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The relationship between education and workplace task discretion from an international comparative perspective

Ashley Pullman¹ et Janine Jongbloed²

Abstract:

Through analyses of Programme for the International Assessment of Adult Competencies (PIAAC) data, the following paper considers the relationship between education and workplace task discretion in 30 countries. We study how mechanisms of inequality function through both 'direct' and 'indirect' means by examining the mediated and non-mediated relationships between education, skill, occupational sector and task discretion. The ways in which these relationships are dependent on both the overall level and the range of task discretion across occupational sectors within a country are considered. Theoretically, individual-agency and critical-institutional hypotheses are compared, two perspectives which provide divergent explanations for the association between education and task discretion. Although our findings partially support both perspectives, there is strong evidence of a relative relationship between education and task discretion. We find that in contexts where overall levels of task discretion are higher and more equal, education and skill operate less strongly as a stratifying force.

Keywords: task discretion; education; skill; international comparative research; PIAAC

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Introduction

Over 40 years ago, Bowles and Gintis argued that research in education cannot be conducted without reference to both labour power and ‘the demands of working people—for literacy, for the possibility of greater occupational mobility, for financial security, for personal growth, for social respect’ (1976, 240). Within the study of education and work various perspectives take up this appeal, examining how education and skill not only generate productive and political forms of labour power (Collins 1979) but also have the power to transform work (Baker 2009). Of central importance for Bowles and Gintis is ‘the degree to which workers have control over planning, decision-making, and execution of production and tasks, as well as sufficient autonomy to express their creative needs and capacities’ (1976, 68-69). That is, education is argued to not only prepare individuals for economic life but also to be intimately connected to the nature of work itself.

Through analyses utilizing the OECD Programme for the International Assessment of Adult Competencies (PIAAC), we consider the relationship between education and workplace task discretion in an international comparative context. We conceptualise task discretion as more than a characteristic of employment by considering it to be an aspect of job quality unevenly distributed by country, occupational sector, literacy skill and education level. With education often perceived as ‘the single most important determinant of occupational success’ (Shavit and Müller 1997, 1), it is necessary to examine the complex relationship between education and the cultivation of workplace practices. Given that both inequality of opportunity and outcome vary across educational systems, the relationship between task discretion and education is framed as ‘interactive and territorially embedded’ (James, Guile, and Unwin 2013, 244) through the lens of international comparison. A comparative framework allows for an exploration into how the relationship between education and task discretion differs across contexts and distinct forms of inequality connected to this association. Indeed, the persistence of unequal achievement and outcomes remains an integral aspect of both education systems and labour markets around the world.

Our work addresses the under-studied relationship between education and workplace task discretion. Although research has linked higher levels of workplace task discretion to contexts where industry-specific skills and on-the-job training are emphasized (Edlund and Grönlund 2010; Esser and Olsen 2012), other studies provide evidence that counters this finding. For example, relatively low levels of workplace discretion have been found in Germany, a country that is often described as promoting industry-specific skills through vocational education (Gallie 2007). Rather than examining specific characteristics of education systems, our contribution examines how the relationship between education and task discretion is dependent upon overall levels and inequality in the availability of task discretion across occupational sectors. Comparing individual-agency and critical-institutional accounts, we investigate how mechanisms of inequality function through both ‘direct’ and ‘indirect’ means by examining the mediated and non-mediated relationship between education and task discretion. This examination is presented in four parts: First, we explore the interplay among education, task discretion and skill in our literature review. Next, we present the research purpose, data and modeling approach. The second-to-last section presents the research findings, while lastly the discussion and conclusion reengage the original research questions in light of our findings.

Literature review

Task discretion can be understood both broadly as the ability for workers ‘to participant in making decisions about their jobs and working conditions’ (Kalleberg, Nesheim, and Olsen 2009, 99) and, more specifically, as ‘the extent to which employees are able to exercise independent initiative and judgment over their job tasks’ (Zhou 2014, 6587). Given that individuals with greater discretion generally report higher workplace satisfaction (Gallie 2013; Green 2004, 2008), management and organizational theory have charged task discretion as the linchpin of a ‘high performance’ workplace, resulting in not only increased employee satisfaction and investment, but also higher levels of productivity (Appelbaum *et al.*

2000; Becker and Huselid 1998). As ‘a nonmonetary labour market reward’ (Petrie and Roman 2004, 590-591) task discretion is unequally distributed, varying within and among regions (Dobbin and Boychuk 1999; Edlund, and Grönlund 2010) and by socio-demographic aspects such as gender (Adler 1993; Halldén, Gallie, and Zhou 2012) and race and ethnicity (Petrie and Roman 2004; McCrate 2007). However, how education—which itself varies both demographically and regionally—predicts task discretion has not yet been examined in detail.

The relationship between education and task discretion can be considered from two broad theoretical standpoints: 1) individual-agency perspectives and 2) critical-institutional approaches. Both perspectives characterize task discretion as either a skill in itself or as a characteristic of employment. An individual-agency perspective often explicitly or implicitly relies on a human capital framework, which casts education as an investment that produces productive and functional forms of capital/skills for both an individual and the wider society in which he or she resides (Schultz 1960). Both capital and skill are understood to increase the ‘effective agency on the part of individuals’ (Mirowsky and Ross 1998, 415). From an individual-agency perspective, Spenner (1990) argues that ‘autonomy-control’ can be conceived of as a workplace skill, defined as control over ‘the content, manner and speed with which tasks are done’ (402-403). From this perspective, researchers consider connected, and in some cases indistinguishable, aspects of task discretion. For example, Lorenz and Lundvall (2011) connect workplace task discretion to the rise of creative work. Additionally, this framework often implies that more flexible work structures, especially within knowledge economies, enables increased levels of workplace task discretion (Viedma Marti and Enache 2008).

Also working from an individual-agency perspective, other researchers highlight task discretion as an important component of workplace well-being (Mustosmäki *et al.* 2011). As Green writes, ‘an individual whose job involves choosing a set of tasks t for a wider set T can be taken to have a higher quality of work life than one whose job precisely prescribes that tasks t will be performed’ (2006, 13). Yet within job-quality literature there is ambiguity concerning the relationship between skill and task discretion. First, although education and skill-level are predicted to increase the discretion afforded to workers, this assumption is not always supported empirically (Green 2006). Second, directionality between skill and discretion is often unclear. That is, discretion is found to promote skill use, especially literacy, communication, self-planning, numeracy and problem solving skills (Green 2012), and not just be a result of previously learned skills and competencies. Literacy is given special consideration, as it is argued to increase participation and enable ‘higher forms of communication that are entailed in facilitating learning and inducing others to follow desired courses of action’ (2012, 39).

Following this examination of individual-agency perspectives, two lines of inquiry arise: first, the separation between skills and the organization of work itself (Guile 2002), and second, how task discretion is attained by workers within different contexts. In response, critical-institutional perspectives situate task discretion as a component of workers’ struggle for power within the labour process. Beginning with Braverman (1974), both the rise of monopoly capitalism and changing use of technology within the workplace are argued to result in processes of deskilling and reduced worker discretion (Lewis 2007). Subsequent research has examined how workers with seemingly little discretion find ways to both covertly and openly gain power (Burawoy 1979; Fuller *et al.* 2009; Sallaz 2002). However, both Burawoy (1979) and Boltanski and Chiapello (2005) assert that post-Fordist contexts offer discretion within the workplace in order to prevent dissent, raise productivity and control the labour power of workers.

This body of critical scholarship emphasizes both the structural and indirect aspects of the education-discretion association. Of concern is how individuals are sorted into unequal economic positions based upon the opportunities their education level provides. Both systems of education and employment are argued to allocate status and skill, propagating hierarchical divisions of labour (Brown 2001; Collins 1979; Willis 1977). Rather than understanding education as a means of endowing individuals with abilities—as found within individual-agency perspectives—critical-institutional

approaches tend to follow a ‘screening hypothesis’ which argues that schools sort pupils in accordance with ‘characteristics employers are more likely to accept as evidence of greater productivity’ (Sobel 1982, 261). That is, it is credentials themselves, rather than the skills learned within education, that provide access to jobs with high task discretion. Thus, the relationship between task discretion and education can be considered through two broad perspectives: one focusing on freedom of choice at the individual level, casting task discretion as an outcome of human capital or skill, and the other providing a more structuralist account that focuses on how education credentials provide opportunities to higher-quality employment where discretion is more readily available.

Research purpose

The purpose of our study is to explore the relationship between education and workplace task discretion from a comparative perspective. The relationships explored within our research are not assumed to be universal; rather, how they may differ across contexts is a crucial aspect considered. Based on the literature review above, two diverging theories of the role of education are clearly delineated:

- a) An individual-agency framework, which assumes the connection between education and task discretion is based on skill acquisition, and
- b) A critical-institutional approach, which alternatively argues that the relationship between education and task discretion is based on occupational sorting.

Given that an ‘*absolute* value of education’ (Horowitz 2015, 750) is assumed under an individual-agency approach, two possible research outcomes arise. First, as illustrated by arrow A in Figure 1 below, education is understood to directly increase task discretion, even when controlling for occupational sector. Second, the effect of education on task discretion is understood to be mediated by skill. In this case, the impact of education on task discretion would be mediated by literacy assessment scores—an available skill indicator with our data—as illustrated by arrow B¹ in Figure 1.

[Insert Figure 1 here]

The second perspective suggests a more ‘*relative* value of education’ (Horowitz 2015, 751). As critical-institutional perspectives suggest, education functions as a ‘sieve’ (Stevens, Armstrong, and Arum 2008, 129), sorting individuals into various occupations that then create varied opportunities for task discretion. As illustrated by arrow B² in Figure 1, the relationship between education and task discretion is assumed to be mediated by occupational sector, even when controlling for skill level. The overall level and the range of task discretion across occupational sectors within a country also provide evidence for these relative effects. Further, given that credentials are argued to have a signaling effect, a direct relationship between education and task discretion would also support a critical-institutional perspective.

Our research questions are grounded both theoretically, as discussed above, and empirically.³ From this framework of inquiry, four research questions arise: 1) *Does education have a direct influence on task discretion?* 2) *Does skill level, as measured by a standardized literacy score, mediate the relationship between education credentials and task discretion?* 3) *Does occupation mediate the relationship between education credentials and task discretion?* and 4) *How do these three relationships differ across contexts?* Before answering these questions in detail, it is necessary to first describe our data and research approach.

Data

³ Correlation is considered to be a strong measure to assess the viability of possible mediation effects (Wu and Zumbo 2008). Across all countries within our analysis both occupational sector and literacy are moderately correlated with formal educational credentials (literacy score = Spearman rho of 0.469, s.e. 0.006; occupational sector = Spearman rho of 0.542, s.e. 0.005).

The OECD Programme for the International Assessment of Adult Competencies (PIAAC) offers a wealth of survey and proficiency data to examine the relationship among education, skill and task discretion across differing contexts. As of early 2017, approximately 216,250 non-institutionalized adults between the age of 16 and 65 have been surveyed in regional and minority languages around the world (OECD 2013, 2016). PIAAC allows for cross-country comparison of aspects related to demographics, education, work, self-reported skill use and standardized assessments in literacy, numeracy and problem solving in technologically-rich environments. Round one of data collection took place between 2011 and 2012 and approximately 5,000 individuals were surveyed in 24 countries and regions.⁴ Round two was conducted between 2014 and 2015, bringing the total number of countries and regions surveyed to 33. Round three, not yet released at the time of publication, will provide data for approximately six additional countries.

The aim of PIAAC was to provide a representative sample and each country was mandated to cover at least 95% of the entire population in the sampling frame, with a target response rate of 70% and a minimum response rate of 50%. Sampling differed in each country and was based on household or registry strategies. The survey included first a 45-minute background questionnaire examining demographic characteristics, education, current and last employment characteristics, skill use outside of employment and, in some cases, country-specific questions. This questionnaire was followed by a 5-minute module that sorted participants into paper- or computer-based competency assessments. Within each assessment area each respondent was allotted a portion of the test, with an imputed final score generated through the use of ten plausible values. Although deemed inconsistent at the individual level, the use of plausible values minimizes measurement error at the population level (OECD 2013). Additional complexity when using these data is found in the 81 replicate weights, which take into account both the country-specific sampling strategy and non-response. The public use file (PUF) includes a number of individuals without skill proficiency information. Although for most countries nonresponse is minimal, it is higher in some regions, specifically 17.7% in Cyprus, 5.2% in Flanders (Belgium), 4.5% in Lithuania and 4.2% in the United States (OECD 2016). Because of the complex survey design of PIAAC, a number of statistical programs have been developed to aid in the modeling process. Consistent with the recommendations of OECD analysts, analysis within the following paper uses both the ‘repest’ and ‘piaactool’ commands for Stata in order to obtain correct estimates and robust standard errors. Although such tools minimize the type of modeling possible, they assure that researchers properly incorporate plausible values and survey weights.

The following analysis uses the PIAAC PUF, a subset of the full national master databases. Our analysis excludes Australia and Jakarta (Indonesia), countries which did not release PUF, and Russia, due to the lack of availability of certain key indicators. Additionally, concerns of data quality for Russia have led others to remove this country from comparative analyses (Heisig and Solga 2015). Given the focus on task discretion within employment, unemployed individuals were dropped from all analyses. PIAAC uses the International Labour Organization’s definition of employment, defining those who worked at least one hour in the previous week as employed. Both respondents who worked less than one hour in paid employment and those who self-described as unemployed were removed from the analyses.

Methodological Approach

The methodological approach taken in this paper is threefold. First, we descriptively compare countries by examining both the overall average and the occupational range in task discretion at the country level. Second, using individual-country OLS linear regression, Models 1, 2 and 3 examine the direct relationship between task discretion and education and how the effect size is impacted by selected covariates. We also examine the results of Models 2 and 3 a second time both graphically and through linear regression which pools all country data in order to consider how the country-level average and

⁴ The one exception is Canada, where, due to the aim of capturing regional and population diversity, approximately 27,000 individuals were surveyed.

occupational range in task discretion is influential in determining these relationships. We use cluster-robust standard errors (also termed the sandwich estimator or empirical standard errors) to account for country clustering within a pooled model. The use of a single-level model with cluster robust standard errors is advantageous when examining variability across clusters through random effects are not a substantive research interest (McNeish, Stapleton, & Silverman, 2017). Rather, this approach estimates fixed effects regression coefficients while accounting for unobserved country-level heterogeneity, a method commonly used with international comparative assessment data (Huang, 2009, 2013) and economics and political science disciplines (Dieleman and Templin 2014). Fixed-effects rather than multi-level modeling was chosen both to render the results more cohesive and comparable between analyses and due to the lack of appropriate country-level weights released in the PIAAC PUF. Third, using the KHB method (Kohler, Karlson, and Holm 2011) we examine how occupational sector and skill mediate the relationship between education and task discretion. The KHB method describes the degree to which a control variable, in this case occupational status (Z , see Figure 1) and literacy score (W), mediates or explains the relationship between educational credentials (X) and task discretion (Y). That is, it decomposes the effect of education on task discretion into direct, indirect and full effects.

Dependent variable

Alongside having a number of education-level indicators, PIAAC also dedicates a section of the questionnaire to measuring perceptions of workplace skills and behaviours. As noted within the literature review above, task discretion has been examined in a variety of ways. Within the PUF, three questions included in the background questionnaire were used to form a standardized derived indicator of task discretion with 125 unique responses ranging from -5.71 to 3.93. The source questions asked respondents, ‘to what extent can you choose or change: 1) the sequence of your tasks? 2) how you do your work? and 3) the speed or rate at which you work?’ Respondents were asked to provide an answer using a 5-point scale: ‘1) not at all, 2) very little, 3) to some extent, 4) to a high extent and 5) to a very high extent.’ The reliability of the derived scale was assessed using Cronbach’s alpha and Pearson’s correlation coefficients. Item-test correlation was found to be similar across all indicators, ranging from 0.88 to 0.84, while the item-rest correlation ranged from 0.73 to 0.65. Across all countries the scale reliability coefficient alpha was 0.83. In examining inter-country differences alpha was found to be highest in South Korea (0.92) and lowest in Finland (0.71).

Independent variables

The main independent variables of interest are formal educational credentials, literacy assessment score, and occupational sector. Within the PUF, educational level is captured through the International Standard Classification of Education (ISCED), a classification system that allows for comparison across different systems of education. Due to coarsened data and cross-national differences, we compare four levels of education: 1) lower secondary or less (ISCED 1, 2 and 3c short) as the reference group; 2) upper secondary (ISCED 3a, 3b and 3c long); 3) non-tertiary and professional diplomas (ISCED 4a, 4b, 4c and 5B); and 4) tertiary bachelor and research degrees (ISCED 5A and 6). Although several different methods of categorizing educational credentials were examined, discrepancy among countries was found to be a limiting factor. For example, there are no respondents in Cyprus, France, South Korea and the Netherlands with credentials at ISCED level 4, and respondents with bachelor degrees and research degrees are grouped together in England/Northern Ireland.

As discussed above, one of the strengths of PIAAC is the ability to include standardized test results that measure skill level. However, given the strong correlations among the three test areas, only the literacy assessment score has been included in our models. Literacy score serves as a proxy for individual skill, one that is limited in capturing the nuanced nature of individual ability but enables cross-country and group comparisons. We conceptualize literacy in a manner consistent with the definition given by the OECD as ‘the ability to understand, evaluate, use and engage with written texts to participate

in society, achieve one's goals, and develop one's knowledge and potential' (2013, 61). Importantly, literacy assessment scores have not been arbitrarily chosen. As noted in the literature review above, Green (2012) finds literacy to be one of the fastest growing workplace skills necessary in the British context. Furthermore, we view literacy as foundational to the other skills.

Occupational sector is examined within our analysis through the International Standard Classification of Occupations (ISCO). This classification system enables an examination of task discretion for (1) managers, (2) professionals, (3) technicians and associate professionals, (4) clerical and support workers, (5) service and sales employees, (6) skilled agriculture, forestry and fishery workers, (7) craft and tradespeople, (8) assemblers, plant and machine operators and (9) elementary occupations (such as cleaners and laborers). Due to the very small number of PIAAC respondents employed in the armed forces ($n=627$, 0.48% of the overall sample) this group is not examined and rather re-categorized as part of a tenth category capturing missing occupational data. In order to examine task discretion across groups, occupational sector has been modeled as a series of dummy variables. Plant and machine operators are held constant as the reference group, the employment sector with the lowest level of task discretion across all countries.

Finally, in order to take into consideration demographic and employment differences, several control variables are included in all models: 1) gender, 2) age (in 10 year increments), 3) native or non-native speaker status, 4) part-time employment (less than 30 hours a week), 5) public and non-profit sector employment, 6) self-employment and 7) yearly income. Income is modeled as a percentile rank categorizing respondents with low (under the 25th percentile), medium (25th to 74th percentile) and high (75th percentile and above) income. Given the large number of missing values for income (11.63% of the overall employed sample), this group has been retained in the model as a fourth income category.

Results

[Place Figure 2 here]

In order to examine the impact of education on task discretion across countries from a comparative perspective, it is necessary to consider 1) how average self-reported task discretion differs between countries and 2) how it is distributed within countries by occupation. As shown by the vertical axis in Figure 2, the weighted average level of task discretion among PIAAC respondents is highest in Finland, Japan, Austria, Sweden and Denmark and lowest in Italy, Lithuania and Greece. The average level of task discretion in the country is linked to notable differences in the distribution of task discretion by occupation. For example, the average level of task discretion reported by managers in Singapore is equal to or less than respondents employed across all occupations other than plant/machine operators and assemblers in Denmark. It cannot be taken for granted that the level of task discretion within an occupational sector is similar across contexts, as dramatic country differences when comparing task discretion within each occupational sector are found. For example, respondents employed in professional occupations reported an average discretion level of 1.53 in Finland, while respondents in Greece reported an average of -0.54. Likewise, respondents employed in elementary occupations reported an average level of task discretion of 0.31 in Norway and -2.67 in South Korea. The horizontal axis in Figure 2 illustrates the range of task discretion scores reported across occupations within each country. As an important marker of inequality, the range in access to task discretion is largest in the Slovak Republic and smallest in Finland. Like a rising tide that lifts all boats, the bivariate relationship in Figure 2 suggests that higher levels of average task discretion across all occupational sectors narrows the gap among occupations within a country. Indeed, a moderate negative correlation between these two measures is found at -0.40

with an R^2 of 0.16.⁵ As will be explored next, this interplay at the country and occupational level signals that inequality in task discretion is distinct within each country, but may exhibit cross-national trends.

[Place Figure 3 here]

Model 1, illustrated in Figure 3, examines the bivariate relationship between education credentials and self-reported task discretion at work (see Appendix 1 for full models). Without taking into account other key covariates, we find that educational credentials do indeed exert a significant impact on task discretion in all countries at the undergraduate degree level or above. Although a relationship between education and task discretion is found for most levels of education, no significant effect is found at the upper secondary level in Lithuania, Poland, Ireland, Japan, Greece, Turkey, Finland and Sweden, nor at the diploma level in Lithuania, Japan, Greece, Turkey and Denmark. Comparing across countries, we find that the strength of the relationship between task discretion and education varies considerably. The coefficient representing credentials at the degree level or above is largest in the Slovak Republic ($\beta=2.87$, $s.e.=0.25$, $p<.001$) and smallest in Sweden ($\beta=0.36$, $s.e.=0.12$, $p<.01$). Generally, the coefficients representing the relationship between education at the diploma level and task discretion are smaller, although the difference between the effects of a degree versus a diploma is narrow or non-existent in Germany, Italy, Finland, Norway and Sweden. In other countries—notably, Lithuania, Estonia, Ireland, Japan, Greece and Turkey—the gap between degree and diploma/upper-secondary credentials is larger. Finally, the explanatory power of Model 1, as illustrated by the R^2 reported in Appendix 1, is found to range from 0.00 in Sweden to 0.13 in Singapore and England/North Ireland.

Model 2 controls for gender, age, non-native speaker status, literacy score, income and part-time, self-employed and public sector employment. In comparing Models 1 and 2, we find that educational credentials at the degree level continue to exert a significant impact on task discretion in all countries other than Sweden and Norway. However, the effect size diminishes considerably across all countries and levels of education. A few exceptions exist: the coefficient measuring diploma is now significant in Greece ($\beta=0.60$, $s.e.=0.26$, $p<.05$) and all three educational coefficients are larger in Cyprus. In Model 2, no significant effect is found at the upper secondary level in Lithuania, the United States, Israel, Poland, Finland, Turkey, Greece, Sweden, Chile, Norway, Ireland, New Zealand and Japan, nor at the diploma level in Lithuania, Turkey, Sweden, Norway, Denmark and Japan. Again, the coefficients measuring education are found to be largest at higher credential levels in the majority of countries. Nevertheless, in Germany, England and the Slovak Republic, respondents with a diploma self-report similar or slightly higher levels of task discretion than degree holders. As found within Model 1, the increased level of task-discretion by educational level varies from country to country. Respondents with upper secondary credentials self-reported a higher level of task discretion ranging from 0.26 ($s.e.=0.12$, $p<.05$) in Estonia to 1.03 ($s.e.=0.31$, $p<.001$) in the Czech Republic. The coefficient for postsecondary diploma credentials spans from 0.24 ($s.e.=0.15$, $p<.05$) in New Zealand to 2.42 ($s.e.=0.64$, $p<.001$) in the Slovak Republic, while credentials at the undergraduate degree level or higher range from 0.30 ($s.e.=0.33$, $p<.05$) in Denmark to 2.21 in the Slovak Republic ($s.e.=0.27$, $p<.001$). As indicated by the R^2 , the explanatory power of Model 2 ranges from 0.05 in Finland to 0.25 in South Korea.

In almost all countries, the effects of education are weakened or disappear altogether once occupational sector is modeled in Model 3. As shown in Figure 2, the relationships between task discretion and all levels of educational credentials become non-significant in Chile, the United States, Israel, Estonia, Japan, New Zealand, Greece, Turkey and Finland (while remaining non-significant in Norway and Sweden). The direct relationship between task discretion and credentials at the degree level becomes non-significant in Germany, Austria and Denmark, although a small significant relationship remains at other levels of education. Regardless of the effect of occupational sector, a direct relation

⁵ Greece has a powerful outlier effect on the bivariate relationship between the average occupational task discretion and the range. When removed, the correlation increases to -0.52 with an R^2 of 0.27.

between task discretion and education exists at the upper-secondary level in the Slovak Republic, Slovenia, the Czech Republic, Singapore, Belgium/Flanders, Germany, Canada, Austria, Italy, England/North Ireland, Cyprus, Spain and Denmark, the diploma level in the Slovak Republic, Slovenia, the Czech Republic, Singapore, Belgium/Flanders, Germany, South Korea, Canada, Poland, Austria, England/North Ireland, Cyprus and Spain, and the degree level in the Slovak Republic, Slovenia, the Czech Republic, Singapore, Lithuania, Belgium/Flanders, France, the Netherlands, South Korea, Canada, Poland, Italy, England/North Ireland, Ireland, Cyprus and Spain. Nevertheless, the size of these significant coefficients shrink when compared with Model 2, signaling that education may function not only to impact access to task discretion within employment directly, but also through occupational sorting (as will be examined in the KHB models below). The direct effect of postsecondary education at the degree level is largest in the Slovak Republic, the Czech Republic and Lithuania. Finally, the explanatory power of Model 3 is found to range from 0.09 in Finland to 0.29 in South Korea.

[Place Figure 4 here]

As shown descriptively in Figure 2, both the average self-reported level of task discretion and the range of responses by occupational sector varies by country. Next, we study this trend in greater detail by examining the relationship between education and the overall country-level average and occupational range in task discretion both graphically and through statistical modeling. Figure 4 illustrates the conditional effect of credential level by plotting the educational coefficients from Model 2 (on the y-axis) by both the average level of task discretion and the overall occupational range (on the x-axis). Net of demographic, employment and income controls, we find that the negative correlation between education and the average level of task discretion grows at higher levels: -0.14 ($R^2=0.02$) at the upper-secondary level, -0.35 ($R^2=0.13$) at the diploma level and -0.60 ($R^2=0.34$) at the degree-level. We find an even stronger relationship when examining the positive correlation between the education and the range in task discretion by occupational sector: 0.66 ($R^2=0.43$ and 0.44) for the upper-secondary and diploma levels and 0.80 ($R^2=0.63$) for the degree level. Accordingly, countries with a higher average level of task discretion tend to exhibit smaller effects of educational level on individuals' self-reported task discretion, and conversely, countries with a larger range in task discretion by occupational sector generally show larger effects of educational level on task discretion. Shown next, statistical modeling allow us to test these descriptive trends empirically.

[Place Table 1 here]

Complementing these findings, Table 1 presents the results of four pooled models that further explore how the effect of education on self-reported levels of task discretion are impacted by both the overall country-level average and distribution of task discretion by occupational sector. We run separate models examining interactions between each level of education and the country-level average or range both with and without occupational controls, given the mediating effect found above. Thus, we replicate Models 2 and 3 of the OLS regressions incorporating the country-level effects suggested in Figure 2. The pooled models for average level of task discretion across all occupations finds a significant negative effect for the degree-level interaction terms, but not at the diploma and upper-secondary level. The results are similar with or without occupational sector controls. These findings suggest that the direct relationship between education at the bachelor's level or above and self-reported task discretion is dependent upon the overall level of task discretion within each country. That is, in countries with higher overall levels of task discretion, individual with a bachelor's degree or above higher self-report, on average, lower levels of task discretion. Alternatively, the results for occupational range in task discretion illustrate a stronger mediation effect. With and without occupational controls, we find significant positive interaction effects at the diploma and degree level. These results illustrate that the greater the level of inequality in task discretion between occupational sectors at the country level (i.e., the larger the range) the greater the direct effect of postsecondary education on individuals' self-reported task discretion. Notably, the coefficients measuring diploma are larger than degree, a finding that is due to an outlier effect which is

visible in Figure 4. Notably, the mediating effect of occupational sector diminishes the size of the interaction terms in Table 1. We now turn our attention towards examining this mediating effect in greater detail.

[Place Figure 5 here]

The results of OLS Models 1, 2 and 3, as well as those of the pooled models, highlight that the direct relationship between education and task discretion weakens with the inclusion of covariates, especially those measuring occupational sector. However, what is less evident in the above models is the distinction between education and skill, as measured by literacy proficiency scores. This relationship is difficult to disentangle through OLS modeling given the strong interrelation between education credentials and literacy score. Prior PIAAC analyses have confirmed the relationship between education credential level and the various skill measures, and note that the inclusion of education controls within a model reduces the magnitude of proficiency coefficients (Holzer and Lerman 2015). PIAAC researchers largely take two approaches to address this issue: 1) As in Models 1 and 2 above, both assessment score and education are modeled as predictors and the effects of collinearity are accepted or ignored (Reder 2015); and 2) path models are used to examine the mediating relationship between education and skill on a given outcome variable (Smith and Fernandez 2015). Here we take the second approach, by examining the extent to which occupational sector and skill mediate the relationship between education and task discretion. Figure 5 presents the results of two KHB decomposition models examining the mediating effects of literacy and occupational sector separately (see Appendix 2 for full models). The indirect effects of these two variables are illustrated graphically for each country. Both models also include all demographic, employment and income controls.

We find that across all countries occupational sector mediates the relationship between education at the degree level or above and task discretion, an effect that is smallest in Spain ($\beta=0.13$, $s.e.=0.09$, $p<.001$) and largest in the Slovak Republic ($\beta=1.15$, $s.e.=0.12$, $p<.001$). Across the majority of countries, we also find that occupational sector mediates the relationship between credentials at the diploma or upper-secondary level, although no significant effect is found for Spain and Lithuania at these levels, nor for Poland, Finland, Greece, Chile and Denmark at the upper-secondary level. When examining the direct relationship between education and task discretion, we find that diploma credentials exhibit an effect size similar to that of a degree in the Slovak Republic, Slovenia, the Netherlands, Germany, Flanders/Belgium and Denmark. In other cases, the extent to which diploma and upper-secondary credentials are mediated through occupational sector is smaller, notably in Norway, New Zealand and Canada. Lastly, in many countries where a significant relationship mediated by occupational sector is found (i.e. a significant indirect effect), a direct effect is also seen (e.g., Spain, Poland, France, Singapore, Canada, Austria, England/North Ireland, Cyprus, Flanders/Belgium, the Czech Republic, South Korea, Slovenia and the Slovak Republic). This suggests that credentials both directly influence task discretion and provide access to occupational sectors where task discretion is more readily available in these contexts. However, in other cases, only a relationship mediated by occupational sector remains (e.g., Finland, Turkey, Greece, Sweden, Chile, Norway, Ireland, New Zealand, Japan, the United States, Estonia and Israel). Notably, in the majority of cases where only an indirect relationship is found, the bivariate relationship examined in Model 1 above is also small.

As illustrated in the bottom half of Figure 5, for the majority of countries, the mediating effect of literacy is comparably smaller than occupational sector, and no significant effect is found in 12 countries. However, in some countries the effect of literacy skills is similar to occupational sector. For example, in Chile, at the degree level or above, both access to high task discretion occupations ($\beta=0.47$, $s.e.=0.21$, $p<.05$) and heightened literacy scores ($\beta=0.38$, $s.e.=0.15$, $p<.05$) significantly explain the effect of education on self-reported task discretion. We find a similar effect in Canada, England/North Ireland, the United States, Estonia, Israel, Poland, Singapore, France, the Netherlands, Greece, Turkey, Ireland, South Korea, Slovenia, Lithuania and Spain. It is also noteworthy that in Spain the mediating effect of literacy

(degree $\beta=0.22$, s.e.=0.05, $p<.001$) is larger than occupational sector (degree $\beta=0.13$, s.e.=0.09, $p<.001$). Curiously, in contrast to the occupational sector results, the overall bivariate effect size—as found in Model 1—does not adequately explain the likelihood of literacy mediating the relationship between education and task discretion, as literacy has no significant mediating effect in the Slovak Republic. Lastly, we examine the correlation between the KHB results and country-level task discretion average and occupational range in task discretion. We find that the β coefficients measuring the mediating effect of occupational sector have a moderate-to-strong correlation with the occupational range within each country (upper-secondary=0.59, diploma=0.57, degree=0.70) but a smaller negative correlation with the overall average (upper-secondary=-0.24, diploma=-0.26, degree=-0.49). The β coefficients measuring the mediating effect of literacy have no correlation with occupational range (upper-secondary=-0.14, diploma=-0.08, degree=-0.04) but a strong negative correlation with the overall average (upper-secondary=-0.60, diploma=-0.61, degree=-0.67). This correlative finding suggests that higher overall levels of task discretion within a country lessen the mediating effects of literacy and occupation, while a greater range in task discretion between occupations increases the mediating effect of occupational sector.

Discussion

Our research partially supports, yet ultimately casts doubts on, a purely individual-agency framework for understanding the relationship between education and task discretion. As discussed in the literature review, the relationship between education and task discretion can be understood as based on skill acquisition—examined within this paper through literacy assessment scores—or occupational sorting. Across all the countries researched, the mediating effect of occupational sector was larger than skill, with the only exception being Spain. We find that education has the power to sort individuals into occupational sectors that are characterized by more or less workplace task discretion. In some countries, this effect works in tandem with a smaller mediating effect of literacy skill. These findings provide support for critical-institutional perspectives, which suggest that although education may indeed increase opportunities for task discretion at work, it does so through a market signal, which enhances workplace opportunities within the occupational and country context. In some countries there is also evidence supporting an individual-agency approach, as skills gained through education also directly enhance self-reported levels of task-discretion at work. Importantly, however, the mediating effect of literacy skill in itself does not provide a complete explanation for the relationship between education and task discretion, but rather functions alongside occupational sorting.

Our second main research finding is that the relationship between education and task discretion is dependent on the country context. As illustrated by the pooled models above, both the overall level of discretion and the range between occupations provide an explanation for country differences surrounding the direct relationship between education and task discretion. We find that the direct effect of credentials at the postsecondary education level is smaller in countries with higher overall levels of task discretion. Correspondingly, the greater the occupational range within a country, the larger the direct effect of education at all levels. This finding suggests that the direct relationship between education and task discretion is relative, based on both the distribution of task discretion within a country and the overall average. As a rising tide lifts all boats, the power of education diminishes and become less of a stratifying force when task discretion is higher and less unequal within a country. These results should also be framed in relation to the KHB decomposition results, where the range has a moderate to strong positive correlation with the coefficients measuring the indirect effect of occupational sector, and the average level of task discretion has a strong negative correlation with the indirect effect of literacy assessment score. Together these findings highlight that both the direct and indirect effects of education on task discretion are impacted by the country-level average and occupational sector range in reported task discretion.

Our findings highlight how the direct and indirect relationships among skill, education and occupation are relative to levels of inequality within a country. When occupations with high levels of task discretion are scarce, education acquisition matters more. This suggests that there is a lack of intrinsic or

essential qualities in determining who is qualified to take on workplace tasks where discretion is necessary (Fuller and Unwin 2006). This finding is supported by prior research showing that the relationship between skill and inequality is relative to both the occupational structure and changing education levels (Marginson 2016). We provide a unique addition to the body of research that examines how the power of skill and/or education is dependent upon country characteristics. Specifically, we suggest that the level and distribution of task discretion are key contextual variables framing these relationships. How and why the ‘returns’ to both education credentials and skill differ among countries has become an important consideration within international comparative research based on PIAAC data (Broecke 2015; Hanushek, Schwerdt, Wiederhold, and Woessmann 2015; Pena 2015). A main argument within this new body of research is that the ways in which skill and education are valued differ across context due to important country characteristics. Importantly, as Pena (2015) argues, skill in itself does not determine inequality.

There are several important institutional factors argued to shape returns to skill. Hanushek *et al.* (2015) find that returns to skill are lower in countries with large public sectors, greater union density and strong employment protection. Although it is beyond the scope of this paper to assess if these three aspects explain country-level differences in the relationship among education, skill and task discretion, this finding provides an avenue for further research. Public sector employment, unionization and employment protection are considered to be three aspects connected to welfare production regimes, characterized as institutional frameworks that support and promote specific forms of skill formation and trajectories. Under this theoretical framework, specific forms of social protection are argued to ‘aid the market by helping economic actors overcome market failures in skill formation’ (Estevez-Abe, Iversen, Soskice 2001, 145). Although Gallie’s (2007) research casts doubt on the strength of a welfare production regime perspective in explaining cross-country differences in task discretion, our research highlights that the relationship among education, skill and task discretion may indeed be weaker in countries where welfare production regimes support equality among workers. As an avenue for further research, country-level labour market and educational system characteristics may provide additional insight on the ways in which education and skill provide access to high quality employment.

Conclusion

In this paper, we have illustrated the importance of educational credentials, alongside and interacting with individual skill and occupational sorting, for workplace task discretion, framed as an important component of job quality. Employing a composite measure of task discretion, we have shown that in many international contexts education does not directly enable individuals to exercise workplace discretion, but rather functions indirectly through access to occupations with high task discretion, and to a lesser extent through literacy enhancement. In particular, occupational sector mediates the effects of postsecondary education in all countries, providing strong support for the critical-institutional approach and our signalling hypothesis. Trends in the distribution of task discretion by educational level, and differences in the predictors of task discretion more generally, illustrate that societal arrangements structure individuals’ possibilities for workplace discretion in lasting ways.

Institutional arrangements that provide high levels of education with fewer opportunities to utilize task discretion within the workplace are a cause for concern. However, countries that unequally distribute task discretion to only those with postsecondary education, thus guarding workplace task discretion for an elite, also signal a problematic form of inequality. It is important to highlight that our findings do not fully support a ‘meritocracy’ based on ability; that is, credentials tend to function as a ‘sieve’ and ‘signal’ that provide access to occupational sectors where task discretion is more readily available. Among all countries studied, the Scandinavian context stands out as having much more equitable distributions of task discretion. Nevertheless, as discussed above, education still functions to indirectly provide access to high task-discretion employment through occupational sorting. Other countries would benefit from focusing on increasing average levels of task discretion across occupational sectors. Importantly, as our

study has demonstrated, simply expanding higher educational opportunities will not necessarily address issues of inequality (Marginson 2016).

The analyses above are limited by several factors, including the cross-sectional nature of the data, the lack of macro-level control variables for relevant country characteristics and the inability to account for cultural differences. The first limitation, weighed against the richness of the PIAAC dataset, was recognized from the outset; however, it leaves open the possibility of reverse causation, in particular regarding literacy scores and task discretion. It is possible, as mentioned above, that task discretion as a form of informal learning (Garrick 2008) may in fact encourage greater literacy, rather than the reverse. The second limitation, that of the country-level effects described above, will be the subject of future research. Multi-level models offer a fruitful way forward for this line of inquiry, but are rendered complex by the lack of country-level weights within the PIAAC PUF. Lastly, our paper does not account for the ways in which cultural differences among countries may influence the availability of and expectations for task discretion in the workplace. Indeed, societal shifts from modernization to postmodernism are understood to include both institutional structures and value systems (Inglehart 1997). All three limitations provide possible avenues for further research.

From a comparative education perspective, our paper has shown that task discretion is unequally dispersed both within and among countries. Importantly, we do not attempt to capture a complete account of this asymmetrical distribution, especially as other important factors play significant roles, such as workplace organization and the strength of organized labour. Rather, our purpose has been to highlight the multiple and complex ways education provides access to task discretion in the workplace. The interactions between education and labour-market systems need to be further explored in order to more fully understand the mechanisms underlying the allocation of task discretion across contexts. However, our research suggests that education in itself does not provide a complete account of how task discretion is distributed; rather, it is dependent upon overall access and inequality between occupational sectors.

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Figure 1. Schema illustrating the potential relationships between education and task discretion

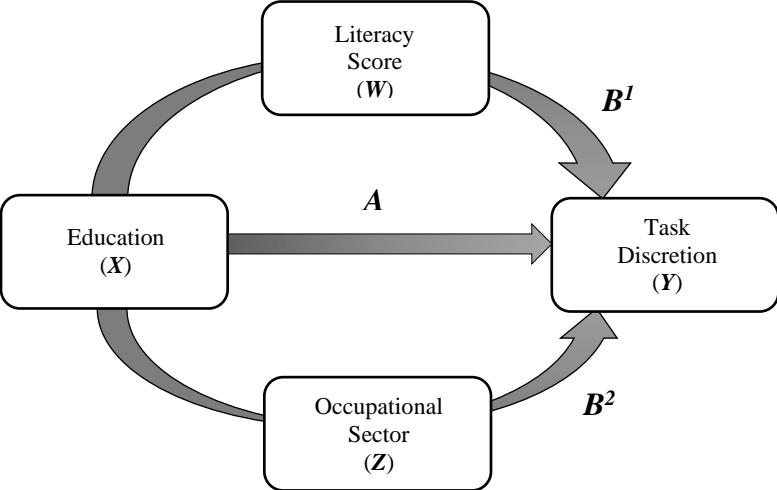


Figure 2. Bivariate relationship between average self-reported task discretion and range among occupational sectors

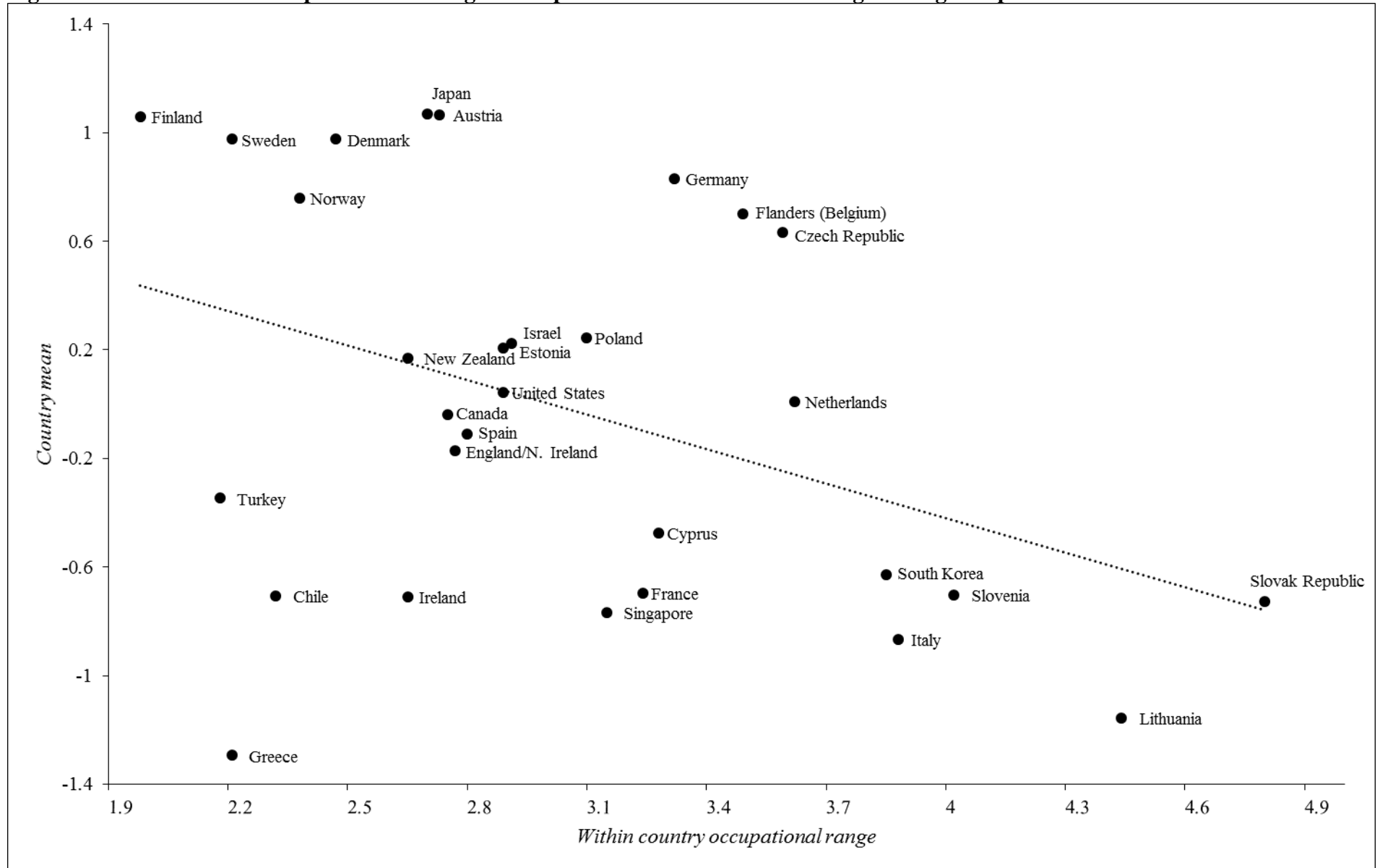
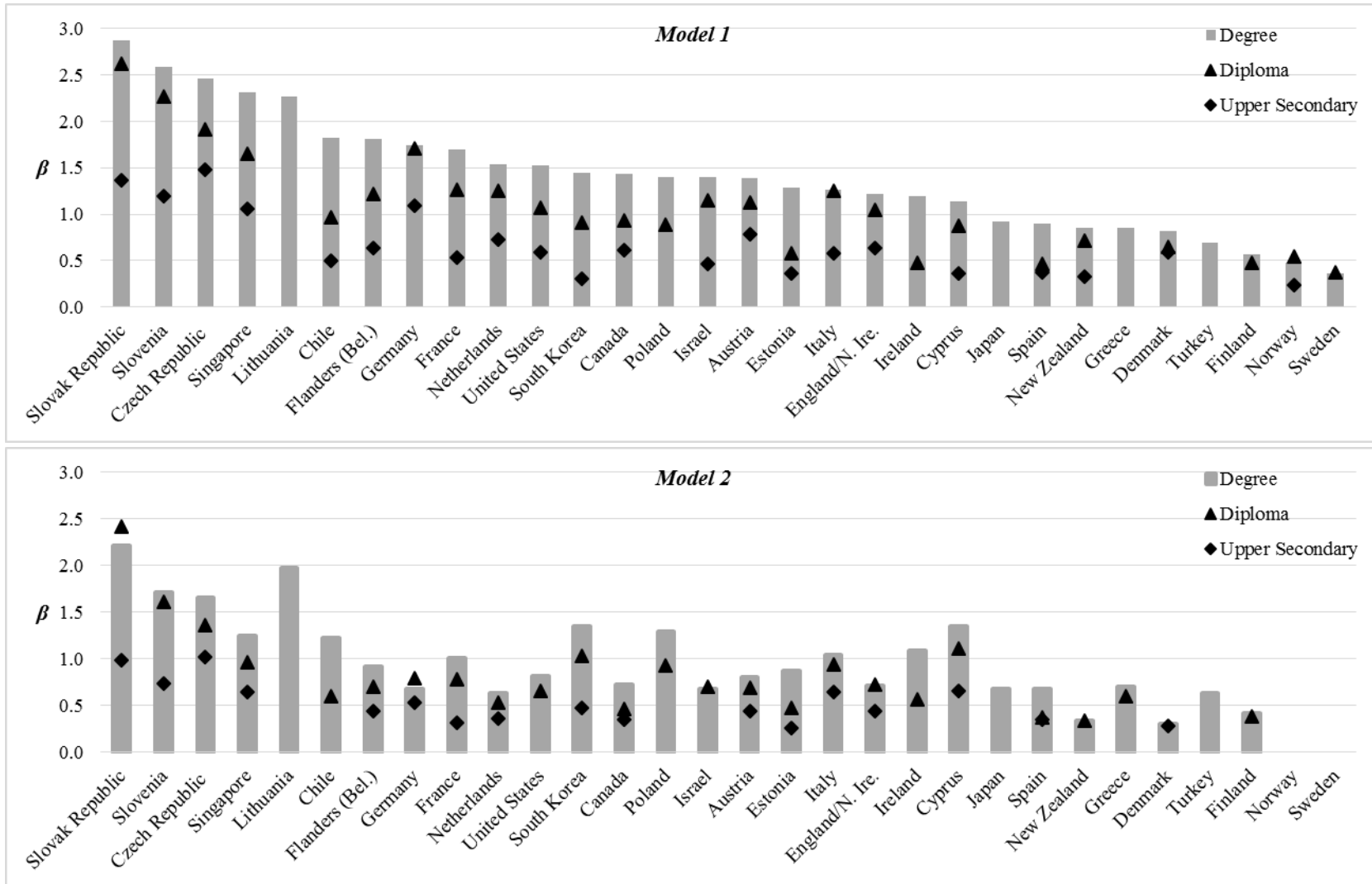
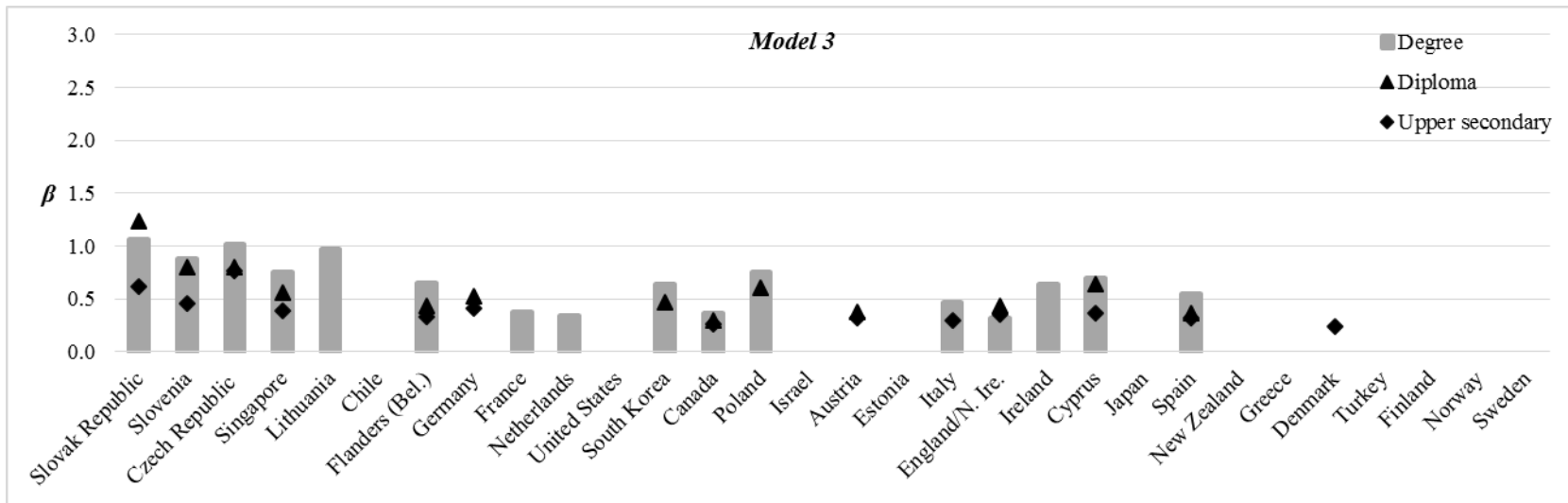


Figure 3. OLS regression results examining the direct relationship between task discretion and education credential





Graphical representation of OLS results (see Appendix 1 for full models).

Only coefficients significant at the 95% confidence level are shown ($p < .05$).

Reference group: lower secondary.

Model 1: Bivariate relationship between education and task discretion.

Model 2: Controls for gender, age, non-native speaker, literacy, self-employment, public sector employment, part-time employment and income.

Model 3: All controls plus occupational sector.

Table 1. Pooled estimation of country average and occupational range in task discretion

	Average task discretion			Occupational range in TD	
	No occupational controls	With occupational controls		No occupational controls	With occupational controls
Mean	1.02*** (.06)	1.02*** (.06)	Range	-.60*** (.06)	-.54*** (.06)
Up.-sec.*Mean	.03 (.07)	.07 (.06)	Up.-sec.*Range	.11 (.08)	.06 (.07)
Diploma*Mean	-.13 (.08)	-.10 (.07)	Diploma*Range	.50*** (.09)	.42*** (.09)
Degree*Mean	-.22*** (.06)	-.19** (.06)	Degree*Range	.35*** (.08)	.27*** (.08)
Upper sec.	.25*** (.04)	.10* (.04)	Upper sec.	.46*** (.04)	.30*** (.04)
Diploma	.53*** (.07)	.23*** (.06)	Diploma	.73*** (.06)	.44*** (.06)
Degree	.76*** (.06)	.30*** (.06)	Degree	.86*** (.05)	.44*** (.06)
<i>R</i> ²	.17	.20	<i>R</i> ²	.13	.15

N=125,123

Reference group: lower secondary.

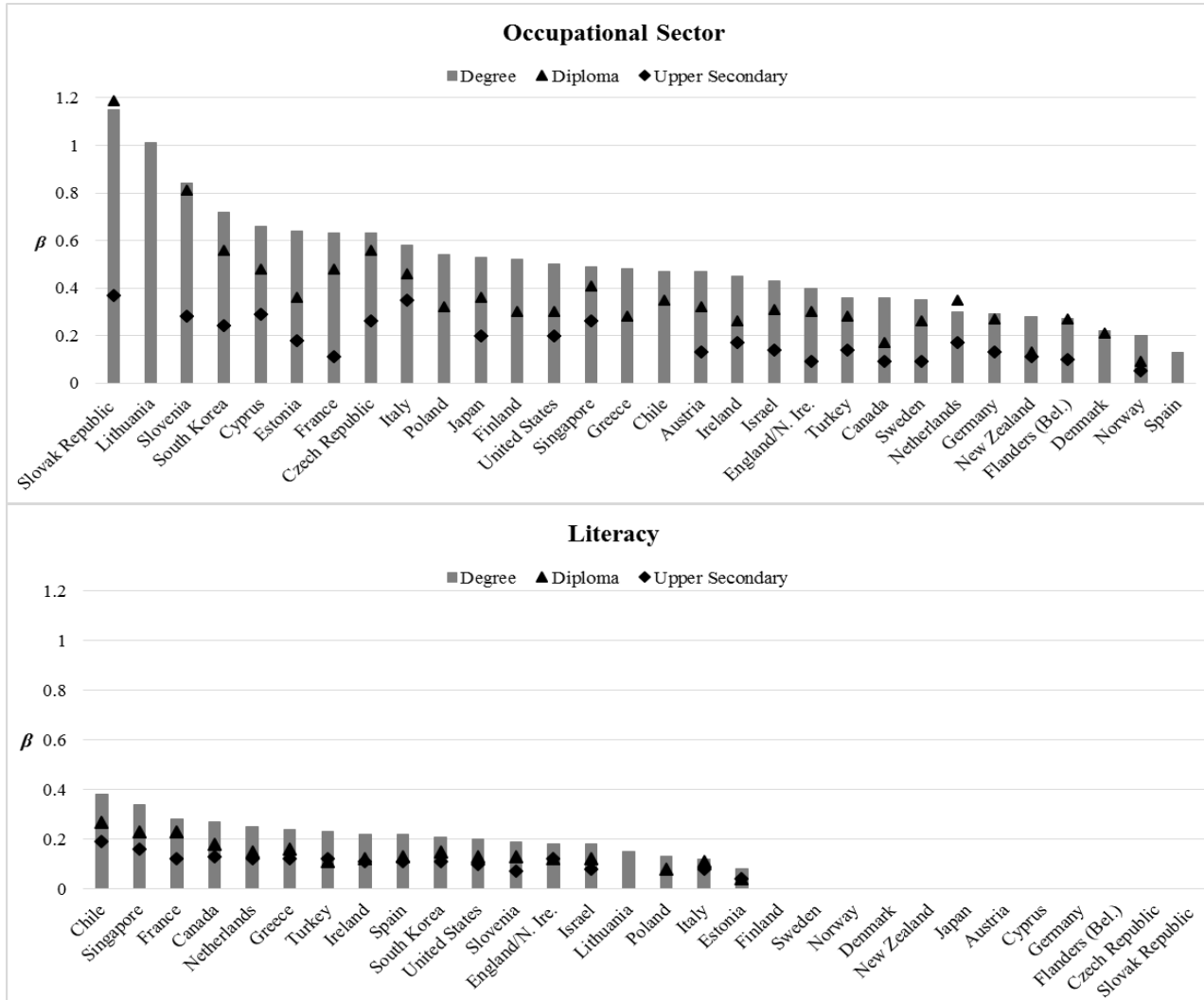
Cluster robust standard errors in parentheses.

Occupational range and average task discretion centered.

All models control for gender, age, non-native speaker status, literacy, self-employment, public sector employment, part-time employment, and income.

p* < .05, *p* < .01, ****p* < .001

Figure 5. The mediation effect of occupational sector and literacy by education level



Graphical representation of KHB results for the indirect effects of occupational sector and literacy score (see Appendix 2 for full models). All demographic and occupational controls included, as well as occupational sector (Model 6) or literacy score (Model 7). Only coefficients significant at the 95% confidence level are shown ($p < .05$).

Appendix 1: OLS regression results

Table 2. The relationship between task discretion and education

Model	Finland			Turkey			Greece			Sweden			Chile			Norway			Denmark			Ireland			New Zealand			Japan		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Up.Sec.	.17 (.16)	.12 (.17)	.06 (.15)	-.02 (.16)	.09 (.19)	-.05 (.20)	-.02 (.19)	.16 (.20)	.03 (.20)	.11 (.13)	.10 (.13)	.01 (.13)	.50* (.22)	.18 (.26)	.08 (.26)	.23* (.10)	.16 (.10)	.11 (.09)	.59*** (.11)	.29* (.11)	.24* (.11)	-.01 (.17)	.18 (.16)	.02 (.16)	.33* (.16)	.31 (.17)	.20 (.16)	.23 (.17)	.25 (.17)	.05 (.17)
Dip.	.48** (.15)	.38* (.16)	.08 (.15)	-.08 (.27)	.18 (.26)	-.10 (.27)	.48 (.25)	.60* (.26)	.32 (.28)	.37** (.14)	.21 (.13)	-.05 (.13)	.96*** (.20)	.60* (.27)	.25 (.27)	.54*** (.11)	.22 (.12)	.13 (.12)	.64*** (.11)	.20 (.12)	-.01 (.13)	.48** (.16)	.57*** (.17)	.31 (.17)	.72*** (.13)	.24* (.15)	.20 (.15)	.23 (.18)	.25 (.19)	-.11 (.19)
Deg.	.57*** (.15)	.42* (.17)	-.10 (.16)	.70** (.21)	.63** (.25)	.27 (.29)	.85*** (.26)	.70* (.28)	.22 (.33)	.36** (.12)	.22 (.12)	-.13 (.14)	1.82*** (.24)	1.22** (.41)	.75 (.50)	.47*** (.09)	.17 (.12)	-.04 (.12)	.81*** (.11)	.30* (.13)	.08 (.13)	1.20*** (.16)	1.09*** (.18)	.64*** (.19)	.86*** (.12)	.34* (.15)	.07 (.15)	.92*** (.15)	.68*** (.17)	.15 (.18)
Int.	.73*** (.14)	.04 (.42)	-.36 (.43)	-.44** (.16)	-2.86*** (.55)	-3.71*** (.63)	-1.58*** (.20)	-3.98*** (.55)	-4.87*** (.65)	.78*** (.12)	-.45 (.35)	-.02 (.40)	-1.33*** (.18)	-2.83*** (.48)	-3.28*** (.55)	.45*** (.07)	-.67 (.42)	-1.5*** (.44)	.45*** (.10)	-.67* (.33)	-1.75*** (.41)	-1.18*** (.15)	-3.37*** (.42)	-3.58*** (.45)	-.36*** (.11)	-2.32*** (.39)	-2.61*** (.42)	.67*** (.15)	-1.48*** (.44)	-1.72*** (.44)
R ²	.01	.05	.09	.01	.14	.17	.02	.11	.13	.00	.11	.14	.05	.11	.13	.01	.12	.14	.02	.10	.13	.03	.13	.16	.02	.10	.14	.02	.13	.17
N	3,709			2,039			2,347			3,266			3,249			3,896			5,188			3,533			4,303			3,780		

Model	Austria			Canada			England/N. Ire.			Spain			United States			Estonia			Israel			Poland			Singapore			France		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Up.Sec.	.78*** (.12)	.44*** (.14)	.32* (.14)	.62*** (.12)	.36** (.12)	.27* (.12)	.64*** (.13)	.44*** (.14)	.36** (.14)	.38** (.14)	.35* (.14)	.33* (.14)	.59*** (.16)	.29 (.17)	.09 (.17)	.37** (.12)	.26* (.12)	.09 (.12)	.46** (.18)	.28 (.17)	.13 (.18)	.29 (.21)	.26 (.18)	.17 (.18)	1.06*** (.14)	.64*** (.14)	.39** (.13)	.53*** (.10)	.31** (.11)	.20 (.10)
Dip.	1.13*** (.12)	.70*** (.14)	.38** (.15)	.93*** (.11)	.47*** (.12)	.30** (.12)	1.05*** (.17)	.72*** (.16)	.43** (.16)	.46** (.16)	.37* (.15)	.37* (.17)	1.07*** (.20)	.65*** (.20)	.35 (.19)	.58*** (.14)	.47*** (.14)	.11 (.13)	1.15*** (.21)	.70*** (.22)	.39 (.22)	.89** (.30)	.93*** (.27)	.61* (.29)	1.65*** (.12)	.96*** (.15)	.56*** (.14)	1.26*** (.14)	.78*** (.16)	.30 (.16)
Deg.	1.39*** (.10)	.80*** (.18)	.34 (.20)	1.43*** (.12)	.72*** (.12)	.37** (.12)	1.23*** (.14)	.72*** (.14)	.32* (.15)	.90*** (.10)	.69*** (.14)	.55*** (.17)	1.53*** (.17)	.82*** (.21)	.33 (.22)	1.29*** (.13)	.87*** (.13)	.23 (.13)	1.40*** (.17)	.68*** (.19)	.26 (.20)	1.40*** (.23)	1.29*** (.21)	.75*** (.20)	2.31*** (.11)	1.25*** (.17)	.76*** (.17)	1.70*** (.11)	1.01*** (.16)	.38** (.14)
Int.	.27** (.10)	-.57 (.42)	-1.14* (.52)	-.94*** (.09)	-2.81*** (.24)	-3.03*** (.27)	-.91*** (.13)	-3.50*** (.44)	-3.64*** (.44)	-.51*** (.08)	-2.86*** (.39)	-3.58*** (.42)	-.88*** (.17)	-2.30*** (.46)	-2.81*** (.48)	-.42*** (.11)	-1.60*** (.26)	-1.60*** (.28)	-.62*** (.16)	-2.57*** (.36)	-2.82*** (.46)	-.45*** (.21)	-2.19 (.43)	-2.65*** (.46)	2.26*** (.12)	-3.35*** (.24)	-3.46*** (.28)	-1.50*** (.09)	-3.84*** (.33)	-4.22*** (.36)
R ²	.03	.12	.17	.03	.10	.14	.13	.14	.19	.02	.13	.14	.04	.10	.14	.04	.16	.21	.04	.11	.14	.04	.15	.18	.13	.20	.23	.05	.10	.14
N	3,630			18,861			5,757			3,135			3,403			5,111			3,430			4,795			3,883			4,314		

Model	Cyprus			Germany			Flanders (Bel.)			Czech Republic			Netherlands			South Korea			Italy			Slovenia			Lithuania			Slovak Republic		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Up.Sec.	.36* (.17)	.66*** (.18)	.37* (.19)	1.09*** (.16)	.53** (.18)	.41* (.19)	.64*** (.15)	.44*** (.18)	.34* (.14)	1.48*** (.32)	1.02*** (.31)	.77** (.30)	.73*** (.11)	.36*** (.11)	.19 (.11)	.30* (.15)	.48*** (.14)	.24 (.14)	.58*** (.15)	.65*** (.15)	.30* (.14)	1.19*** (.17)	.74*** (.16)	.46** (.18)	-.30 (.34)	-.33 (.35)	-.35 (.36)	1.36*** (.23)	.99*** (.22)	.62** (.22)
Dip.	.87*** (.17)	1.11*** (.20)	.64** (.23)	1.71*** (.18)	.79*** (.20)	.53* (.21)	1.22*** (.16)	.70*** (.17)	.43* (.17)	1.91*** (.37)	1.36*** (.37)	.80* (.34)	1.25*** (.19)	.54** (.21)	.19 (.21)	.90*** (.16)	1.03*** (.16)	.47** (.17)	1.25*** (.42)	.95* (.42)	.48 (.43)	2.27*** (.17)	1.61*** (.19)	.80*** (.22)	.48 (.33)	.59 (.36)	.24 (.39)	2.63*** (.59)	2.42*** (.64)	1.23 (.65)
Deg.	1.14*** (.16)	1.35*** (.21)	.70** (.26)	1.74*** (.17)	.68*** (.20)	.39 (.22)	1.81*** (.17)	.92*** (.19)	.65*** (.19)	2.46*** (.34)	1.65*** (.36)	1.02** (.35)	1.54*** (.11)	.64*** (.14)	.34** (.13)	1.45*** (.16)	1.36*** (.18)	.64*** (.17)	1.26*** (.19)	1.05*** (.20)	.47* (.21)	2.59*** (.18)	1.72*** (.19)	.88*** (.22)	2.27*** (.33)	1.98*** (.37)	.97* (.42)	2.87*** (.25)	2.21*** (.27)	1.07*** (.29)
Int.	-1.08*** (.14)	-1.62*** (.52)	-2.53*** (.56)	-.40** (.15)	-1.62*** (.35)	-2.59*** (.36)	-.24 (.14)	-2.16*** (.35)	-2.85*** (.38)	-.97** (.31)	-1.70** (.55)	-1.78*** (.57)	-.81*** (.09)	-3.40*** (.41)	-4.32*** (.48)	-.126*** (.14)	-4.61*** (.40)	-4.50*** (.43)	-.131*** (.47)	-3.84*** (.46)	-4.70*** (.46)	-.215*** (.15)	-4.08*** (.37)	-4.54*** (.36)	-.182*** (.31)	-4.21*** (.70)	-4.70 (.68)	2.38*** (.23)	-3.96*** (.50)	-4.35*** (.49)
R ²	.02	.13	.16	.05	.14	.19	.05	.14	.18	.05	.18	.26	.05	.17	.20	.03	.25	.29	.03	.19	.23	.09	.20	.26	.11	.21	.26	.08	.20	.28
N	2,709			3,960			3,273			3,500			3,816			4,245			2,753			2,920			3,117			3,201		

Standard errors in parentheses

Reference group: lower secondary

Model 1: Bivariate relationship between education and task discretion.

Model 2: Controls for gender, age, non-native speaker, literacy, self-employment, public sector employment, part-time employment and income.

Model 3: All controls plus occupational sector.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix 2. KHB Results

Table 3. The effect of education as mediated by occupational sector and literacy assessment score

	Finland		Turkey		Greece		Sweden		Chile		Norway		Denmark		Ireland		New Zealand		Japan	
	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.
Up.Sec.																				
Total effect	.12 (.17)	.08 (.15)	.09 (.19)	.08 (.19)	.16 (.20)	.15 (.20)	.10 (.13)	-.02 (.13)	.18 (.26)	.26 (.22)	.16 (.10)	.13 (.09)	.29* (.11)	.25* (.11)	.19 (.16)	.14 (.17)	.31 (.17)	.24 (.16)	.25 (.17)	.09 (.17)
Direct effect	.06 (.15)	.06 (.15)	-.05 (.20)	-.05 (.20)	.03 (.20)	.03 (.20)	.01 (.13)	.01 (.13)	.08 (.26)	.08 (.26)	.11 (.09)	.11 (.09)	.24* (.11)	.24* (.11)	.02 (.16)	.02 (.16)	.20 (.16)	.20 (.16)	.05 (.17)	.05 (.17)
Indirect effect	.06 (.03)	.01 (.02)	.14* (.07)	.12* (.05)	.13 (.07)	.12* (.05)	.09** (.03)	-.03 (.02)	.10 (.06)	.19* (.08)	.05* (.02)	.02 (.01)	.05 (.03)	.01 (.02)	.17*** (.04)	.11** (.04)	.11** (.04)	.04 (.03)	.20*** (.05)	.04 (.03)
Dip.																				
Total effect	.39* (.16)	.10 (.15)	.18 (.26)	.01 (.26)	.60* (.26)	.49 (.27)	.21 (.13)	-.11 (.14)	.60* (.27)	.52* (.21)	.22 (.12)	.16 (.12)	.20 (.12)	.02 (.13)	.57** (.17)	.43** (.17)	.34* (.14)	.24 (.14)	.25 (.19)	-.05 (.19)
Direct effect	.09 (.15)	.08 (.15)	-.10 (.27)	-.10 (.27)	.32 (.28)	.32 (.28)	-.05 (.13)	-.05 (.13)	.25 (.27)	.25 (.27)	.13 (.12)	.13 (.12)	-.01 (.13)	-.01 (.13)	.31 (.17)	.31 (.17)	.20 (.15)	.20 (.15)	-.11 (.19)	-.11 (.19)
Indirect effect	.30*** (.05)	.02 (.03)	.28*** (.07)	.11* (.05)	.28** (.10)	.16* (.07)	.26*** (.05)	-.06 (.04)	.35*** (.08)	.27* (.11)	.09** (.03)	.04 (.02)	.21*** (.05)	.02 (.03)	.26*** (.04)	.12** (.04)	.13** (.04)	.04 (.03)	.36*** (.05)	.06 (.04)
Deg.																				
Total effect	.42* (.17)	-.07 (.16)	.63* (.25)	.50 (.28)	.70* (.28)	.46 (.31)	.22 (.12)	-.22 (.14)	1.22** (.41)	1.13** (.40)	.17 (.12)	.03 (.11)	.30* (.13)	.11 (.13)	1.09*** (.18)	.85*** (.18)	.34* (.15)	.14 (.15)	.68*** (.17)	.24 (.17)
Direct effect	-.10 (.16)	-.10 (.16)	.27 (.29)	.27 (.29)	.22 (.33)	.22 (.33)	-.13 (.14)	-.13 (.14)	.75 (.50)	.75 (.50)	-.04 (.12)	-.04 (.12)	.08 (.13)	.08 (.13)	.64*** (.19)	.64*** (.19)	.07 (.15)	.07 (.15)	.15 (.18)	.15 (.18)
Indirect effect	.52*** (.06)	.03 (.05)	.36* (.14)	.23* (.09)	.48** (.18)	.24* (.09)	.35*** (.07)	-.09 (.05)	.47* (.21)	.38* (.15)	.20*** (.05)	.07 (.05)	.22*** (.06)	.03 (.04)	.45*** (.07)	.22** (.07)	.28*** (.06)	.06 (.05)	.53*** (.07)	.09 (.06)

	Austria		Canada		England/N. Ire.		Spain		United States		Estonia		Israel		Poland		Singapore		France	
	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.
Up.Sec.																				
Total effect	.44*** (.14)	.29* (.14)	.36** (.12)	.40*** (.12)	.44** (.14)	.47*** (.14)	.35* (.14)	.43** (.14)	.29 (.17)	.19 (.17)	.26* (.12)	.12 (.12)	.28 (.17)	.22 (.17)	.26 (.18)	.22 (.18)	.64*** (.14)	.55*** (.13)	.31** (.11)	.32*** (.10)
Direct effect	.32* (.14)	.32* (.14)	.27* (.12)	.27* (.12)	.36* (.14)	.36** (.14)	.33* (.14)	.33* (.14)	.09 (.17)	.09 (.17)	.09 (.12)	.09 (.12)	.13 (.18)	.13 (.18)	.17 (.18)	.17 (.18)	.39** (.13)	.39** (.13)	.20 (.10)	.20 (.10)
Indirect effect	.13** (.04)	-.03 (.02)	.09*** (.03)	.13*** (.02)	.09* (.04)	.12*** (.04)	.02 (.03)	.11*** (.03)	.20*** (.05)	.10** (.04)	.18*** (.03)	.04** (.01)	.14*** (.04)	.08** (.03)	.09 (.05)	.05 (.03)	.26*** (.04)	.16*** (.04)	.11*** (.03)	.12*** (.02)
Dip.																				
Total effect	.70*** (.14)	.31* (.14)	.47*** (.12)	.48*** (.11)	.72*** (.16)	.55*** (.16)	.37* (.15)	.50** (.17)	.65*** (.20)	.48* (.19)	.47*** (.14)	.15 (.13)	.70** (.22)	.51* (.22)	.93*** (.27)	.70* (.30)	.96*** (.15)	.78*** (.13)	.78*** (.16)	.53*** (.15)
Direct effect	.38** (.15)	.38** (.15)	.30** (.12)	.30** (.12)	.43** (.16)	.43** (.16)	.37* (.17)	.37* (.17)	.35 (.19)	.35 (.19)	.11 (.13)	.11 (.13)	.39 (.22)	.39 (.22)	.61* (.29)	.61* (.29)	.56*** (.14)	.56*** (.14)	.30 (.16)	.30 (.16)
Indirect effect	.32*** (.06)	-.07 (.04)	.17*** (.03)	.18*** (.03)	.30*** (.05)	.12** (.04)	.00 (.04)	.13*** (.03)	.30*** (.08)	.13** (.05)	.36*** (.04)	.04** (.02)	.31*** (.05)	.12** (.04)	.32** (.11)	.08* (.04)	.41*** (.06)	.23*** (.05)	.48*** (.05)	.23*** (.04)
Deg.																				
Total effect	.80*** (.18)	.24 (.19)	.72*** (.12)	.63*** (.11)	.72*** (.14)	.50*** (.15)	.69*** (.14)	.77*** (.16)	.82*** (.20)	.53** (.20)	.87*** (.13)	.30* (.13)	.68*** (.20)	.44* (.19)	1.29*** (.21)	.88*** (.21)	1.25*** (.17)	1.10*** (.15)	1.01*** (.14)	.66*** (.13)
Direct effect	.34 (.20)	.34 (.20)	.37** (.12)	.37** (.12)	.32* (.15)	.32* (.15)	.55** (.17)	.55*** (.17)	.33 (.22)	.33 (.22)	.23 (.13)	.23 (.13)	.26 (.20)	.26 (.20)	.75*** (.20)	.75*** (.20)	.76*** (.17)	.76*** (.17)	.37** (.14)	.38** (.14)
Indirect effect	.47*** (.08)	-.09 (.06)	.36*** (.04)	.27*** (.04)	.40*** (.06)	.18*** (.06)	.13*** (.09)	.22*** (.05)	.50*** (.09)	.20** (.08)	.64*** (.06)	.08** (.03)	.43*** (.08)	.18** (.06)	.54*** (.12)	.13* (.06)	.49*** (.07)	.34*** (.07)	.63*** (.07)	.28*** (.05)

	Cyprus		Germany		Flanders (Bel.)		Czech Republic		Netherlands		South Korea		Italy		Slovenia		Lithuania		Slovak Republic	
	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.	Occ.	Lit.
Up.Sec.																				
Total effect	.66*** (.18)	.34 (.19)	.53** (.18)	.45* (.18)	.44** (.15)	.38** (.14)	1.03*** (.31)	.77** (.29)	.36** (.11)	.31** (.11)	.48** (.14)	.35** (.13)	.65*** (.15)	.38** (.13)	.74*** (.16)	.54** (.18)	-.33 (.35)	-.28 (.37)	.99*** (.22)	.64** (.22)
Direct effect	.37* (.19)	.37* (.19)	.41* (.18)	.41* (.18)	.34* (.14)	.34* (.14)	.77** (.29)	.77** (.29)	.19 (.11)	.19 (.11)	.24 (.14)	.24 (.14)	.30* (.14)	.30* (.14)	.46** (.18)	.46** (.18)	-.35 (.36)	-.35 (.36)	.62** (.22)	.62** (.22)
Indirect effect	.29*** (.07)	-.03 (.02)	.13* (.06)	.04 (.02)	.10** (.03)	.04 (.02)	.26*** (.06)	.00 (.03)	.17*** (.04)	.12*** (.03)	.24*** (.05)	.11** (.03)	.35*** (.06)	.08* (.03)	.28*** (.08)	.07** (.03)	.02 (.07)	.06 (.04)	.37*** (.08)	.02 (.03)
Dip.																				
Total effect	1.11*** (.20)	.58* (.23)	.79*** (.20)	.61** (.21)	.70*** (.17)	.51** (.16)	1.36*** (.37)	.80* (.33)	.54* (.21)	.35 (.21)	1.03*** (.16)	.63*** (.16)	.96* (.42)	.59 (.41)	1.61*** (.19)	.93*** (.23)	.59 (.36)	.33 (.40)	2.42*** (.64)	1.26 (.65)
Direct effect	.64** (.23)	.64** (.23)	.53* (.21)	.53* (.21)	.43* (.17)	.43* (.17)	.80* (.34)	.80* (.34)	.19 (.21)	.19 (.21)	.47** (.17)	.47** (.17)	.48 (.43)	.48 (.43)	.80*** (.22)	.80*** (.22)	.24 (.39)	.24 (.39)	1.23 (.65)	1.23 (.65)
Indirect effect	.48*** (.09)	-.05 (.03)	.27*** (.07)	.08 (.05)	.27*** (.06)	.08 (.04)	.56*** (.12)	.00 (.05)	.35*** (.05)	.15*** (.04)	.56*** (.06)	.15*** (.05)	.46*** (.11)	.11* (.05)	.81*** (.12)	.13*** (.04)	.35 (.10)	.09 (.04)	1.19*** (.13)	.03 (.04)
Deg.																				
Total effect	1.35*** (.21)	.60* (.25)	.68** (.20)	.49* (.22)	.92*** (.19)	.77*** (.18)	1.65*** (.36)	1.02** (.34)	.64*** (.14)	.59*** (.13)	1.36*** (.18)	.84*** (.16)	1.05*** (.20)	.60** (.21)	1.72*** (.19)	1.06*** (.23)	1.98*** (.36)	1.13** (.43)	2.21*** (.27)	1.10*** (.28)
Direct effect	.70** (.26)	.70** (.26)	.39 (.22)	.39 (.22)	.65*** (.19)	.65*** (.19)	1.02** (.35)	1.02** (.35)	.34* (.13)	.34** (.13)	.64*** (.17)	.64*** (.17)	.47* (.21)	.47* (.21)	.88*** (.22)	.88*** (.22)	.97* (.42)	.97* (.42)	1.07*** (.29)	1.06*** (.29)
Indirect effect	.66*** (.13)	-.10 (.06)	.29** (.10)	.10 (.05)	.27*** (.07)	.12 (.06)	.63*** (.13)	.00 (.07)	.30*** (.05)	.25*** (.05)	.72*** (.08)	.21*** (.06)	.58*** (.11)	.12* (.05)	.84*** (.13)	.19*** (.05)	1.01*** (.15)	.15* (.06)	1.15*** (.12)	.04 (.05)

Standard errors in parentheses.

Reference group: lower secondary.

All demographic and occupational controls included in models, as well as occupational sector (Model 6) or literacy score (Model 7).

* $p < .05$, ** $p < .01$, *** $p < .001$