
Education	0.057*** (0.003)	0.086*** (0.004)	0.100*** (0.004)
Experience	0.037*** (0.002)	0.065*** (0.003)	0.084*** (0.003)
Experience ²	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Female	-0.249*** (0.016)	-0.339*** (0.016)	-0.270*** (0.017)
ARAB STATES	0.027 (0.100)	-0.282 (0.227)	-0.075 (0.141)
CENTRAL AND EASTERN EUROPE	-0.094* (0.039)	-0.080 (0.052)	0.059 (0.048)
CENTRAL ASIA	-0.155 (0.468)	-0.613 (0.602)	0.521 (0.698)
EAST ASIA AND PACIFIC (POORER)	-0.130 (0.134)	0.082 (0.089)	-0.109 (0.097)
EAST ASIA AND PACIFIC (RICHER)	-0.056 (0.254)	0.657*** (0.068)	-0.338 (0.222)
LATIN AMERICA AND CARIBBEAN	-0.094 (0.071)	-0.144 (0.127)	-0.268* (0.107)
NORTH AMERICA AND WESTERN EUROPE	0.057 (0.041)	-0.045 (0.044)	-0.075 (0.047)
SOUTH AND WEST ASIA	-0.057 (0.054)	0.032 (0.073)	-0.250 (0.142)
SUB SAHARAN AFRICA	-0.137 (0.198)	-0.226 (0.204)	-0.164* (0.068)
ARAB STATES x Lit	0.074 (0.057)	-0.201 (0.126)	-0.073 (0.109)
CENTRAL AND EASTERN EUROPE x Lit	-0.041 (0.027)	-0.094** (0.029)	-0.031 (0.027)
CENTRAL ASIA x Lit	-0.100 (0.387)	-0.653 (0.467)	0.216
EAST ASIA AND PACIFIC (POORER) x Lit	0.073 (0.088)	0.078 (0.062)	-0.127 (0.091)
EAST ASIA AND PACIFIC (RICHER) x Lit	0.194 (0.313)	-0.607*** (0.108)	0.245 (0.346)
LATIN AMERICA AND CARIBBEAN x Lit	0.024 (0.041)	0.252*** (0.044)	-0.172* (0.073)
NORTH AMERICA AND WESTERN EUROPE x Lit	-0.101 (0.064)	0.012 (0.031)	-0.052 (0.044)
SOUTH AND WEST ASIA x Lit	0.028 (0.040)	-0.068 (0.093)	-0.028 (0.088)
SUB SAHARAN AFRICA x Lit	-0.054 (0.104)	-0.052 (0.130)	-0.058 (0.053)
R ²	0.307	0.411	0.449
N obs.	3179.000	3766.000	4854.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with log monthly wage as the dependent variable, with the native-born as the reference group. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and std dev 1.

Table 4: Returns to literacy by region of birth in Sweden, Norway and Denmark

5.3 Determinants of Literacy Skills Among Immigrants

The foreign-born lag the natives in all countries, but the proficiency in the local language varies by background characteristics. The immigrants' language skills improve with the years of education and years spent in the destination country. This results implies that previously acquired human capital (in terms of education) improves the ability to learn a new language and become more fluent in the destination language. The exposure to the host language increases with years spent in the country, which improves the literacy skills significantly in all countries. Gender and working experience do not affect the literacy level achieved in the destination language.

	Finland	Sweden	Norway	Denmark
Intercept	4.758*** (0.168)	4.849*** (0.047)	4.880*** (0.068)	4.939*** (0.067)
Education	0.022* (0.008)	0.042*** (0.004)	0.035*** (0.004)	0.032*** (0.003)
Experience	0.004 (0.007)	-0.004 (0.003)	-0.002 (0.004)	-0.001 (0.004)
Experience ²	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Imyrs	0.038*** (0.008)	0.011*** (0.002)	0.016*** (0.003)	0.010*** (0.002)
Imyrs ²	-0.001*** (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)
Female	0.054 (0.045)	-0.022 (0.019)	0.001 (0.022)	0.025 (0.019)
R ²	0.347	0.261	0.222	0.164
N obs.	145.000	665.000	459.000	893.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with logarithm of literacy as the dependent variable. Results are weighted by sampling weights. 'Imyrs' is the measure for years since immigration.

Table 5: The effects of different background characteristics on literacy score in Finland, Sweden, Denmark and Norway

By looking at the literacy scores by country and the region of birth, a few notable points arise. In Finland, those born in Russia have significantly lower literacy scores among the immigrant subgroups. The Estonian-born lag the Swedish-born in literacy despite the similarities between Finnish and Estonian languages. This can be due to the official status of the Swedish language in Finland. In the other countries, being born outside of North America and Western Europe is generally linked to lower literacy scores in the destination language, indicating that both physical and linguistic distance might affect the acquirement of the language.

6 Discussion

This chapter reflects the findings of the study on previous literature on immigrant integration and human capital theory. The positive returns to literacy in the main analysis indicate that skills in the local language are associated with higher wages, the variation in magnitude and significance across countries and demographic backgrounds is significant.

6.1 Choice of Destination

The decision to migrate is rarely random, and often based on economic incentives and cultural proximity. Cultural and linguistic distance help with the transferability of previously acquired human capital to the destination country labor market. The linguistic proximity between the origin and destination countries has a significant effect on the decision to migrate (Adsera & Pytlikova, 2010). Similarly, the cultural proximity reduces costs related to migration, which affects the decision to migrate (Chiswick & Miller, 2015).

This mechanism might explain the differences between the immigrants from different countries or regions of origin. Norwegian, Swedish and Danish language closely resemble each other, and the countries are culturally more similar with other Western European countries, which can help with the integration of immigrants from neigh-

boring countries. Finland and Sweden have a long history of migration between the countries, and Swedish holds the status of an official language, which can explain why Swedish immigrants do well in the Finnish labor market.

6.2 Labor Market Friction

Immigrants may encounter disadvantages also during the hiring process, contributing to higher unemployment levels in comparison to the native-born. The language skills can serve as an important signal to the employer, which can affect the hiring decision. This mechanism might explain the differences in the unemployment rates across all countries in the data.

Additionally, this effect might explain the relatively small differences in returns to literacy between immigrants and native-born individuals. The language skills may play a larger role in the hiring decision than in the wage negotiation, leading to higher unemployment but similar wage structure for the employed (see e.g. Hayfron (2001), Duvander (2001)). Although the analysis on the effect of language skills on employment are outside the scope of this study, it provides important information for the interpretation of the results acquired.

6.3 Reverse Causation and Omitted Variable Bias

As with many of the other studies examining the returns to language skills, it is not possible to rule out the presence of reverse causation in the results. Employment outcomes might be improved by stronger language skills, but it is plausible that better jobs improve the language proficiency. From the data, it is difficult to distinguish whether the language skills are gained through learning at work, for example.

While the model using literacy as the dependent variable may imply that work experience does not affect literacy scores, it is important to note that the variable includes all work experience – both prior and after migration. This makes it challenging to isolate how much of the post-migration language development (as measured by

'imyr's') is attributable specifically to workplace exposure in the host country.

Another limitation of the analysis is the omission of relevant background variables that may influence both literacy skills and earnings. The dataset does not include many of the variables mentioned by Chiswick and Miller (1995), which could be important determinants of language acquisition and labor market performance. Some interpretations regarding the effects of linguistic and physical distance can be made based on the results, but they remain incomplete. Further research could expand on these aspects by including more detailed background variables to better capture the mechanisms through which language skills affect economic outcomes.

7 Conclusive Thoughts

This thesis examined the relationship between host-country language proficiency and labor market outcomes among immigrants in Finland, Sweden, Norway, and Denmark. Adapting a modified human capital earnings function to the data from the Programme for the International Assessment of Adult Competencies (PIAAC), this study finds that literacy skills in the destination language are linked to higher earnings in Sweden and Norway, while the link is statistically insignificant in Finland and Denmark. A higher literacy score was also linked to higher wages for native-born, suggesting that the immigrant wage gap is not primarily driven by language skills. The estimates show that education and working experience have a strong influence on the wage level.

The analysis finds a persistent gender wage gap across countries, even after controlling for literacy skills, education and experience.

Disaggregation of the immigrant subgroups by country or region of birth reveals that immigrants from geographically, culturally and linguistically distant countries face disadvantages in labor market integration. The immigrant groups outside Western Europe generally have lower returns to their literacy skills and have lower earnings. These results were not consistent with all subgroups in each country, as there exists considerable individual variation.

The results have a limited generalizability due to the limited sample size - especially among some of the subgroups that have only a handful of observations. Second, the cross-sectional data provides limited causal inference. There exists potential reverse causality with language skills and earnings. The methodology applied excludes some potential background variables affecting literacy skills that may cause omitted variable bias.

Despite the limitations, the findings support the argument that learning the host-country language can help with the labor market integration for immigrants. The results indicate that the returns for literacy tend to be lower for immigrants, which might be due to other disadvantages immigrants face in the labor market. Future research could benefit from richer longitudinal data that allows to follow the wage development and language skill development in the long run.

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8 Appendix

8.1 Descriptive Statistics

	AgeGroup	BornInCountry	Females	Literacy	Earnings	Education	Experience
1	24 OR LESS	NO	0.524	247.54 (17.62)	1250.69 (177.74)	10.41 (0.64)	1.95 (0.52)
2	24 OR LESS	YES	0.521	303.15 (2.36)	1502.97 (47.9)	11.29 (0.09)	2.34 (0.12)
3	25-34	NO	0.361	236.38 (16.8)	2293.93 (203.6)	11.82 (0.49)	8.25 (0.63)
4	25-34	YES	0.467	315.18 (1.56)	2699.49 (39.44)	13.73 (0.1)	7.68 (0.12)
5	35-44	NO	0.513	261.93 (9.94)	2864.22 (229.42)	13.98 (0.38)	12.8 (1.03)
6	35-44	YES	0.470	305.87 (1.63)	3271.35 (43.64)	13.67 (0.09)	16.48 (0.2)
7	45-54	NO	0.680	277.86 (8.58)	2372.59 (122.87)	12.81 (0.45)	22.49 (1.53)
8	45-54	YES	0.513	294.21 (1.6)	3353.32 (52.9)	13.03 (0.08)	26.05 (0.18)
9	55 PLUS	NO	0.574	251.66 (11.73)	2207.94 (168.72)	12.23 (0.88)	31.7 (2.32)
10	55 PLUS	YES	0.533	272.35 (1.33)	2939.83 (44.97)	12.13 (0.12)	36.29 (0.2)

Table 6: Descriptive statistics by age group in Finland

	AgeGroup	BornInCountry	Females	Literacy	Earnings	Education	Experience
1	24 OR LESS	NO	0.459	236.15 (6.5)	22132.61 (3867.26)	10 (0.22)	1.51 (0.25)
2	24 OR LESS	YES	0.483	288.81 (1.41)	14951.87 (371.91)	10.65 (0.05)	1.7 (0.08)
3	25-34	NO	0.524	236.02 (4.8)	21212.94 (1112.14)	12.6 (0.21)	7.09 (0.37)
4	25-34	YES	0.481	302.69 (1.71)	23593.92 (394.73)	12.66 (0.07)	7.62 (0.16)
5	35-44	NO	0.509	242.46 (4.94)	23488.16 (942.27)	11.99 (0.25)	13.5 (0.53)
6	35-44	YES	0.484	300.34 (1.57)	27715.49 (497.66)	12.92 (0.07)	17.42 (0.21)
7	45-54	NO	0.567	230.79 (5)	24715.45 (1187.39)	11.76 (0.2)	22.53 (0.88)
8	45-54	YES	0.494	285.08 (1.36)	28361.99 (421.88)	12.51 (0.06)	27.37 (0.26)
9	55 PLUS	NO	0.556	229.05 (4.31)	23078.1 (1354.21)	11.56 (0.24)	31.62 (0.98)
10	55 PLUS	YES	0.486	267.36 (1.08)	26078.22 (491.62)	11.69 (0.06)	37.4 (0.29)

Table 7: Descriptive statistics by age group in Sweden

	AgeGroup	BornInCountry	Females	Literacy	Earnings	Education	Experience
1	24 OR LESS	NO	0.318	245.59 (8.14)	15031.72 (1758.87)	11.97 (0.41)	3.23 (0.35)
2	24 OR LESS	YES	0.510	282.16 (1.68)	16223.61 (508.55)	12.67 (0.07)	3.33 (0.1)
3	25-34	NO	0.413	249.07 (4.88)	28240.39 (1071.03)	14.59 (0.29)	8.08 (0.39)
4	25-34	YES	0.497	304.47 (1.68)	33271.66 (681.31)	14.94 (0.09)	9.46 (0.19)
5	35-44	NO	0.508	254.94 (5.53)	30774.06 (1288.35)	15.14 (0.24)	15.28 (0.66)
6	35-44	YES	0.470	298.51 (1.28)	40586.05 (615.82)	14.99 (0.07)	17.9 (0.14)
7	45-54	NO	0.425	260.39 (6.59)	33733.19 (1833.83)	14.63 (0.27)	22.78 (0.91)
8	45-54	YES	0.488	285.09 (1.18)	38832.7 (588.15)	14.4 (0.08)	27.63 (0.18)
9	55 PLUS	NO	0.485	252.43 (6.31)	31974.56 (2569.65)	15.53 (0.32)	34.85 (1.45)
10	55 PLUS	YES	0.487	268.78 (1.35)	35332.62 (882.28)	14.17 (0.1)	36.52 (0.32)

Table 8: Descriptive statistics by age group in Norway

	AgeGroup	BornInCountry	Females	Literacy	Earnings	Education	Experience
1	24 OR LESS	NO	0.611	252.91 (7.88)	10015.9 (965.83)	11.12 (0.26)	3.81 (0.3)
2	24 OR LESS	YES	0.469	280.73 (1.74)	10039.77 (416.87)	10.64 (0.09)	4.3 (0.12)
3	25-34	NO	0.455	243.06 (4.77)	23750.7 (1005.16)	13.79 (0.21)	8.17 (0.35)
4	25-34	YES	0.451	295.17 (2.12)	29182.44 (538.93)	13.85 (0.09)	10.85 (0.22)
5	35-44	NO	0.440	248.9 (3.8)	28938.04 (979.41)	13.51 (0.2)	15.93 (0.35)
6	35-44	YES	0.483	288.54 (1.58)	34622.84 (575.89)	13.57 (0.07)	19.91 (0.18)
7	45-54	NO	0.428	241.48 (4.69)	27464.02 (1080.51)	13.22 (0.24)	23.3 (0.57)
8	45-54	YES	0.499	276.08 (1.38)	34690.44 (564.94)	12.9 (0.07)	29.78 (0.19)
9	55 PLUS	NO	0.513	244.34 (5.33)	27698.99 (1524.57)	13.74 (0.3)	34.59 (1)
10	55 PLUS	YES	0.465	264.88 (0.99)	31694.43 (425.42)	12.81 (0.09)	39.06 (0.19)

Table 9: Descriptive statistics by age group in Denmark

	CountryOfBirth	N	Females	Literacy	Earnings	Education	Experience
	FINLAND	3,421	0.497	297.995 (0.61)	2933.919 (19.53)	12.990 (0.04)	19.631 (0.16)
	ESTONIA	23	0.594	256.297 (10.98)	2340.803 (215.22)	12.050 (0.49)	21.610 (2.09)
	RUSSIAN FEDERATION	31	0.574	258.881 (13.17)	2227.021 (120.41)	12.925 (0.71)	16.533 (1.85)
	SWEDEN	41	0.625	310.659 (6.24)	2692.559 (256.38)	12.854 (0.39)	14.803 (1.16)

Note: '52 observations missing as the country of birth was not stated or inferred'

Table 10: Different countries of birth in Finland

CountryOfBirth	N	Females	Literacy	Earnings	Education	Experience
DENMARK	3,962	0.476	281.194 (0.73)	30002.191 (257.28)	12.933 (0.04)	22.335 (0.14)
AFGHANISTAN	14	0.569	225.433 (15.54)	14546.181 (3090.06)	12.819 (0.91)	9.420 (2.11)
BOSNIA AND HERZEGOVINA	43	0.415	237.859 (7.95)	27740.697 (1729.75)	12.459 (0.47)	12.044 (0.97)
SRI LANKA	29	0.346	225.692 (6.70)	18947.990 (3737.47)	11.059 (0.65)	13.251 (2.54)
CHINA	15	0.759	242.196 (13.57)	22371.326 (3238.24)	14.509 (0.61)	9.836 (1.62)
GERMANY	61	0.351	291.546 (5.77)	29578.747 (2799.57)	14.186 (0.44)	16.604 (2.24)
ICELAND	18	0.492	276.506 (13.14)	30730.524 (4310.05)	13.391 (0.53)	19.698 (3.08)
INDIA	18	0.444	241.161 (18.57)	22887.393 (5991.05)	13.049 (0.85)	9.748 (2.06)
IRAN, ISLAMIC REPUBLIC OF	19	0.296	249.951 (11.53)	25836.172 (3146.24)	13.848 (0.74)	17.601 (2.35)
IRAQ	25	0.481	211.331 (10.98)	22538.304 (3033.71)	12.997 (0.53)	12.526 (1.91)
LAO PEOPLE'S DEMOCRATIC REPUBLIC	16	0.624	238.466 (14.98)	18589.480 (4226.79)	11.352 (0.77)	13.777 (3.20)
LEBANON	15	0.191	242.428 (12.39)	28051.227 (4586.63)	12.843 (0.65)	15.206 (2.62)
NETHERLANDS	27	0.397	282.109 (12.89)	24096.703 (4545.34)	14.154 (0.46)	18.161 (1.96)
NORWAY	34	0.713	273.483 (9.44)	27390.389 (2539.13)	13.969 (0.51)	19.531 (2.03)
PAKISTAN	12	0.085	217.108 (27.85)	26488.517 (3655.21)	13.382 (0.99)	18.753 (3.88)
PHILIPPINES	22	0.779	221.347 (13.78)	15580.432 (2168.06)	12.327 (0.52)	10.656 (1.66)
POLAND	54	0.576	220.633 (9.38)	25265.774 (1983.44)	13.862 (0.54)	13.944 (1.21)
ROMANIA	19	0.611	211.034 (15.23)	18102.029 (2473.39)	12.325 (0.44)	8.154 (1.49)
RUSSIAN FEDERATION	16	0.597	242.677 (16.49)	30233.814 (3846.50)	14.290 (0.90)	11.144 (1.92)
SWEDEN	42	0.688	292.602 (6.61)	32869.110 (2448.63)	14.105 (0.59)	21.353 (2.61)
THAILAND	16	0.783	160.051 (21.26)	19511.343 (2359.88)	9.776 (0.90)	13.764 (2.94)
TURKEY	47	0.342	205.878 (8.44)	23235.429 (1606.19)	11.018 (0.55)	18.339 (1.67)
UKRAINE	17	0.433	229.334 (17.78)	21120.563 (2443.37)	15.429 (0.44)	8.054 (1.96)
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA	11	0.222	224.708 (17.82)	27933.804 (5611.43)	11.480 (0.99)	14.186 (2.84)
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND	37	0.280	275.540 (4.76)	27100.334 (4035.09)	13.356 (0.55)	18.965 (2.90)
UNITED STATES OF AMERICA	20	0.418	277.828 (14.54)	27137.838 (6081.64)	16.392 (0.77)	23.632 (3.33)

Note: 'Countries with 10 or less observations excluded from the table (Albania, Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Myanmar, Burundi, Cameroon, Canada, Chile, Colombia, Congo, Cyprus, Czech Republic, Ethiopia, Eritrea, Estonia, Faeroe Islands, Finland, France, Gambia, Occupied Palestinian Territory, Ghana, Greece, Greenland, Guinea, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Cote d'Ivoire, Japan, Jordan, Kenya, Republic of Korea, Kuwait, Latvia, Lithuania, Malaysia, Malta, Mexico, Montenegro, Morocco, Namibia, Nepal, New Zealand, Nicaragua, Nigeria, Paraguay, Peru, Portugal, Rwanda, Serbia, Sierra Leone, Singapore, Slovakia, Slovenia, Somalia, South Africa, Spain, Switzerland, Syria, Uganda, Egypt, Tanzania, Uruguay, Uzbekistan).'

Table 11: Different countries of birth in Denmark

BirthRegion	N	Females	Literacy	Earnings	Education	Experience
DENMARK	3,962	0.476	281.194 (0.73)	30002.19 (257.28)	12.933 (0.04)	22.335 (0.14)
ARAB STATES	56	0.399	228.732 (7.29)	24187.43 (1759.49)	13.052 (0.39)	13.698 (1.35)
SOUTH AND WEST ASIA	97	0.334	228.177 (7.34)	21027.09 (2047.82)	12.834 (0.37)	12.979 (1.20)
LATIN AMERICA AND THE CARIBBEAN	31	0.566	250.193 (13.99)	20139.44 (2705.00)	13.417 (0.63)	14.951 (2.36)
SUB-SAHARAN AFRICA	40	0.290	223.355 (13.36)	23056.90 (1810.81)	12.612 (0.42)	15.850 (1.83)
EAST ASIA AND THE PACIFIC (POORER COUNTRIES)	76	0.713	215.986 (10.13)	19045.89 (1112.44)	11.877 (0.37)	12.289 (1.09)
CENTRAL ASIA	2		155.623 (115.74)	28451.48 (3762.56)	16.381 (1.51)	15.664 (10.54)
EAST ASIA AND THE PACIFIC (RICHER COUNTRIES)	16	0.420	270.232 (13.44)	19319.03 (5181.32)	12.828 (1.35)	12.531 (3.48)
CENTRAL AND EASTERN EUROPE	265	0.491	225.302 (4.05)	24096.94 (798.53)	12.912 (0.21)	12.888 (0.57)
NORTH AMERICA AND WESTERN EUROPE	312	0.462	279.807 (3.01)	29211.91 (1284.84)	14.300 (0.20)	18.859 (0.76)

Table 12: Descriptive statistics by region of birth for foreign-born in Denmark

BirthRegion	N	Females	Literacy	Earnings	Education	Experience
SWEDEN	2,730	0.486	287.893 (0.67)	25234.90 (189.83)	12.067 (0.02)	19.922 (0.13)
ARAB STATES	54	0.501	205.318 (4.88)	19930.97 (1444.28)	11.127 (0.30)	10.547 (0.84)
SOUTH AND WEST ASIA	43	0.504	244.928 (5.70)	21507.55 (1174.53)	12.362 (0.37)	14.475 (1.37)
LATIN AMERICA AND THE CARIBBEAN	28	0.526	254.706 (7.48)	21309.07 (2246.70)	12.565 (0.45)	14.654 (1.91)
SUB-SAHARAN AFRICA	23	0.394	187.347 (12.20)	18525.44 (2233.58)	10.262 (0.47)	11.787 (2.05)
EAST ASIA AND THE PACIFIC (POORER COUNTRIES)	21	0.747	212.007 (7.76)	18410.31 (2612.13)	10.675 (0.49)	11.912 (2.04)
CENTRAL ASIA	4	0.331	234.626 (28.08)	18334.46 (2009.22)	11.195 (1.36)	7.032 (3.89)
EAST ASIA AND THE PACIFIC (RICHER COUNTRIES)	9	0.714	293.083 (16.24)	26248.82 (5660.32)	13.669 (0.62)	12.144 (3.55)
CENTRAL AND EASTERN EUROPE	133	0.569	232.553 (3.76)	21509.10 (942.73)	11.731 (0.16)	15.742 (0.73)
NORTH AMERICA AND WESTERN EUROPE	138	0.474	269.004 (4.13)	28710.53 (1243.56)	12.319 (0.23)	24.821 (1.12)

Note: '7 observations stated 'Don't know' or 'Refused' excluded from the table.'

Table 13: Descriptive statistics by region of birth for foreign-born in Sweden

BirthRegion	N	Females	Literacy	Earnings	Education	Experience
NORWAY	3,312	0.488	288.731 (0.65)	34258.89 (268.73)	14.359 (0.03)	19.838 (0.16)
ARAB STATES	24	0.246	220.764 (12.20)	21213.34 (2068.72)	13.116 (0.82)	9.938 (2.40)
SOUTH AND WEST ASIA	40	0.356	235.264 (9.58)	26404.29 (1982.07)	13.740 (0.56)	9.688 (1.00)
LATIN AMERICA AND THE CARIBBEAN	13	0.640	240.802 (18.63)	23743.26 (3429.94)	14.385 (0.70)	17.300 (2.97)
SUB-SAHARAN AFRICA	29	0.325	233.627 (9.46)	21403.21 (2327.54)	13.489 (0.55)	9.469 (1.43)
EAST ASIA AND THE PACIFIC (POORER COUNTRIES)	47	0.748	229.690 (7.96)	24116.15 (1767.73)	13.836 (0.51)	12.048 (1.18)
CENTRAL ASIA	3	0.693	265.862 (54.84)	20075.70 (8953.64)	14.976 (1.30)	7.732 (4.63)
EAST ASIA AND THE PACIFIC (RICHER COUNTRIES)	4	0.279	312.430 (8.33)	51180.02 (6528.54)	15.917 (0.89)	27.962 (6.65)
CENTRAL AND EASTERN EUROPE	113	0.424	229.169 (6.98)	26785.05 (932.39)	14.488 (0.26)	13.674 (0.91)
NORTH AMERICA AND WESTERN EUROPE	184	0.421	286.704 (3.28)	35284.51 (1199.81)	15.456 (0.16)	17.973 (0.87)

Note: '3 observations 'Not Stated or Inferred' excluded from the table.'

Table 14: Descriptive statistics by region of birth for foreign-born in Norway

8.2 Regression Results

	Finland		Sweden		Norway		Denmark	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	6.564*** (0.318)	6.675*** (0.344)	9.026*** (0.138)	9.296*** (0.170)	8.809*** (0.169)	9.093*** (0.196)	8.386*** (0.162)	8.303*** (0.188)
Literacy		0.029 (0.047)		0.084*** (0.023)		0.077** (0.026)		-0.030 (0.026)
Education	0.053* (0.020)	0.051* (0.021)	0.054*** (0.008)	0.039*** (0.009)	0.067*** (0.010)	0.054*** (0.010)	0.077*** (0.010)	0.081*** (0.011)
Experience	0.052** (0.016)	0.051** (0.016)	0.031*** (0.007)	0.032*** (0.007)	0.042*** (0.008)	0.042*** (0.008)	0.064*** (0.008)	0.064*** (0.008)
Experience ²	-0.001** (0.000)	-0.001** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Imyrs	0.003 (0.013)	-0.001 (0.014)	0.008 (0.006)	0.004 (0.006)	0.007 (0.007)	0.001 (0.007)	-0.001 (0.006)	0.001 (0.006)
Imyrs ²	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Female	-0.173 (0.099)	-0.179 (0.097)	-0.309*** (0.047)	-0.300*** (0.044)	-0.266*** (0.049)	-0.267*** (0.048)	-0.207*** (0.056)	-0.205*** (0.054)
R ²	0.244	0.246	0.258	0.283	0.265	0.285	0.299	0.301
N obs.	145.000	145.000	454.000	454.000	459.000	459.000	893.000	893.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and std dev 1. Variable 'Imyrs' refers to years since immigration.

Table 15: Standard Mincerian regression results for Finland, Sweden, Norway and Denmark with literacy scores and years since immigration added.

	24 OR LESS	25-34	35-44	45-54	55 PLUS
Intercept	6.187*** (0.342)	6.752*** (0.125)	6.564*** (0.146)	6.648*** (0.195)	6.935*** (0.241)
Literacy	-0.153** (0.049)	0.028 (0.027)	0.037 (0.027)	0.087*** (0.017)	0.057* (0.028)
Foreign-born	-0.002 (0.280)	0.000 (0.074)	-0.156* (0.076)	-0.177* (0.075)	-0.189 (0.152)
Education	0.078* (0.031)	0.063*** (0.007)	0.081*** (0.008)	0.062*** (0.006)	0.058*** (0.007)
Experience	0.167** (0.049)	0.046* (0.019)	0.036** (0.011)	0.050** (0.016)	0.020 (0.016)
Experience ²	-0.017* (0.007)	-0.001 (0.001)	-0.001 (0.000)	-0.001* (0.000)	-0.000 (0.000)
Female	-0.284** (0.085)	-0.276*** (0.036)	-0.278*** (0.033)	-0.304*** (0.025)	-0.272*** (0.038)
Literacy:Foreign-born	0.251 (0.517)	0.068 (0.088)	-0.069 (0.048)	-0.171 (0.099)	-0.051 (0.104)
R ²	0.131	0.186	0.288	0.323	0.183
N observations	316.000	802.000	818.000	892.000	740.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions use log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and standard deviation 1.

Table 16: Regression results for age groups in Finland

	24 OR LESS	25-34	35-44	45-54	55 PLUS
Intercept	8.989*** (0.191)	9.180*** (0.121)	9.151*** (0.166)	9.134*** (0.174)	8.790*** (0.289)
Literacy	-0.048 (0.039)	-0.015 (0.025)	0.086*** (0.024)	0.120*** (0.022)	0.096*** (0.023)
Foreign-born	0.155 (0.137)	-0.136* (0.055)	-0.012 (0.048)	-0.006 (0.043)	-0.071 (0.053)
Education	0.042* (0.018)	0.055*** (0.008)	0.051*** (0.008)	0.049*** (0.008)	0.056*** (0.008)
Experience	0.137*** (0.030)	0.038* (0.016)	0.030* (0.014)	0.036** (0.011)	0.038 (0.018)
Experience ²	-0.013** (0.004)	-0.001 (0.001)	-0.001 (0.000)	-0.001* (0.000)	-0.000 (0.000)
Female	-0.256*** (0.050)	-0.251*** (0.030)	-0.180*** (0.035)	-0.294*** (0.028)	-0.238*** (0.030)
Literacy:Foreign-born	-0.065 (0.148)	0.057 (0.040)	0.016 (0.042)	-0.074 (0.041)	0.042 (0.060)
R ²	0.227	0.176	0.214	0.270	0.240
N observations	324.000	626.000	746.000	804.000	682.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions use log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and standard deviation 1.

Table 17: Regression results for age groups in Sweden

	24 OR LESS	25-34	35-44	45-54	55 PLUS
Intercept	7.460*** (0.229)	8.822*** (0.177)	9.510*** (0.157)	8.957*** (0.237)	9.020*** (0.253)
Literacy	-0.070 (0.038)	0.051 (0.040)	0.112*** (0.022)	0.119*** (0.022)	0.136** (0.042)
Foreign-born	-0.181 (0.143)	-0.046 (0.062)	-0.160** (0.048)	-0.070 (0.056)	-0.052 (0.089)
Education	0.146*** (0.018)	0.082*** (0.009)	0.057*** (0.007)	0.060*** (0.007)	0.058*** (0.011)
Experience	0.149*** (0.033)	0.054* (0.022)	0.018 (0.013)	0.051** (0.016)	0.039** (0.012)
Experience ²	-0.010* (0.004)	-0.001 (0.001)	-0.000 (0.000)	-0.001** (0.000)	-0.001** (0.000)
Female	-0.426*** (0.051)	-0.330*** (0.041)	-0.332*** (0.029)	-0.303*** (0.036)	-0.276*** (0.052)
Literacy:Foreign-born	-0.138 (0.103)	0.005 (0.050)	0.010 (0.040)	-0.005 (0.058)	0.019 (0.073)
R ²	0.285	0.217	0.327	0.294	0.227
N observations	538.000	770.000	942.000	886.000	633.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions use log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and standard deviation 1.

Table 18: Regression results for age groups in Norway

	24 OR LESS	25-34	35-44	45-54	55 PLUS
Intercept	6.877*** (0.190)	8.768*** (0.195)	8.980*** (0.169)	9.420*** (0.274)	8.924*** (0.311)
Literacy	-0.243*** (0.053)	-0.015 (0.034)	0.089*** (0.022)	0.112*** (0.022)	0.057** (0.019)
Foreign-born	-0.012 (0.108)	-0.205* (0.080)	-0.137** (0.049)	-0.151* (0.054)	-0.156* (0.063)
Education	0.181*** (0.018)	0.077*** (0.009)	0.066*** (0.007)	0.048*** (0.006)	0.049*** (0.006)
Experience	0.091 (0.043)	0.054* (0.023)	0.044*** (0.012)	0.021 (0.017)	0.042* (0.017)
Experience ²	-0.003 (0.005)	-0.001 (0.001)	-0.001* (0.000)	-0.000 (0.000)	-0.001* (0.000)
Female	-0.445*** (0.067)	-0.192*** (0.044)	-0.224*** (0.033)	-0.264*** (0.030)	-0.246*** (0.030)
Literacy:Foreign-born	-0.014 (0.083)	0.024 (0.055)	-0.104* (0.041)	-0.024 (0.037)	0.003 (0.058)
R ²	0.284	0.193	0.240	0.213	0.178
N observations	518.000	740.000	1065.000	1145.000	1386.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions use log monthly wage as the dependent variable. Results are weighted by sampling weights. Literacy scores are standardized to mean zero and standard deviation 1.

Table 19: Regression results for age groups in Denmark

Intercept	5.282*** (0.106)
Education	0.024** (0.006)
Experience	0.000 (0.005)
Experience ²	0.000 (0.000)
Imyrs	0.017** (0.006)
Imyrs ²	-0.000** (0.000)
Female	-0.056 (0.035)
Estonia	-0.157* (0.060)
Russia	-0.157*** (0.034)
R ²	0.383
N obs.	94.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Dependent variable log of literacy score. Sweden as the reference country. Results weighted by sampling weight. 'Imyrs' is years since migration.

Table 20: Literacy skills by country of birth for immigrants in Finland

	Sweden	Norway	Denmark
Intercept	5.068*** (0.055)	5.117*** (0.065)	5.175*** (0.064)
Education	0.037*** (0.004)	0.028*** (0.004)	0.025*** (0.003)
Experience	-0.005 (0.003)	-0.003 (0.003)	-0.000 (0.004)
Experience ²	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Imyrs	0.012*** (0.002)	0.018*** (0.003)	0.011*** (0.002)
Imyrs ²	-0.000** (0.000)	-0.000*** (0.000)	-0.000** (0.000)
Female	-0.025 (0.019)	0.009 (0.021)	0.027 (0.021)
Arab States	-0.254*** (0.037)	-0.227** (0.062)	-0.215*** (0.039)
South and West Asia	-0.134** (0.036)	-0.209*** (0.047)	-0.219*** (0.037)
Latin America and the Caribbean	-0.083*** (0.023)	-0.189 (0.079)	-0.110 (0.063)
Sub-Saharan Africa	-0.239*** (0.056)	-0.164*** (0.043)	-0.200** (0.060)
East Asia and the Pacific (Poorer)	-0.164*** (0.045)	-0.219*** (0.035)	-0.233** (0.052)
Central Asia	-0.076 (0.115)	-0.073 (0.202)	-0.745 (0.627)
East Asia and the Pacific (Richer)	0.015 (0.057)	0.112* (0.044)	-0.043 (0.053)
Central and Eastern Europe	-0.142*** (0.025)	-0.197*** (0.039)	-0.205*** (0.022)
R ²	0.330	0.334	0.276
N obs.	661.000	456.000	893.000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

All regressions are run with log literacy as the dependent variable. Results are weighted by sampling weights. 'North America and Western Europe' set as the reference group. 'Imyrs' is the measure for years since immigration.

Table 21: Literacy scores by background characteristics and region of birth in Sweden, Norway and Denmark