UNIVERSITAT DE BARCELONA

# Essays on education and intergenerational mobility

Joselin Segovia

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PhD in Economics

# Essays on education and intergenerational mobility

Joselin Segovia

UNIVERSITAT DE BARCELONA

PhD in Economics

**Thesis tittle:**

# Essays on education and intergenerational mobility

**PhD candidate:**
Joselin Segovia

**Advisor**:
Raul Ramos

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# Abstract

Intergenerational mobility measures the association between children and parental outcomes. Consisting of five chapters, this thesis investigates the drivers of intergenerational educational mobility by examining how regional, gender disparities, and skill-related factors influence opportunities for educational advancement, combining observational and experimental approaches. The introductory chapter briefly motivates and presents each study. The thesis then moves to Chapter 2, which explores regional disparities in intergenerational mobility across Ecuadorian cantons, tests the spatial correlation across them and investigates its drivers. The findings reveal contrasting landscapes for mobility in the country, as the levels largely vary across territories and across the measures applied. The spatial analysis shows that indeed intergenerational mobility is spatially correlated; however, this more frequently reinforces persistent disadvantage than privilege. Regional rates of migration, educational attainment, and family-based economic activities tend to foster more upward mobility. Chapter 3 shifts the focus to individual-level mechanisms and examines the role of cognitive and noncognitive skills in explaining gender differences in intergenerational mobility across 23 OECD countries. The findings point to the educational mobility advantage of women relative to men, highlight significant variability in the magnitude of the gender gap across countries, and identify skills—particularly numeracy, Conscientiousness, and Open-mindedness—as key explanatory factors. How each of these skills contribute to intergenerational mobility varies by country, but in general cognitive skills are associated with reduced gaps in mobility, while noncognitive skills are associated with increased gaps in mobility. Chapter 4 builds on the relevance of skills. Particularly, focusing on skills key to university access, measurable in the short term and theoretically connected to longer-term mobility prospects. The chapter presents the design and implementation of a randomized controlled trial in Cuenca, Ecuador's third largest city that provided training in numerical and logical reasoning to students in low performing schools. The evaluation of the program demonstrates that targeted training can enhance exam performance and that it could reduce socioeconomic disparities in college admissions. Notably, gains stemmed more from improved exam strategies than from cognitive improvements alone, emphasizing the power of noncognitive skills and the importance of relatively simple and scalable interventions to level the playing field. Chapter 5 concludes by summarizing that together, the studies reveal that intergenerational mobility is not only a product of individual factors but is embedded in context specific structures. Human capital development emerges as a recurring theme, not only in improving

individual outcomes but in shaping broader systems of opportunity. The thesis calls for policies that recognize this complexity, integrating place-based, skill-focused and gender-sensitive approaches to foster greater educational mobility across generations.

**Keywords**: Intergenerational mobility, Educational outcomes, Ecuador, Spatial analysis, Cognitive skills, Noncognitive skills, Randomized controlled trial, Standardized tests.

# Assajos sobre educació i mobilitat intergeneracional

## Resum

La mobilitat intergeneracional mesura l'associació entre els resultats dels fills i els dels pares. Està àmpliament considerat com un baròmetre de la justícia i la igualtat d'oportunitats. Aquesta tesi, que consta de cinc capítols, investiga els factors que impulsen la mobilitat educativa intergeneracional examinant com les disparitats regionals, de gènere i els factors relacionats amb les habilitats influeixen en les oportunitats de progrés educatiu, combinant enfocaments observacionals i experimentals. El capítol introductori motiva i presenta breument cadascuna de les recerques realitzades. El Capítol 2 explora les disparitats regionals en la mobilitat intergeneracional entre els cantons equatorians, la possible existència de correlació espacial i i els factors que podrien explicar aquestes diferències. L'evidència obtinguda mostra l'existència d'una forta heterogeneïtat dins del país, tant entre territoris com entre els conceptes de mobilitat aplicats. L'anàlisi espacial mostra que, de fet, la mobilitat intergeneracional està espacialment correlacionada; tanmateix, això reforça més sovint el desavantatge persistent que el privilegi. Les taxes regionals de migració, el nivell educatiu i les activitats econòmiques familiars tendeixen a fomentar una major mobilitat ascendent. El contrari es troba a les regions amb taxes més altes de desigualtat i major presència de pobles indígenes. El Capítol 3 canvia el focus als mecanismes a nivell individual i examina el paper de les habilitats cognitives i no cognitives, juntament amb els antecedents familiars, a l'hora d'explicar les diferències de gènere en la mobilitat intergeneracional a 23 països de l'OCDE. Els resultats obtinguts apunten a l'avantatge de les dones en relació amb els homes pel que fa a la mobilitat educativa, tot i que també mostren una variabilitat significativa en la magnitud de la bretxa de gènere entre països on factors com les diferències en habilitats, en particular les càlculs numèrics, la consciència i la mentalitat oberta, juguen un paper clau. La manera com cadascuna d'aquestes habilitats contribueix a la mobilitat intergeneracional varia segons el país, però, en general, les habilitats cognitives s'associen amb una reducció de les bretxes de mobilitat, mentre que les habilitats no cognitives s'associen amb un augment de les bretxes de mobilitat. El Capítol 4 es basa en la rellevància del desenvolupament d'habilitats i en una preocupació urgent en molts contextos: el debat sobre la influència de la preparació extracurricular en els exàmens estandarditzats que

molts països implementen com a pas previ per a poder accedir a la universitat. Aquesta darrera recerca se centra en la importància del desenvolupament d'habilitats cognitives rellevants per a l'accés a la universitat, mesurables a curt termini i teòricament relacionades amb perspectives de mobilitat a llarg termini. El capítol presenta el disseny i la implementació d'un experiment (randomised control trial) a Cuenca, la tercera ciutat més gran de l'Equador. El programa va proporcionar formació en raonament numèric i lògic a escoles de baix rendiment mitjançant pràctiques guiades i independents. L'avaluació del programa demostra que la formació específica pot millorar el rendiment als exàmens i que podria reduir les disparitats socioeconòmiques en les admissions a la universitat. Cal destacar que els guanys van derivar més de la millora de les estratègies d'exàmens que de les millores cognitives per si soles, cosa que emfatitza el poder d'intervencions relativament senzilles i escalables per igualar les condicions. El Capítol 5 conclou resumint que, junts, els estudis revelen que la mobilitat intergeneracional no és només un producte de factors individuals, sinó que està integrada en estructures específiques del context que s'analitza. El desenvolupament del capital humà emergeix com un tema recurrent, no només en la millora dels resultats individuals, sinó també en la configuració de sistemes d'oportunitats més amplis. La tesi finalitza proposant polítiques que reconeguin aquesta complexitat, integrant enfocaments basats en el context específic on es volen implementar, centrats en les habilitats i sensibles al gènere per fomentar una major mobilitat educativa entre generacions.

**Paraules clau**: Mobilitat intergeneracional, Resultats educatius, Equador, Anàlisi espacial, Habilitats cognitives, Habilitats no cognitives, Assaig controlat aleatoritzat, Proves estandarditzades

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# 1.Introduction

Intergenerational mobility measures the extent to which individuals' socioeconomic status depends upon the parental background. High levels of mobility signal that society rewards effort and talent over inherited advantage, contributing to a more just and meritocratic social order. Conversely, low levels of mobility reflect the transmission of advantage and disadvantage across generations, generating cycles of poverty or privilege and undermining the principle of equal opportunity (Corak, 2020). Therefore, intergenerational mobility is viewed as a measure of a country's fairness and openness (Hout, 2015).

The topic has been largely debated in the past decade from different angles, with attention from Nobel Prize-winning economists, policy makers, best-selling authors and acknowledged press (Jerrim & Macmillan, 2015). Its relevance has been highlighted in the debates about overall inequality levels, resulting in the widespread notion that higher cross-section inequality is associated with lower mobility across generations. This notion has been referred to as the Great Gatsby Curve and its rising levels have been pointed out as a serious threat to the economic growth in the US (Krueger, 2012). Furthermore, the transmission of high levels of inequality across generations has been pointed as a major contributor to the "development trap" in Latin America (UNDP, 2021). As a marker of fairness, the debate about intergenerational mobility has taken a normative view. Beyond this view, mobility has practical implications for social cohesion, institutional trust, and economic performance. Research has further linked mobility to increased civic engagement, reduced crime, better health, longevity and parenting (UNDP, 2021; Chetty et al., 2014; Hout, 2015). Moreover, mobility enhances economic efficiency by enabling a more optimal allocation of human capital (OECD, 2018).

Due to its multidimensional importance, the study of intergenerational mobility has attracted attention from several academic disciplines. In the sociological branch of research, the focus has been put on studying class mobility represented by occupational categories, emphasizing the reproduction of status through family structures, school systems, and social networks (Breen & Jonsson, 2005). Economists have focused on income and educational mobility, highlighting the role of human capital, educational returns, and labor market dynamics (Blanden et al., 2005; Solon, 1999). From a political science perspective, recent research has added to this understanding by examining institutional contexts and policy regimes (Ares & van Ditmars, 2022; Ichino et al.

2011). This broad engagement has given rise to rich and varied theoretical and empirical literature, using diverse data sources and methodological approaches. As a result, the study of intergenerational mobility spans numerous debates, including the disparities experienced across migration and ethnicity backgrounds, gender and subnational entities, to name a few (Chetty et al., 2014; Bukodi & Goldthorpe, 2013; Erikson & Goldthorpe, 1992).

Given its societal relevance, intergenerational mobility has become a policy priority across countries and levels of government. International organizations like the OECD and UNESCO have advocated for strategies that promote equal educational opportunities as a foundation for long-term mobility (OECD, 2018; UNESCO, 2020). Common policy approaches include investments in early childhood education, school financing reforms, academic and career counseling, conditional cash transfers, and affirmative action in university admissions (Corak, 2013).

This thesis aims to advance the ongoing debates on intergenerational educational mobility by studying how contextual and individual-level factors shape opportunities for educational advancement across generations. This is done through three empirical studies and specifically by examining spatial disparities, gendered skill pathways, and the role of skill-building in preparing disadvantaged students for educational progression.

One key definition throughout this thesis is how to measure intergenerational mobility. Empirically, its measurement can adapt different dimensions and concepts (Jäntti & Jenkins, 2015). The dimension refers to the variable selected to analyse mobility. In this thesis, we focus on education as the dimension of mobility, i.e., to what extent is children and parental educational attainment associated. This choice has been extensively performed.

In the economic literature, while some authors emphasize the advantages of using income to measure intergenerational mobility, others highlight the strengths of education-based indicators. On the one hand, income is viewed as a fundamental indicator of individual well-being and socioeconomic status, making its intergenerational transmission especially relevant from a welfare perspective. Its continuous and quantitative nature also facilitates comparisons across countries and over time, especially when social or educational classifications are less harmonized (LeFranc et al., 2010). On the other hand, education has practical benefits in empirical research. Educational attainment is typically stable throughout adulthood and can be reliably collected in a single cross-section, whereas income is more volatile over the life course and requires

longitudinal data to be measured consistently (Neidhofer et al., 2018; Nybom & Stuhler, 2016). Additionally, retrospective reports on parental education tend to be more accurate than those on parental income. Authors have also pointed out that focusing solely on one dimension of mobility may overlook the real scene (Van der Weide et al., 2024) as educational and income mobility can diverge (Chuard & Grassi, 2020). Despite these differing points, both income and education-based approaches have proved to capture long-run socioeconomic status, and studies have shown a meaningful correlation between the two measures (Hertz et al., 2007), suggesting that while each offers distinct insights, they are empirically and conceptually connected.

Furthermore, we build on prior evidence showing that intergenerational mobility is a multifaceted phenomenon where the results depend on the selected measures and concepts (Corak, 2020). Hence, we opt for providing informative discussions of mobility by calculating different measures. With some specificities in the scope and methodological approaches for each chapter, we broadly cover two concepts through the selected measures: i) origin-dependence, which captures the extent to which parents and children educational attainment is correlated, irrespective of the levels of attainment and ii) positional movement, which captures the extent to which children raised in low (high) attainment households move toward higher (lower) attainment.

In Chapter 2, titled *"Regional Intergenerational Mobility in Ecuador: Many Lands in One Country"*, we delve into the debate about subnational disparities of intergenerational mobility. In this study we aim to contribute to a strand of empirical research in intergenerational mobility conducted at the subnational levels, finding that within country disparities can be as large as cross-country disparities in mobility. An important finding from this line of research is that despite marked heterogeneities arise, spatial correlations can also be identified (Acciari et al., 2022; Chetty et al., 2014). Hence, an important step forward and our contribution with this chapter is to directly measure these correlations and incorporate them to investigate their impact on the subnational levels of mobility.

We focus on Ecuador as a case study. The country presents a particularly relevant context due to its limited opportunities for social mobility, especially among traditionally disadvantaged groups (Daude & Robano, 2015). This structural immobility is mirrored in public perceptions: a significant majority of Ecuadorians view socioeconomic inequality as the outcome of systemic unfairness, and confidence in the possibility of upward mobility remains low (UNDP, 2021). In this context, Ecuador also serves as a representative case within the Latin American context, illustrating the broader social

and regional dynamics through which intergenerational mobility can be measured and understood. On its own, Ecuador also presents a relevant case study due to its political commitment to addressing social disparities as included in the 2008 Constitution, which explicitly prioritizes equality of opportunity and social inclusion as central tenets of public policy.

In this chapter, we rely on the cross-sectional microdata collected in the Encuesta de Condiciones de Vida (ECV), provided by the Instituto Nacional de Estadística y Censos (INEC). We use five waves of the survey. We calculate and examine eight measures of intergenerational education mobility for 124 cantons, an administrative level which population is usually below the lowest population threshold defined in NUTS 3 regions. We then adapt the theoretical framework of spatial dependence of mobility to test the significance of the spatial dimension and identify its drivers by incorporating elements of the demographic, human capital and labor market structure of the canton. Our results point to large variation of intergenerational mobility across measures and across the territories. This implies for instance that places where there is low association between parent-child outcomes (high mobility on the origin-dependence concept), not necessarily provide opportunities for higher attainment (high mobility on the positional concept). We formally document a significant spatial association in the selected measures, with least two broad crucial implications. First, that the estimation of the drivers of intergenerational mobility at the subnational level should consider the spatial correlations to pursue unbiased estimates. Second, that the design of public policy that aims to address mobility should be developed on a place-based focus rather than national-level focus.

In Chapter 3, under the title "*Gendered Pathways to Intergenerational Mobility: The Role of Cognitive and Noncognitive Skills*", we shift our attention to a different debate about the disparities in intergenerational mobility: those between women and men. In this chapter, we touch on two research lines. One that documents a gender gap in intergenerational mobility that in general favors women. A second, largely explored, research line documents strong gender differences in cognitive and noncognitive skills, with men having a dominance in the former and women in the latter. Furthermore, men have lower educational attainment -the so-called boy problem-, which has been suggested to be due to the superiority of women's noncognitive skills. We aim to bridge both strands of research by asking whether and to what extent the gender disparities in intergenerational mobility can be linked to the gender disparities in cognitive and noncognitive skills.

In this chapter, we turn the focus away from territorial disparities and instead aim to provide broader cross-national evidence to address our research question. The motivation is twofold. Much of the existing research on skill-related disparities has been conducted in high-income countries, where large-scale initiatives such as the Programme for the International Assessment of Adult Competencies (PIAAC) offer periodic data. Second, these data collections are regularly refined to reflect emerging research objectives and methodological improvements. An example is the recent inclusion of measures of noncognitive skills in the second cycle of PIAAC, building on prior evidence that highlights the importance of these skills for a wide range of adult outcomes. This innovation makes the collection of the second cycle of PIAAC well-suited to address our research question, while building on previous research for these countries.

The second cycle of PIAAC thus represents the largest international effort to collect comparable data on adults' both cognitive and noncognitive skills, enabling cross-country comparisons. Ecuador is not part of the empirical analyses of this chapter. Although the country took part in the first cycle of PIAAC, the country has not yet taken part in the second cycle. Drawing on evidence for 23 participating countries, we first discuss the gender differences in intergenerational mobility, cognitive and noncognitive skills. Like in Chapter 2, we include four measures that capture both concepts of mobility: origin-dependence and directional measures. As for measures of cognitive skills, we analyze differences in literacy and numeracy proficiency. Regarding measures of noncognitive skills, we analyze differences in the Big 5 personality traits: Agreeableness, Conscientiousness, Open-mindedness, Extraversion and Emotional Stability.

The results show that men outperform women in numeracy skills, while women outperform in literacy skills and across the personality traits with the exception of Emotional Stability. With respect to the measures of mobility, the differences show a more favorable scenario for women, as they are more likely than men to experience higher educational attainment than their parents, and less likely to experience lower attainment. In a second step, we use decomposition analysis to understand the extent to which are these gender differences linked. The findings reveal that after controlling for household background, overall cognitive skills are the largest contributor to the gender gap in intergenerational mobility. Within cognitive skills, numeracy stands out as a factor that could reduce the male disadvantage in mobility; however, noncognitive skills play a significant role in the female advantage in mobility. Among the latter, Conscientiousness and Open-mindedness stand out. Furthermore, large heterogeneity across

countries shows that in some cases noncognitive skills can be as important as numeracy skills for intergenerational mobility.

In Chapter 4 of this thesis, "*Leveling the Playing Field: Cognitive Skills and Test Know-How in Standardized Tests*", we turn our attention to a more action-oriented aim. Specifically, we explore whether targeted interventions can enhance skill development in ways that are relevant for fostering intergenerational mobility. While a wide range of strategies have been proposed to promote intergenerational mobility, many operate at highly complex or structural levels. These strategies include reforming tax systems, overhauling labor markets, or designing social protection policies. In contrast, the literature has increasingly emphasized the potential of malleable, individual-level factors, that can contribute to this aim. One key relevant factor is the improvement of cognitive and non-cognitive skills (Heckman & Kautz, 2012). This chapter builds on this evidence, connected to that of Chapter 3, to focus on skills that are both measurable in the short term and theoretically connected to longer-term mobility prospects.

In particular, we target cognitive skills relevant to university access—an important gateway for upward mobility. We return our focus to Ecuador as an interesting case study since the country's 2008 Constitution enshrines the principle of equality of opportunity and explicitly guarantees free access to public higher education as a means of fostering social mobility. However, in practice, the implementation of a standardized entrance exam has generated controversy. Based on interviews, critics have noted that although tuition was eliminated, access to public universities has become increasingly skewed in favor of students who can afford private preparation courses or multiple exam attempts (Madrid, 2019). Therefore, this chapter is informative to the country, but it is also informative to broader international debates about the extent to which entrance exams may act as barriers—rather than gateways—to higher education, particularly for students from disadvantaged backgrounds.

Despite the controversy, there is no official data to assess how supplementary preparation influences students' skills and performance on the national university entrance exam in the country. To address this gap, in this chapter we designed a randomized controlled trial to collect such data and put this to the test. Particularly, we focus on whether numeracy-related skills can be improved through a low-cost, short-term intervention. The study sample consists of third-year low income students from 29 public secondary schools in the city of Cuenca, the country's third largest city. The program consists of eight sessions aimed at enhancing logical and numerical reasoning skills, which are central to Ecuador's national university entrance exam, through targeted exercises and test-taking strategies. We find that treated students experience a significant

increase in their score. Specifically, they achieve 2.4 additional test points representing a 0.37 of a standard deviation impact. Furthermore, back of the envelope calculations show that socioeconomic gaps could be reduced as a result. We then try to delve deeper into the mechanisms behind the impact of the intervention and find that it could only partially be attributed to improvements in cognitive knowledge and it rather stems from a change in how students engage with the exam. They attempted significantly more questions, suggesting that other noncognitive skills were built such as exerted effort and perseverance.

The structure of the rest of thesis is as follows. Chapter 2 presents the research titled "*Regional intergenerational mobility in Ecuador: Many lands in one country"*. Chapter 3 is devoted to the study "*Gendered Pathways to Intergenerational Mobility: The Role of Cognitive and Noncognitive Skills in PIAAC"*. Chapter 4 covers the intervention leading to "*Leveling the Playing Field: Cognitive Skills and Test Know-How in College Entrance*". Each chapter is accompanied by appendices that provide supplementary information, tables and figures. To conclude, Chapter 5 of the thesis synthesizes the main findings from each of the preceding empirical studies, drawing together the diverse strands of analysis to highlight their collective contributions to the understanding of intergenerational educational mobility. By connecting the evidence presented across chapters, it further outlies recommendations for policy design aiming to equalize opportunity chances across generations and suggests avenues for future work.

# 2.Regional Intergenerational Mobility in Ecuador: Many Lands in One Country[1]

## 2.1. Introduction

Interest in intergenerational mobility studies has increased in the past decade because of the widespread notion that higher cross-sectional inequality is associated with lower mobility across generations, hence linking inequality of opportunity with inequality of outcomes. In Latin America, the second most unequal region in the world, the United Nations Development Programme (UNDP, 2021) has linked low social mobility to the stark inequalities and 'development trap' that the region experiences. Furthermore, the region has been labelled the least socially mobile in the world by a great margin (Torche, 2021).

Studies have been carried out estimating mobility at the subnational level (e.g. Chetty et al., 2014), unveiling stark within-country differences (Acciari et al., 2022; Chetty et al., 2014; Corak, 2020) with marked patterns of spatial correlation. This not only leaves room for future studies to delve into the importance and effects of the correlations when trying to explain mobility, but it is also consistent with the theoretical models of intergenerational mobility developed by Benabou (1993) and Durlauf (1996a, 1996b) and, more recently, by Becker et al. (2018), who posit that spillovers in mobility across places can generate positive or negative cycles. A potential step towards explaining mobility would be to study the effects of spatial dependence and the possibility for spillovers.

We take this regional evidence into consideration and incorporate spatial statistical tools to estimate and explain the intergenerational transmission of socioeconomic status, using education as a proxy. We use Ecuador as a case study as it is the third least mobile country in Latin America (Daude & Robano, 2015), where 83 per cent of the

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[1] This study is coauthored with Raul Ramos, my advisor, and published in https://doi.org/10.1080/00343404.2024.2350611. This work was supported by the Ministerio de Ciencia e Innovación/Agencia Estatal de Investigación [grant numbers PID2020-118800GBI00, MCIN/AEI/10.13039/50110001103, AEI – 10.13039/501100011033].

population think that inequality is the result of an unfair society and only 21 per cent believe that upward mobility may be possible for their children (Latinobarómetro, 2020). Between 2006 and 2017, Ecuador experienced a substantial reduction in poverty and the rise of the middle class in line with the regional pattern. Mobility from lower to higher social classes, however, has proved to be a rather weak process driven by the boom in commodities and the redistributive policies it allowed (Azevedo et al., 2015) and not by better social mobility indicators (Torche, 2021). Therefore, this analysis can contribute to the broader audience of countries where, like in Ecuador, there is a significant presence of primary sector activities while the space for structural changes in terms of social mobility is still limited.

Furthermore, empirical evidence on this topic is rather scarce for Ecuador: research has been conducted mainly at the country level as part of international surveys and using only one concept, that of origin dependence (Andersen, 2001; Daude & Robano, 2015; Hertz et al., 2007; Neidhöfer et al., 2018). In contrast, we estimate eight measures of intergenerational mobility for 114 cantons and identify marked geographical differences for such a small country. The results reflect the unequal/unfair nature of the country in which higher inequality is associated with larger parent-child correlations, coexisting with reduced rates of upward mobility and a high chance of poverty traps. Furthermore, we formally document evidence of a significant spatial correlation of mobility estimates, which allows it to be treated as a spatial phenomenon and its potential spillovers to be explored.

The structure of this paper is as follows. Section 2.2 presents a brief literature review of the drivers of intergenerational mobility. Section 2.3 describes the eight measures of mobility that we calculate and the spatial techniques applied to study its drivers. Section 2.4 describes the data sources and their handling, as well as the territorial unit of analysis. Section 2.5 presents the results: it is divided into (i) a description of intergenerational mobility through the set of measures and (ii) a spatial analysis of mobility. Section 2.6 offers concluding remarks and Section 2.7 is the Appendix.

## 2.2. The drivers of intergenerational mobility

The regional literature on intergenerational mobility has experienced a surge since the study by Chetty et al. (2014) and it has contributed by consistently finding large variations yet clear spatial correlations across subnational territories (Acciari et al., 2022). Furthermore, the geography of intergenerational mobility seems to be more important in some countries than in others (Delajara et al., 2021) and has emphasised that

the local—both micro- and meso-level—contexts that individuals face are key for mobility (Connor & Storper, 2020; Granström & Engzell, 2023).

This literature has also identified multiple drivers to explain the observed heterogeneity. These differ depending on the dimension and the measure of intergenerational mobility under analysis. Following Granström and Engzell (2023), they can be divided into categories representing the human capital, labour, demographics, and socio-spatial structure of a country. Since our second aim is to explain what drives mobility, we describe in what follows the set of variables that we select for this.

Based on the literature, we know that one of the most common and robust drivers of subnational mobility is migration, which is usually found to increase the probability of moving up the social ladder (Acciari et al., 2022; Corak, 2020; Song et al., 2020). This is explained by the fact that migrants move for better jobs and overall better economic opportunities. Hence, locations with higher immigration rates might highly reflect this 'moving to opportunity' behaviour (Berger et al., 2023). A second important demographic driver is the proportion of disadvantaged ethnic groups. For instance, mobility is inversely correlated to the share of indigenous groups in Chile and Australia (Cortés Orihuela et al., 2022; Deutscher & Mazumder, 2020), and to black populations in the US (Chetty et al., 2014). The mechanisms behind this pattern have not been studied in detail, but it is argued that differences in the institutions and industries developed in the areas with a larger presence of these ethnicities might be one mechanism, while racial segregation might be another (Chetty et al., 2014).

Human capital is another category that is widely studied and measured in a variety of ways. Overall, regions with better performance in human capital dimensions such as average schooling, tertiary attendance, share of professionals and school completion predict better social mobility opportunities (Connolly et al., 2019; Granström & Engzell, 2023. Connor and Storper (2020) argue that the mechanism underlying this relationship is that in modern societies, where schooling is strongly rewarded, its expansion may result in reductions in interpersonal inequality and favour better economic and social opportunities for all households in a region, improving social mobility. Among the variables relating to human capital, measures of education inequality are also important and can provide an insight into the existence of a Great Gatsby curve in education. This suggests that greater inequality in one generation is associated with decreased social mobility. According to Durlauf and Seshadri (2018), at the subnational level, the underlying mechanism of this relationship is territorial segregation: inequality increases segregation and segregation is related to parental status; hence, inequality increases the transmission of parental status—i.e. it decreases mobility.

The variables of the labour market structure are diverse and include shares of unemployment as well as teenage and youth labour and the population outside of the labour force, the unionisation rate, job automation and the sectoral composition of employment (Berger & Engzell, 2022; Connolly et al., 2019; Corak, 2020; Delajara et al., 2021). Within the sectoral composition of employment, the concentration of industrial employment has been associated with both positive and negative effects on mobility, while agricultural employment has been mostly linked to lower mobility (Granström & Engzell, 2023), especially upward mobility in industrialised economies (Alesina et al., 2021; Berger et al., 2023; Corak, 2020). Another relevant variable for Ecuador, as in other developing countries, is self-employment, which in fact accounts for six out of ten workers. Going into this type of employment is mainly explained by necessity and family tradition. Self-employment has been found to be highly correlated among parents and children in European countries (Giménez-Nadal et al., 2022). Furthermore, Acciari et al. (2022) note that intergenerational mobility is higher for the sons of self-employed parents. We take this into consideration by including a variable capturing the percentage of workers who are self-employed due to family tradition. The mechanisms through which this could affect mobility can be found in recent theoretical models where family and social explanations are at the core, with parental role models as a key factor defining belief formation and aspirations (Cholli & Durlauf, 2022).

## 2.3. Methodology

### 2.3.1. Concepts and dimensions of mobility

The measurement of intergenerational mobility can encompass different dimensions and concepts: this has resulted in at least 20 different proposed indices (Jäntti & Jenkins, 2015). The dimension[2] refers to the variable selected for calculating mobility: education. This choice has been extensively evaluated and is particularly informative in our case because education is the main predictor of earnings in Latin America (Psacharopoulos & Patrinos, 2018). Therefore, it is associated with multiple non-pecuniary outcomes such as health and parenting, crime and political engagement (UNDP, 2021). Furthermore, it can be strongly related to mobility in other domains such as the

[2] Also called 'space of mobility' (Jäntti & Jenkins, 2015). We avoid using this term and reserve it for addressing the spatial econometric analysis of mobility

economic and occupational (Torche, 2021), although this has been challenged depending on the context (Fletcher & Jajtner, 2023).

Studying educational mobility has several advantages with respect to income mobility (Neidhöfer, 2019). Firstly, educational attainment is usually fixed and time-invariant once a certain age is reached, representing a suitable proxy for lifetime socioeconomic status. This contributes to avoiding attenuation and lifecycle bias (Black & Devereux, 2011). Secondly, while revealing one's income can be sensitive and is avoided by some people, this is rarely the case with education. Therefore, it is more reliable and less affected by measurement errors. Given these advantages, mobility indicators in the area of education are broadly available for developed and developing countries, making it a convenient measurement for comparison purposes, too.

A number of concepts refer to how mobility is defined and hence interpreted. Two of the most used concepts of mobility are 'movement' and 'origin dependence' (Ferreira et al., 2012). Movement defines mobility as gross and net movements along the distribution from one generation to another (e.g. moving downward or upward in the distribution). The concept of origin dependence views mobility as the extent to which one generation's future is independent of the preceding generation.

Within these two concepts are indices of absolute and relative mobility. Absolute mobility measures capture the total change from one generation to another, which might result from economic expansion or growth, while relative mobility measures capture the change in relative positions along the distribution between generations. Since growth may make everybody better off while they all retain their relative positions, absolute and relative measures provide different views of mobility. Relative measures are believed to reflect the structure of opportunities in a society better and its degree of 'openness' (Erikson & Goldthorpe, 1992). We estimate eight measures covering the two concepts.

### 2.3.2. Measures of mobility

The single most used measure of intergenerational mobility is the slope of a cross-sectional linear regression of children's outcomes on parental outcomes (Cholli & Durlauf, 2022; Jäntti & Jenkins, 2015; Stuhler, 2018). In our case, we regress schooling years of children in region $c$ ($y_{1c}$) on the schooling years of parents ($y_0$), as follows:

$$y_{1c} = \alpha_c + \beta_c y_0 + \varepsilon_{ic} \tag{2.1}$$

$\beta_c$ is a measure of relative intergenerational mobility that follows the concept of origin dependence since it reflects the strength of the association between children and parental outcomes. The higher the coefficient, the greater the origin dependence or persistence (i.e. the lower the intergenerational mobility).

Following the literature (Deutscher & Mazumder, 2020; Neidhöfer et al., 2018; Torche, 2021), as a complement of $\beta_c$, we also present the Pearson correlation coefficient between children and parental income. This is a measure of origin dependence as well, but it differs from $\beta_c$ by netting out the cross-sectional inequality of education across generations, providing a standardised index:

$$\rho_c = \beta_c \frac{y_0}{y_{1c}} \tag{2.2}$$

The next measure, the intergenerational rank association (IRA), constitutes an increasingly prevalent index in the empirical literature and was introduced by Dahl and DeLeire (2008), who adopted the method used in the literature on intergenerational occupational mobility. Here, it is necessary to construct rankings for everyone within their generation and then regress the education rank of children who live in region $c$ on the education rank of parents:

$$R_{1c} = a_c + b_c R_0 + \varepsilon_{ic} \tag{2.3}$$

$b_c$ is the IRA or rank–rank slope coefficient, capturing the movement concept of mobility. It identifies persistence in rank position and can be viewed as abstracting changes in inequality. When the ranks are built from the population in question, $b_c$ allows mobility to be studied on a 'fixed' national scale. This is simply the Spearman correlation (Deutscher & Mazumder, 2020); it has been emphasised since the work of Chetty et al. (2014) as a relative measure of mobility (Corak, 2020; Delajara et al., 2021; Deutscher & Mazumder, 2020; Neidhöfer et al., 2018).

The intercepts $\alpha_c$ and $a_c$ from Equations (2.1) and (2.3) are also used in the literature as absolute measures reflecting the concept of movement. Following Corak (2020), $\alpha_c$ captures differences in schooling growth between regions. On the other hand, $a_c$ measures the expected rank for children from families at the bottom of the income distribution (Chetty et al., 2014).

The remaining measures of mobility come from the matrix of transition probabilities across quintiles of the national education distribution. Since linearity is not assumed, mobility matrices have the advantage of allowing asymmetric patterns of mobility (Stuhler, 2018); therefore, they complement other indicators. Mobility matrices,

also referred to as positional measures, represent relative measures of mobility and follow the movement concept. Following the literature (Acciari et al., 2022; Corak, 2020; Delajara et al., 2021; Neidhöfer et al., 2018), we will focus on three specific cells from the matrix:

$$Q1Q1 = Pr\{R_{1c} \leq 20 \mid R_0 \leq 20\} \tag{2.4}$$

$$Q5Q5 = Pr\{R_{1c} \geq 80 \mid R_0 \geq 80\} \tag{2.5}$$

$$Q1Q5 = Pr\{R_{1c} \geq 80 \mid R_0 \leq 20\} \tag{2.6}$$

These capture the so-called intergenerational cycles of poverty (Q1Q1), or the probability of being born and remaining in the bottom quintile of the distribution, and intergenerational cycles of privilege (Q5Q5), or the probability of being born and staying in the top quintile of the distribution. The third index (Q1Q5) has been called a measure of the American Dream (Chetty et al., 2014) or rags to riches (Corak, 2020); it measures movement from the bottom to the top quintile of the distribution. This is one of the most discussed measures in the literature (Deutscher & Mazumder, 2020).

### 2.3.3. Spatial analysis of mobility

To analyse the drivers of mobility, we introduce space as a relevant dimension based on the regional literature on intergenerational mobility, which has found patterns of spatial correlations, and the theoretical models by Becker et al. (2018), Benabou (1993) and Durlauf (1996a, 1996b), who argue that intergenerational mobility is reinforced by neighbourhood effects.

Benabou (1993) states that when adults choose their neighbourhood, they do this for themselves and their offspring. In the same vein, Troost et al. (2023) argue that this choice is based on a wide array of factors including their tastes and resources, with the aim of preserving or improving their status. Neighbourhoods are formed by and generate internal and external social interactions, which in turn affect individuals' sets of information, preferences and even aspirations (Lekfuangfu & Odermatt, 2022; Topa & Zenou, 2015). This process leads to spillover effects across territories. As a result, positive or negative cycles of mobility may arise. Evidence of neighbourhood effects where negative cycles of mobility may arise includes the study by Connor et al. (2023).

One potential mechanism through which interaction happens is migration, which was first pointed out by Benabou (1993) when trying to explain high- versus low-skilled neighbourhoods. Evidence by Borck and Wrede (2018) supports this for the US,

finding that internal migration can help explain the variation in intergenerational mobility within a country by sorting different skills into geographic areas.

To explore these potential neighbourhood effects, we apply econometric techniques to account for the spatial correlation between adjacent territories in Ecuador and identify the spillover effects. To our knowledge, previous contributions applying these techniques have not delved deep into studying the spatial correlations and spillovers (Qin et al., 2020; Wei et al., 2023), while others have not found support for spatial lags (Weber et al., 2018).

With this aim, we first conduct an exploratory analysis of our hypothesis that there are spatial correlations by calculating the global and local Moran's I statistic. After this, we move on to the spatial econometric analysis, where we depart from the general spatial regression that follows:

$$y_i = \rho W y_i + X_i \beta + W X_i \theta + \mu_i \tag{2.7}$$

$$\mu_i = \lambda W \mu_i + \varepsilon_i \tag{2.8}$$

Here, $i$ represents the regional level ($i = 1, \dots, n$). In our case, $y_i$ denotes intergenerational mobility, while $W$ represents the spatial weighting matrix to capture the spatial relationship between regions. $X_i$ signifies a set of independent variables that, according to the literature and the structural characteristics of Ecuador, may drive mobility, and $\mu_i$ is a random error term with zero mean and constant variance.

The literature on spatial econometrics has proposed a collection of spatial econometric specifications for which Equation (2.7) is a generalisation, known as the spatial Durbin model (SDM). Under this general specification, the right-hand side of the equation includes as control variables the spatial lags of the dependent and independent variables denoted by $W y_i$ and $W X_i$, respectively. Coefficient $\rho$ is the spatial dependence coefficient, $\lambda$ is the spatial error lag, and $\beta$ and $\theta$ are vectors of coefficients corresponding to the explanatory variables, with $\theta$ representing the spatial lag or the influence of these variables averaged over the neighbouring regions.

The primary definition of the spatial weights' matrix is a binary contiguity matrix with first-order neighbours and row standardisation. As sensitivity analysis, we also vary the matrix specification to a contiguity matrix with second-order neighbours and distance-based matrices with the inverse of the distance, the inverse of the squared distance, and a k-nearest neighbours matrix using the information of the four nearest.

## 2.4. Data

In this study, we use the Encuesta de Condiciones de Vida (ECV). This survey was first carried out in 1994 with the aim of measuring the quality of life of citizens and, overall, to assess poverty and welfare. The design is based on stratified two-stage sampling and is representative at the national and subnational levels of regions, provinces, and some cities. We use all the datasets collected from 1998 onwards. Since then, the ECV has gathered information on the education of parents and adult children and whether or not they live together. If they do, a retrospective question on parental education applies. This allows the usual limitation on longitudinal data availability in developing countries to be overcome and avoids the cohabitation bias that can arise if estimated only with adults who live with their parents.

We impose three restriction criteria on our sample. Firstly, we restrict the sample to the availability of information on the individuals' own and their parents' education. Secondly, we limit our sample to adults aged 25 to 64 years in each wave. Next, we exclude individuals who have not finished their studies and who report that they are enrolled in any education degree. An inspection of this criterion shows that nearly 3 per cent of the adults are enrolled in education, mainly tertiary, and the remaining 97 per cent are not studying. Together, these criteria help ensure that we work with a variable that captures the final schooling level of the individuals in our sample to the greatest extent possible.

Next, we define four cohorts of children aged 25–34, 35–44, 45–54 and 55–64 years in each wave and limit our sample to those observed at least twice, which rules out the oldest cohort of the first wave and the youngest of the last wave. With this, our final sample consists of 66,038 parent–child pairs. Schooling years have been calculated following the methodological approach by the Sistema Nacional de Información (2016). To calculate mobility, we use a variable of joint parental education, applying the dominance principle developed in sociology (Erikson, 1984)—that is, we use the maximum years of schooling of either the father or mother. To compute the measures from the transition probability matrix (Q1Q1, Q1Q5, Q5Q5), we generate quintiles of the national distribution of education (Acciari et al., 2022; Chetty et al., 2014).

To define the territorial unit for our estimates, we use the canton where the children reside, as in other studies that have focused on regional differences (Berger & Engzell, 2022; Granström & Engzell, 2023). Ecuador is geographically divided into four regions—the Galápagos, the coast, the Andes and the Amazon (Figure A.1 in the

Appendix)—and administratively divided into 24 provinces, 221 cantons, and 1,024 parishes. The great majority of cantons (91 per cent) have populations below the lowest threshold defined in the Nomenclature of Territorial Units for Statistics 3 region. Cantons have for a long time been the basic unit of territorial organisation in Ecuador (Benabent & Vivanco, 2021). They are the most common unit at which economic and social phenomena are studied; hence, we know there is high heterogeneity between them but shared characteristics within them in terms of their economic, social and demographic indicators (Pontarollo et al., 2020. Cantons have some important functions that aim to create employment and income opportunities for the local population (Benabent & Vivanco, 2021). Their importance for local economic and social development is reflected in the fact that, amongst the administrative divisions, they receive the largest share of central government transfers, reaching 67 per cent in the latest regulation code (Código Orgánico de Organización Territorial, Autonomía y Descentralización, 2010).

Cantons are very diverse in terms of population size, however, which can range from 2,000 residents to 2.5 million (Instituto Nacional de Estadística y Censos (INEC), 2020). As this entails very small sample sizes for a lot of cantons, we also restrict our sample to those with at least 100 parent–child pairs, which allows us to study intergenerational mobility in 124 cantons. These represent 57 per cent of the existing cantons which are home to 91 per cent of the population in Ecuador. All estimates are obtained by weighting each observation by the inverse probability of selection of the household divided by the household size for each survey wave.

Lastly, when addressing our aim of explaining regional differences in intergenerational mobility, we include the following variables: the share of migrants and the indigenous population to represent the demographic structure; average schooling and education inequality to reflect human capital; and the proportion of agricultural employment and the amount of family self-employment to signify the economic structure. All these variables are obtained at the canton level from the ECV. Descriptive information for the considered variables can be found in Table A. 2.1 and Figure A.2.2 of the Appendix.

## 2.5. Results

### 2.5.1. Describing intergenerational mobility

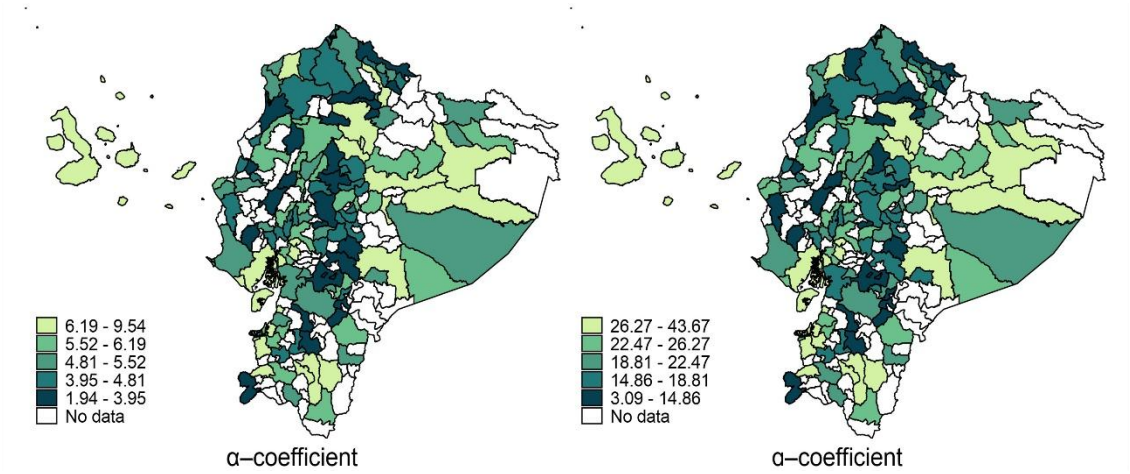
At the national level, the slope of the schooling regression ($\beta$ coefficient) shows that, on average, a one-year increase in parental education will increase offspring's education by 0.66 years. The most comparable estimates are those of Daude and Robano (2015), who also find a $\beta$ coefficient of 0.66 for Ecuador and a Latin American average of 0.65, placing the country as the third least mobile in the region. Other studies also rank the country as a low-mobility place for teenagers (Andersen, 2001) when considering different waves of the ECV (Hertz et al., 2007) and when using varying measures of mobility (Neidhöfer, 2019).

The cantonal indexes are mapped in Figures 2.1 to 2.3 and can be found in detail in Table A.2.2 in the Appendix. For ease of interpretation, we plotted all the measures such that the darker areas correspond to more persistent (i.e. less mobile) cantons. According to the interpretation of each measure, this entails higher persistence—i.e. darker tones for higher values of $\beta$, $\rho$, $b$, $\mathrm{Q1Q1}$ and $\mathrm{Q5Q5}$ and for lower values of $a$, $\alpha$ and $\mathrm{Q1Q5}$.

The maps show large territorial heterogeneity underlying the aggregate behaviour, with places resembling both the least and the most mobile societies worldwide. Interestingly, Table A.2.2 shows that despite concentrating public services and economic activity, capital cantons do not follow any particular pattern. In fact, analysing the capitals only, the indicator varies greatly, ranging from 0.35 in the most mobile (San Cristobal, Galápagos) to 0.96 in the least (Guaranda, Central Andes).

Figure 2.1 maps the values of $\alpha_c$ and $a_c$. These indicators depict absolute mobility by capturing the schooling levels that children attain if their parents exhibit no schooling; hence, they represent cantonal schooling growth. Some patterns emerge: cantons in the Amazon and the Galápagos experience high rates of mobility in general, while those in the Central Andes display low mobility and those on the coast have both high and low mobility rates.

Figure 2.1. Absolute measures of schooling mobility: Canton level




Notes: These measures depict darker areas where schooling is lower and so is the potential for intergenerational mobility. Therefore, darker areas represent lower mobility.

Figure 2.2 compares the three measures of mobility that depict origin dependence. In general, we find that the Andes region is the least socially mobile. Within this region, the lowest levels of mobility are concentrated in the cantons in the central territory. This is followed by the central cantons on the coast, where mobility is moderate. The north and south cantons of these regions, alongside the cantons in the Amazon, are more heterogeneous.

Positional measures in Figure 2.3 also show great heterogeneity and, overall, great persistence between generations. We see, for instance, an average 56 per cent probability that a child raised by parents in the bottom quintile of education stays in the same position (Q1Q1), but this measure rises above 90 per cent for some cantons in the Central Andes and the north coast. The probability of persisting at the top (Q5Q5) is, on average, 52 per cent, rising to 80 per cent in some places.

These results show that in Ecuador, persistence through this concept is strong at the extremes of the transition matrix, with poverty cycles being stronger. Although not entirely comparable given the population, measures and data involved, Cano (2015) examines estimates of top-income persistence in Ecuador and also finds great persistence.

Figure 2.2. Origin dependence measures of schooling mobility: Canton level

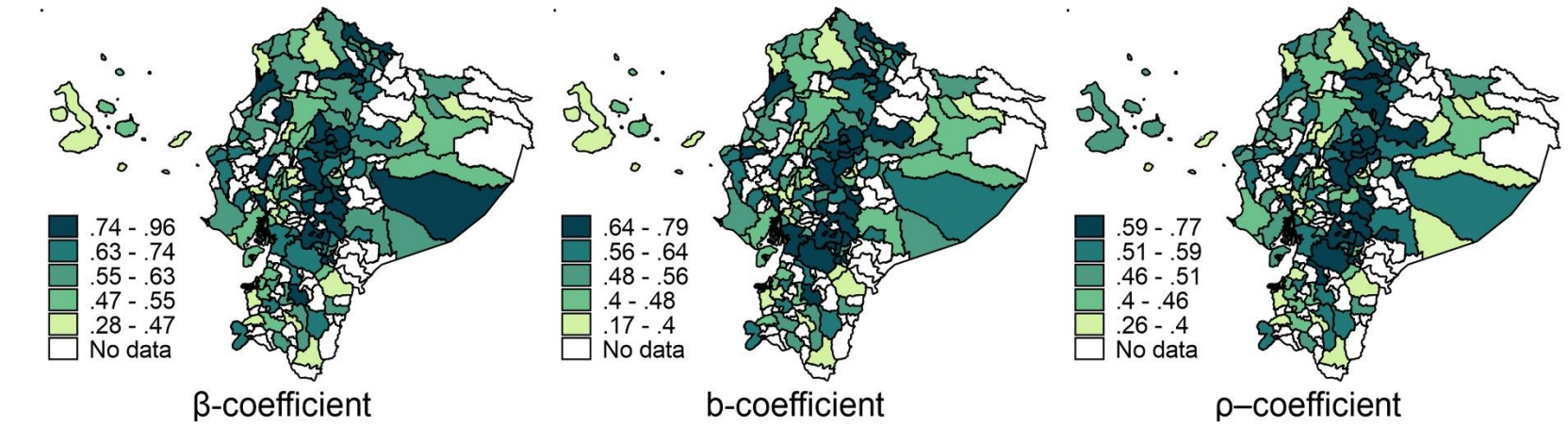
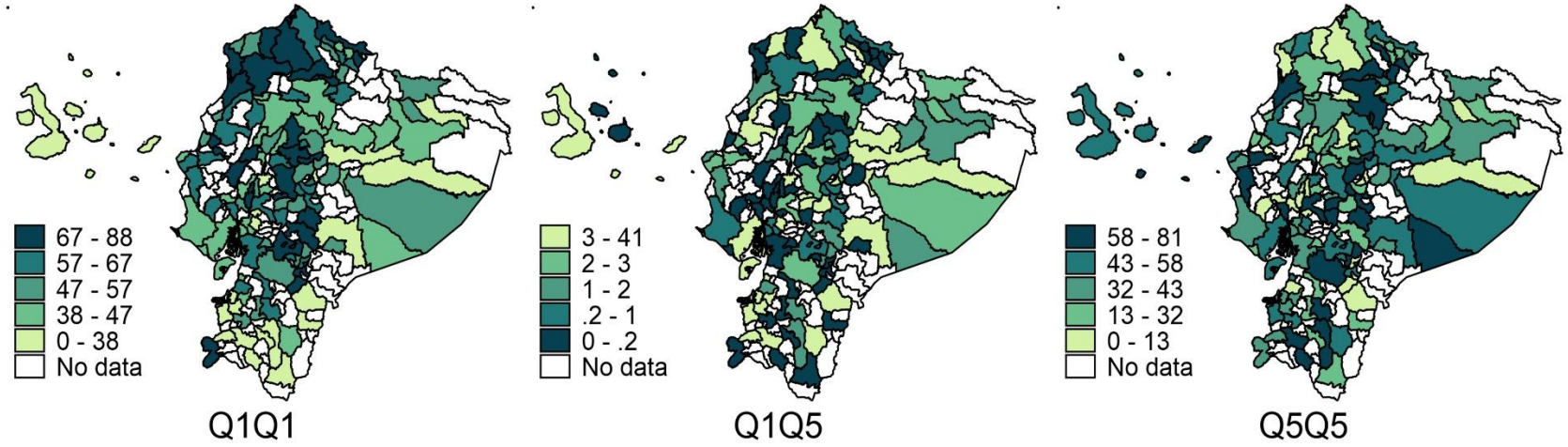



Figure 2.3. Positional measures of schooling mobility: Canton level




Notes: Origin dependence measures depict darker areas where origin dependence is higher. Positional measures depict darker areas where probabilities of Q1Q1 and Q5Q5 are higher and Q1Q5 are lower. Therefore, in all measures, darker areas represent lower mobility according to the different concepts.

Although a full comparison with other countries is difficult due to the diverse nature of the datasets and measures used, if we do some comparisons, we also uncover steeper persistence than in other contexts. The best-case scenario is Switzerland (Chuard & Grassi, 2020), where the probability of a Swiss person being born and staying in the bottom quintile is less than half that of an Ecuadorian (24 per cent), while the probability of being raised and staying in the top quintile is 30 per cent on average. Other available estimates for Canada (Corak, 2020) and Italy (Acciari et al., 2022) also show great divergence with our estimates, which is partially expected given that these are characterised as largely open societies.

On the other hand, the results of the Q1Q5 measure are rather small. While in Switzerland, Canada and Italy, a child from the bottom of the distribution can rise to the top quintile with a probability of nearly 10 per cent, in Ecuador, this probability stands at an approximate average of 3 per cent. Only three out of 124 cantons approach this international reference. The Latin American average for the Q1Q5 measure using quartiles is approximately 13 per cent (Torche, 2021). In terms of the heterogeneity observed, our estimates are quite similar to the subnational patterns in other Latin American countries such as Mexico (Delajara et al., 2021) and Chile (Cortés Orihuela et al., 2022).

### 2.5.2. Explaining geographical differences in intergenerational mobility

In this section, we present the exploratory analysis of the spatial dependence of mobility. Once we find that there is a spatial correlation, we move on to find the best-fitting specification and decompose the spatial direct and indirect effects. We focus on the $\beta$ coefficient (Tables 2.1 to 2.3), as it is the most studied measure in the literature. It should be noted that this index of mobility is larger where there is more origin dependence; hence, it can be read as intergenerational persistence. To complement the results on $\beta$, we also provide the best-fitting spatial model for each mobility measure (Table 2.4). Given the exclusion of cantons with reduced samples when measuring mobility, we are left with some islands that are discarded for the spatial analysis in this section, resulting in 111 cantons in all regressions.

Exploratory analysis of the spatial dependence of $\beta$ resulted in a statistically significant global Moran's I statistic of 0.30, meaning that cantons where intergenerational mobility is low (high) are surrounded by similarly low (high) mobility cantons. As presented in Figure A.2.3, the local statistic also reported significant values at the

cantonal level. These results remain unchanged when incorporating the cantons excluded due to reduced samples.

As a result, we next apply the combined approach developed by Elhorst (2010) to identify the best fitting spatial specification. Three spatial models for $\beta$ with different spatial spillovers to account for the correlations are presented in Table 2.1. Firstly, the spatial autoregressive (SAR) and spatial error model (SEM) specifications are studied, where, through robust Lagrange multiplier (LM) tests, we find evidence of a spatially lagged dependent variable at the significance level of 5 per cent ($\rho \neq 0$). Then we study the SDM and, by means of a likelihood ratio test on $\theta = 0$, we find no evidence that the spatial lag on the independent variables is statistically different from zero. This favours the SAR as an appropriate simplification of the SDM, backed up by the Akaike information criterion (AIC) and Bayesian information criterion (BIC) measures.

We now proceed to the decomposition of these coefficients into direct and indirect spatial effects. At first glance, we see in Table 2.2 that the signs of the effects echo those of the coefficient estimates and that the direct effects are also similar in magnitude. The direct impacts show, for instance, that intergenerational persistence decreases with migration, schooling, agriculture, family self-employment and oil activity. On the other hand, inequality and the percentage of indigenous people increase intergenerational persistence. The indirect effects also display interesting information in the same direction as the direct effects, with the difference that the Gini coefficient and oil activity dummy become not significant.

Starting with the demographic variables, these are in line with the literature and show that internal migration reduces persistence and so increases social mobility. This would reflect the moving to opportunity behaviour discussed by Berger et al. (2023), where people may be migrating to cantons with better economic opportunities; this would exert a local effect as well as spillovers to neighbouring cantons. In Ecuador, internal migration is an important phenomenon and it is associated with the formation of a multipolar economic development scenario in the country (Royuela & Ordóñez, 2018), which could in turn be linked to its power to improve intergenerational mobility.

On the other hand, the share of indigenous population increases persistence. As stated by the UNDP (2021), indigenous groups are known to be subject to structural disadvantages in numerous respects; hence the fact that these disadvantages may be passed on through generations represents an additional constraint.

Table 2.1. Spatial models of intergenerational persistence ($\beta$)

| | Intergenerational persistence β | | |
|---|---|---|---|
| | SAR | SEM | SDM |
| Indigenous | 0.1380*** | 0.1408** | 0.0680 |
| Migration | -0.2339*** | -0.2313*** | -0.2246*** |
| Schooling | -0.0346*** | -0.0344*** | -0.0376*** |
| Gini education | 0.8708** | 0.9255** | 0.9654** |
| Agriculture | -0.3616*** | -0.3565*** | -0.3389*** |
| Family self-empl. | -0.4420*** | -0.4044** | -0.4915*** |
| Oil activity | -0.0459* | -0.0638** | -0.0631 |
| ρ | 0.2872*** | | |
| λ | | 0.2575** | |
| θ-Indigenous | | | 0.1867* |
| θ-Migrant | | | -0.1304 |
| θ-Education children | | | -0.0146 |
| θ-Gini education | | | -0.3376 |
| θ-Agriculture | | | -0.1625 |
| θ-Family-owned b. | | | -0.2824 |
| θ-Oil activity | | | 0.033 |
| N | 111 | 111 | 111 |
| AIC | -146.6542 | -142.3022 | -139.9171 |
| BIC | -119.5589 | -115.2069 | -93.85512 |
| R^2 Adjusted | 0.3730 | 0.3327 | 0.3740 |
| LM-Error test (λ=0) | | 3.2160* | 1.3860 |
| LM-Lag test (ρ=0) | 8.5510*** | | 2.1098 |
| Robust LM-Error test | | 2.6254 | 1.604 |
| Robust LM-Lag test | 7.9610*** | | 2.3278 |
| Wald (ρ=0) (λ=0) | 9.0440*** | 4.24** | 16.90** |
| LR test (ρ=0) | 8.2910*** | | 2.3876 |
| LR test (λ=0) | | 3.9390** | |
| LR test (θX's=0) | | | 7.3810 |

Notes: Significance levels are denoted by * p<0.10, ** p<0.05, *** p<0.010. The estimations are computed defining the spatial weights' matrix as a binary contiguity matrix with first-order neighbours and row standardisation.

Previous calculations show that indigenous groups in Ecuador are approximately 9 per cent less likely to overcome income poverty than non-indigenous populations (UNDP, 2016). The impact of indigeneity on neighbouring cantons reflects what we observed at a descriptive level, where the lowest intergenerational mobility rates form an important cluster in the Central Andes cantons in those territories with the largest proportions of indigenous people. An explanation for the feedback effect is that

these ethnic groups tend to inhabit the most impoverished and institutionally underdeveloped areas and are prone to being geographically concentrated (UNDP, 2021). The disadvantageous social mobility experienced in places with larger shares of disadvantaged ethnic groups is not new and has been tested in a variety of contexts (Chetty et al., 2014; Connolly et al., 2019; Cortés Orihuela et al., 2022; Deutscher & Mazumder, 2020).

Table 2.2. Decomposition of spatial effects on intergenerational persistence ($\beta$)

| | Direct effects | | Indirect effects | | Total effects | |
|---|---|---|---|---|---|---|
| | Coefficients | z-values | Coefficients | z-values | Coefficients | z-values |
| Indigenous | 0.1416*** | 2.77 | 0.0521** | 2.03 | 0.1937*** | 2.84 |
| Migration | -0.2399*** | -3.60 | -0.0883** | -2.00 | -0.3282*** | -3.40 |
| Schooling | -0.0354*** | -3.25 | -0.0130* | -1.85 | -0.0485*** | -3.00 |
| Gini education | 0.8930** | 1.99 | 0.3287 | 1.48 | 1.2217* | 1.92 |
| Agriculture | -0.3708*** | -3.76 | -0.1365** | -1.98 | -0.5073*** | -3.46 |
| Family self-empl. | -0.4533*** | -2.78 | -0.1669* | -1.71 | -0.6202** | -2.58 |
| Oil activity | -0.0471* | -1.88 | -0.0173 | -1.59 | -0.0644* | -1.90 |

Notes: Significance levels are denoted by * p<0.10, ** p<0.05, *** p<0.010. The estimations are computed defining the spatial weights' matrix as a binary contiguity matrix with first-order neighbours and row standardisation.

In regard to the variables capturing the human capital structure of the country, as expected, the findings suggest that better performance in these indicators is associated with better mobility prospects. The result of the variable that captures schooling is in line with Benabou's (1993) notion that schooling creates contagion effects, which could be through the spread of opportunities (Connor & Storper, 2020). The impact of the Gini coefficient is in line with that reported in the literature and reflects the existence of the Great Gatsby curve; it is in fact the largest of impacts showing that a society with higher inequality is correlated with a lower capacity to provide equal opportunities to all. Durlauf and Seshadri (2018) have developed a model in which it is argued that multiple mechanisms underlie this relationship. However, the key aspect is that greater inequality causes greater segregation across space (neighbourhoods) and this in turn affects mobility.

Turning our attention to the labour market structure variables, we find that the concentration of agricultural employment increases intergenerational mobility through both local and spillover effects. Though this is contrary to the evidence in countries such as Canada or England (Granström & Engzell, 2023), as Iversen et al. (2019) discusses, the relationship between mobility and sectoral composition could present contrasts, especially in developing countries where agriculture and the informal sector

absorb most of the workforce. Furthermore, there is a strand of literature arguing that agriculture can play a positive role in reducing poverty traps, especially in low- to middle-income and resource-rich countries and, moreover, when agricultural employment is associated with poor workers (Christiaensen et al., 2011; Fan & Cho, 2021). Although delving more deeply into this is not our aim, we argue that it could be one of the underlying mechanisms behind our results, as in Ecuador approximately one in two poor workers is employed in agriculture and this trend has remained the same for at the least the past two decades for which we have information (INEC, 2023).

Furthermore, family self-employment is associated with increases in social mobility. This is in line with the discussion in Section 2. By definition, we know that such individuals are not in self-employment because of necessity or due to a lack of opportunities; hence, to delve deeper into this, we looked at the information reported by those self-employed due to family tradition. We find that in general they have a higher probability of being in formal business and report larger monthly revenues and a larger trajectory (almost doubling the trajectory of businesses established out of necessity). According to García and Burbano (2021), many go into self-employment due to the lack of opportunities in Ecuador, but this then turns into a family habit as they find in it an escape route from poverty (García & Burbano, 2021). Laferrère (2001) adds that self-employment in the family could have positive effects, since the sons of self-employed parents could be exposed to less binding liquidity constraints. In this sense, it is natural to think that these characteristics of family self-employment may make it better at promoting social mobility, hence decreasing persistence.

With respect to the variable of oil activity, as found by Alesina et al. (2021), the effects of the exploitation of natural resources on mobility could be both positive and negative, resulting in a null impact. When positive, it may be a sign that resource exploitation can promote human capital and structural transformation in the territories in which it takes place, which may be the reason for our results.

To conclude this section and assess the sensitivity of our results to the spatial weights matrix, we estimated the SAR model for $\beta$ using different specifications. We have considered different contiguity matrices involving first- and second-order neighbours and different distance-based measures (inverse of distance, inverse of the squared distance, and the four nearest neighbours). Table 2.3 shows that similar results can be obtained.

Table 2.3. SAR model of $\beta$: Different spatial weights matrix specifications

| | Queen contiguity matrix | | Haversine distance matrix | | |
|---|---|---|---|---|---|
| | First- order neighbours | Second-order neighbours | Inverse distance | Inverse squared distance | Knn −4 |
| Indigenous | 0.138*** | 0.160*** | 0.167*** | 0.179*** | 0.154*** |
| Migration | -0.234*** | -0.246*** | -0.256*** | -0.297*** | -0.231*** |
| Schooling | -0.035*** | -0.034*** | -0.034*** | -0.031** | -0.031*** |
| Gini education | 0.871** | 0.909** | 0.863* | 0.428 | 0.875* |
| Agriculture | -0.362*** | -0.372*** | -0.377*** | -0.498*** | -0.343*** |
| Family self-empl. | -0.442*** | -0.454*** | -0.440*** | -0.629*** | -0.438*** |
| Oil activity | -0.046* | -0.056** | -0.056** | -0.062** | -0.049* |
| ρ | 0.287*** | 0.218*** | 0.555 | 0.525 | 0.232** |
| N | 111 | 111 | 111 | 111 | 111 |
| AIC | -146.65 | -140.65 | -140.11 | -126.84 | -142.42 |
| BIC | -119.56 | -113.55 | -113.02 | -99.75 | -115.33 |
| LM-Lag test (ρ=0) | 8.55*** | 2.99* | 1.83 | 1.18*** | 4.24** |
| Robust LM-Lag test | 7.96*** | 3.67* | 3.02* | 1.05*** | |
| LR test | 9.04*** | 2.38 | 2.48 | 2.09 | 4.06** |

Notes: Significance levels are denoted by * p<0.10, ** p<0.05, *** p<0.010.

Lastly, we tested the global and local spatial correlation for the remaining mobility measures, identifying such correlations in seven out of eight measures. Only the rags-to-riches measure (Q1Q5) could not be considered a spatial phenomenon in our case study. When the global Moran's I is statistically significant (see Table 2.4), it is always positive, implying that mobility behaves in the same direction between adjacent territories. The local statistic also reported significant spatial correlations at the canton level in several jurisdictions, showing different clusters across the country depending on the measure (Figure A.2.3 in the Appendix). One pattern that stands out is the spatial correlation of persistence in cantons in the Central Andes.

Accordingly, the best model is identified for the seven indicators where correlations were found. Table 2.4 presents a summary of these results. For simplicity, we include the sign of the covariates' correlations with intergenerational mobility only when significant. Detailed results are available upon request. In general, the results show consistency with Table 2.1. In line with the literature, we find that migration is the most robust predictor of intergenerational mobility regardless of the mobility measure we analyse. However, we also observe that the set of covariates chosen may better explain the relative measures of mobility that depict origin dependence (β, ρ, b).

Table 2.4. Best-fitting model and covariates' effect on intergenerational mobility measures

| | **β** | **ρ** | **b** | **ɑ** | **α** | **Q1Q1** | **Q5Q5** |
|---|---|---|---|---|---|---|---|
| Global Moran's I | 0.304*** | 0.164*** | 0.283*** | 0.182*** | 0.162** | 0.369*** | 0.088* |
| Spatial specification | SAR | SDM | SAR | SLX | SLX | SAR | SLX |
| Direction of the covariates' relationship | | | | | | | |
| Indigenous | + | | + | - | - | | |
| Migration | - | - | - | - | - | | - |
| Schooling | - | | | - | - | - | + |
| Gini education | + | + | + | + | + | | + |
| Agriculture | - | - | - | - | | - | |
| Family self-empl. | - | - | - | | | | - |
| Oil activity | - | | - | - | | | - |
| θ-Indigenous | | + | | | + | | |
| θ-Migration | | | | | | | |
| θ-Schooling | | | | | | | |
| θ-Gini education | | | | | | | |
| θ-Agriculture | | - | | | | | |
| θ-Family self-empl. | | | | | | | |
| θ-Oil activity | | | | | | | + |

Notes: A model for Q1Q5 was estimated through the ordinary least squares method, but none of the covariates we selected have been found to correlate with it; hence, it has been omitted from this table. Significance levels are denoted by * p<0.10, ** p<0.05, *** p<0.010. The estimations are computed defining the spatial weights' matrix as a binary contiguity matrix with first-order neighbours and row standardisation.

## 2.6. Conclusions

In this study, we calculate intergenerational education mobility across cantons using different concepts. We then test whether mobility has a significant spatial dimension and identify its correlates. The study is correlational and presents a snapshot of intergenerational mobility in time and space in line with recent literature such as that by Connor and Storper (2020), Tan (2023) and Ward (2023), among others.

For a small country such as Ecuador, one should not expect much regional variation; however, this proves not to be the case. We find heterogeneity in the estimates not only across territories, but also across concepts of mobility. We observe that using different concepts provides a richer view of the phenomenon and helps distinguish the Ecuadorian case from other contexts for which subnational evidence is available. In fact, we find few coincidences between the different concepts and mostly observe that cantons where children's outcomes are barely tied to those of their parents are not necessarily places that provide better opportunities for upward mobility. Hence, depending

on the context, a general perspective on intergenerational mobility may not only be difficult to establish but misleading. For instance, we also find that average schooling is higher in the capital cantons of the country while intergenerational mobility is not. In fact, some capitals exhibit the highest transmission of status across generations. This may sound counterintuitive as capitals are characterised by economic dynamism and access to health and education, which should be expected to improve social mobility (Daude & Robano, 2015). However, if these opportunities are not guaranteed for all, low social mobility could be the result.

The spatial techniques that we apply help conclude that intergenerational mobility can be treated as a spatial phenomenon, as expected by the theoretical models on which we base our work. This suggests that analysis of the drivers of mobility should consider spatial correlations to avoid bias in the results. Furthermore, as Chetty (2014) pointed out, the subnational estimates highlight that to address intergenerational mobility more efficiently, place-based public policy should be developed rather than national-level efforts. Specifically, our results suggest that this place-based policy making can be focused in the areas where significant clusters of persistence are found. In this study, this area is composed of the cantons in the Central Andes.

The analysis of the drivers of mobility allows some concluding remarks with regard to the findings for the indigenous and migrant populations. Regarding the former, two important aspects should be considered. Firstly, the inclusion of ethnic minorities tends to increase the estimated level of mobility (Ward, 2023). Secondly, a large share of the indigenous populations in Ecuador are in rural areas, where recent literature has found that there is an advantage (Connor et al., 2023). Therefore, a deeper analysis of mobility for these groups could be a new direction in further work.

Regarding migrant populations, our result aligns with prior work and poses a key consideration when public policy is to be developed. As migration entails costs for both the individuals and places involved, these may be better addressed by knowing that there can be spillover effects and so by coordinating public policymaking across the cantons where these spillovers take place.

Finally, our findings may help with a better understanding of intergenerational mobility in other Latin American countries similar to Ecuador and to advance study of the concept. The relevance of this should not be understated as this had previously been a difficult task due to data limitations in these countries. More importantly, in this context, our work contributes to the debate on the high inequality and low growth trap in

which the region is embedded, where intergenerational mobility has a major role (UNDP, 2021).

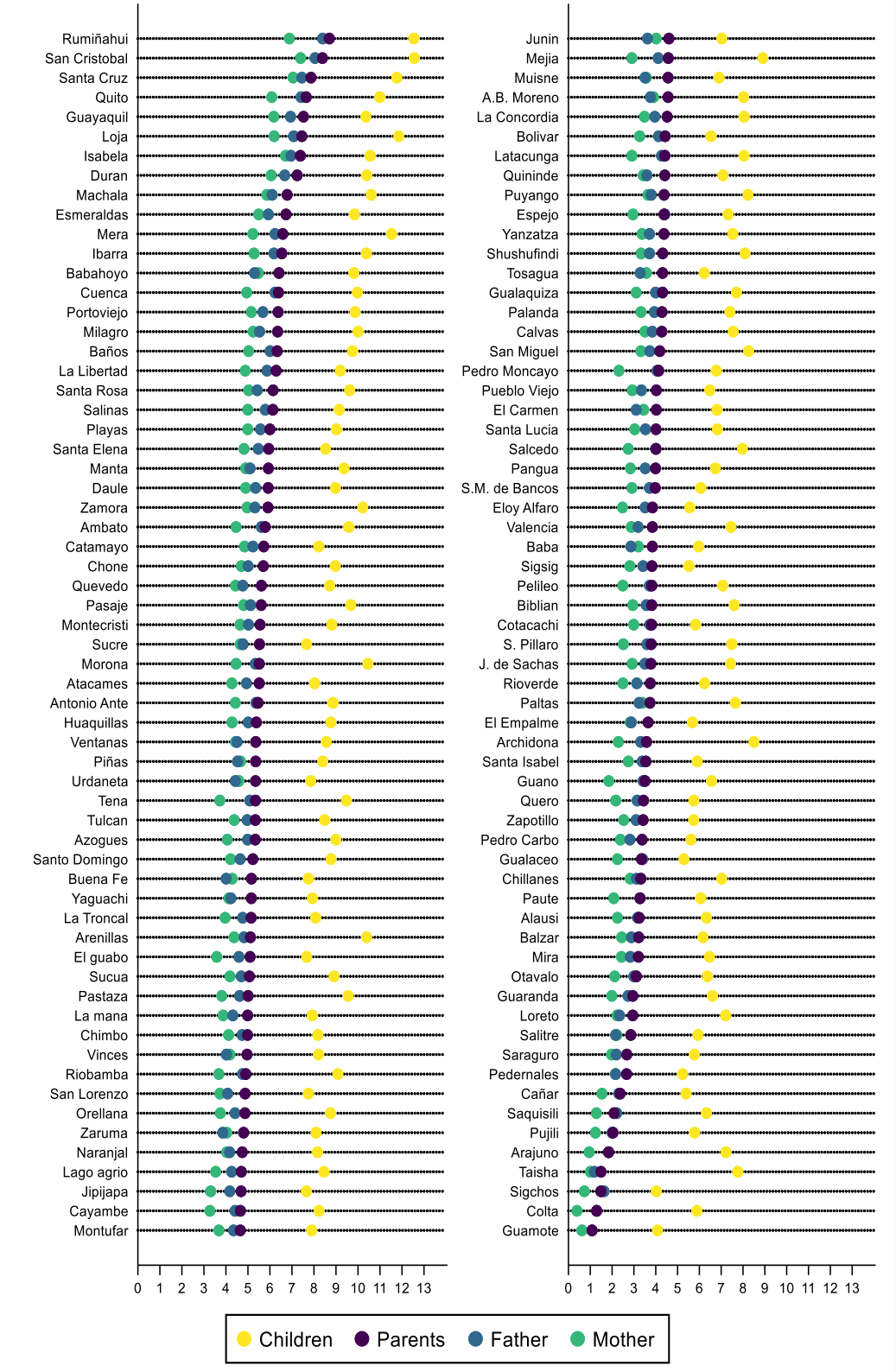
# 2.7. Appendix

Figure A. 2.1. Ecuador: Natural geographic division


Table A. 2.1. Descriptive statistics of covariates at the canton level

| Variable | N | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Oil activity | 111 | 0.35 | 0.48 | 0.00 | 1.00 |
| Family-owned business | 111 | 0.09 | 0.07 | 0.00 | 0.51 |
| Self-employment | 111 | 0.37 | 0.13 | 0.05 | 0.69 |
| Gini education | 111 | 0.23 | 0.03 | 0.16 | 0.30 |
| Literacy | 111 | 0.67 | 0.11 | 0.42 | 0.89 |
| Indigenous | 111 | 0.15 | 0.24 | 0.00 | 0.99 |
| Safety | 111 | 0.84 | 0.10 | 0.58 | 1.00 |

Figure A.2.2. Descriptive statistics of education at the canton level (highest to lowest parental education)




Notes: The figure displays the average of the schooling variables for children and parents based on the ECV 1998-2014.

Table A.2.2 Measures of intergenerational mobility at the canton level

| Canton | β | b | ρ | α | ɑ | Q1Q5 | Q5Q5 | Q1Q1 |
|---|---|---|---|---|---|---|---|---|
| **Cuenca** | **0.74** | **0.67** | **0.65** | **5.18** | **19.27** | **0.0187** | **0.6401** | **0.6383** |
| Gualaceo | 0.83 | 0.68 | 0.71 | 1.94 | 3.18 | 0.0000 | 0.6097 | 0.9290 |
| Paute | 0.60 | 0.50 | 0.45 | 4.06 | 14.28 | 0.0000 | 0.0000 | 0.8088 |
| Santa Isabel | 0.71 | 0.58 | 0.61 | 3.59 | 11.78 | 0.0000 | 0.6672 | 0.8186 |
| Sigsig | 0.51 | 0.38 | 0.44 | 3.31 | 11.60 | 0.0000 | 0.0000 | 0.6690 |
| **Guaranda** | **0.95** | **0.76** | **0.68** | **3.90** | **16.28** | **0.0269** | **0.5889** | **0.7650** |
| Chillanes | 0.86 | 0.74 | 0.61 | 4.30 | 16.70 | 0.0000 | 0.0000 | 0.5709 |
| Chimbo | 0.86 | 0.69 | 0.51 | 3.71 | 13.57 | 0.0777 | 0.0735 | 0.8398 |
| San Miguel | 0.66 | 0.54 | 0.44 | 5.38 | 22.63 | 0.0558 | 0.7770 | 0.4699 |
| **Azogues** | **0.70** | **0.65** | **0.61** | **5.63** | **21.93** | **0.0442** | **0.6395** | **0.4538** |
| Biblian | 0.74 | 0.66 | 0.52 | 4.90 | 18.77 | 0.0367 | 0.3220 | 0.5997 |
| Cañar | 0.93 | 0.75 | 0.64 | 3.06 | 10.40 | 0.0247 | 0.5872 | 0.8176 |
| La Troncal | 0.63 | 0.52 | 0.50 | 4.82 | 19.65 | 0.0000 | 0.4639 | 0.5723 |
| **Tulcan** | **0.82** | **0.67** | **0.57** | **3.59** | **12.27** | **0.0216** | **0.5030** | **0.8195** |
| Bolivar | 0.72 | 0.61 | 0.68 | 3.20 | 10.47 | 0.0000 | 0.8000 | 0.6357 |
| Espejo | 0.52 | 0.46 | 0.41 | 4.95 | 19.11 | 0.0000 | 0.2908 | 0.4729 |
| Mira | 0.62 | 0.49 | 0.45 | 4.45 | 17.06 | 0.0000 | 0.5000 | 0.6486 |
| Montufar | 0.76 | 0.59 | 0.51 | 4.22 | 16.11 | 0.0000 | 0.6680 | 0.7685 |
| **Latacunga** | **0.75** | **0.66** | **0.66** | **4.74** | **18.22** | **0.0094** | **0.5447** | **0.6037** |
| La Mana | 0.53 | 0.44 | 0.50 | 5.65 | 24.15 | 0.0965 | 0.4370 | 0.4181 |
| Pangua | 0.69 | 0.59 | 0.58 | 4.06 | 15.99 | 0.0000 | 0.2232 | 0.6358 |
| Pujili | 0.92 | 0.76 | 0.60 | 3.70 | 15.50 | 0.0231 | 0.2108 | 0.6893 |
| Salcedo | 0.93 | 0.77 | 0.69 | 3.97 | 14.98 | 0.0073 | 0.6256 | 0.6075 |
| Saquisili | 0.76 | 0.66 | 0.56 | 4.56 | 18.87 | 0.0191 | 0.1153 | 0.5702 |
| Sigchos | 0.75 | 0.58 | 0.56 | 2.83 | 10.31 | 0.0000 | 0.0000 | 0.7911 |
| **Riobamba** | **0.88** | **0.73** | **0.68** | **4.37** | **17.71** | **0.0125** | **0.6385** | **0.7483** |
| Alausi | 0.81 | 0.67 | 0.60 | 3.71 | 14.93 | 0.0092 | 0.0000 | 0.7443 |
| Colta | 0.77 | 0.61 | 0.42 | 4.80 | 20.18 | 0.0321 | 0.3196 | 0.5475 |
| Guamote | 0.90 | 0.71 | 0.59 | 2.61 | 8.92 | 0.0023 | 0.0000 | 0.9003 |
| Guano | 0.56 | 0.42 | 0.43 | 4.30 | 16.32 | 0.0028 | 0.1535 | 0.7858 |
| **Machala** | **0.49** | **0.43** | **0.43** | **7.22** | **33.05** | **0.0660** | **0.3963** | **0.4401** |
| Arenillas | 0.44 | 0.34 | 0.33 | 8.10 | 39.14 | 0.0778 | 0.6134 | 0.2955 |
| El Guabo | 0.52 | 0.43 | 0.37 | 5.44 | 23.51 | 0.0226 | 0.0000 | 0.4218 |
| Huaquillas | 0.39 | 0.43 | 0.43 | 6.32 | 24.88 | 0.0366 | 0.0669 | 0.4571 |
| Pasaje | 0.62 | 0.55 | 0.53 | 6.15 | 25.70 | 0.0397 | 0.4599 | 0.4137 |
| Piñas | 0.63 | 0.56 | 0.43 | 4.69 | 16.00 | 0.0000 | 0.6323 | 0.7346 |
| Santa Rosa | 0.51 | 0.36 | 0.40 | 6.05 | 28.82 | 0.0556 | 0.4793 | 0.4563 |
| Zaruma | 0.55 | 0.43 | 0.43 | 4.72 | 18.46 | 0.0000 | 0.4551 | 0.7987 |
| **Esmeraldas** | **0.57** | **0.48** | **0.50** | **6.23** | **27.60** | **0.0452** | **0.4523** | **0.5660** |
| Eloy Alfaro | 0.29 | 0.17 | 0.28 | 4.09 | 16.80 | 0.0290 | 0.0000 | 0.8011 |
| Muisne | 0.39 | 0.36 | 0.37 | 5.47 | 21.92 | 0.0000 | 0.1228 | 0.6830 |

Notes: Capitals are in bold.

Table A.2.2. Measures of intergenerational mobility at the canton level (Continued)

| Canton | β | b | ρ | α | σ | Q1Q5 | Q5Q5 | Q1Q1 |
|---|---|---|---|---|---|---|---|---|
| Quininde | 0.56 | 0.43 | 0.44 | 4.35 | 17.20 | 0.0129 | 0.1701 | 0.7772 |
| San Lorenzo | 0.61 | 0.54 | 0.47 | 5.24 | 21.54 | 0.0492 | 0.1166 | 0.6379 |
| Atacames | 0.61 | 0.55 | 0.57 | 5.17 | 21.21 | 0.0000 | 0.3875 | 0.5224 |
| Rioverde | 0.54 | 0.45 | 0.51 | 4.01 | 14.28 | 0.0000 | 0.0000 | 0.8096 |
| **Guayaquil** | **0.52** | **0.46** | **0.51** | **6.71** | **29.64** | **0.0335** | **0.4741** | **0.4990** |
| A. B. Moreno | 0.40 | 0.36 | 0.32 | 6.50 | 28.45 | 0.0257 | 0.2316 | 0.4592 |
| Balzar | 0.85 | 0.64 | 0.68 | 3.22 | 13.03 | 0.0000 | 1.0000 | 0.6751 |
| Daule | 0.76 | 0.67 | 0.67 | 4.37 | 16.14 | 0.0041 | 0.8032 | 0.6122 |
| Duran | 0.54 | 0.48 | 0.52 | 6.25 | 27.17 | 0.0222 | 0.2884 | 0.6315 |
| El Empalme | 0.58 | 0.46 | 0.52 | 3.46 | 12.28 | 0.0103 | 0.0000 | 0.8188 |
| Milagro | 0.50 | 0.48 | 0.46 | 6.97 | 28.98 | 0.0412 | 0.5048 | 0.4945 |
| Naranjal | 0.72 | 0.67 | 0.53 | 4.90 | 18.05 | 0.0000 | 0.0000 | 0.6542 |
| Pedro Carbo | 0.71 | 0.57 | 0.48 | 3.81 | 14.82 | 0.0000 | 0.0000 | 0.7807 |
| Santa Lucia | 0.38 | 0.34 | 0.35 | 5.29 | 20.61 | 0.0000 | 0.1270 | 0.6659 |
| Salitre | 0.38 | 0.27 | 0.32 | 4.70 | 18.87 | 0.0000 | 0.0822 | 0.7530 |
| Yaguachi | 0.43 | 0.36 | 0.39 | 5.53 | 24.41 | 0.0057 | 0.3924 | 0.3742 |
| Playas | 0.42 | 0.46 | 0.42 | 6.30 | 23.23 | 0.0000 | 0.2078 | 0.7008 |
| **Ibarra** | **0.64** | **0.60** | **0.52** | **6.48** | **26.45** | **0.0855** | **0.6314** | **0.5653** |
| Antonio Ante | 0.80 | 0.72 | 0.65 | 4.92 | 19.41 | 0.0000 | 0.6236 | 0.5927 |
| Cotacachi | 0.90 | 0.73 | 0.76 | 2.10 | 6.09 | 0.0000 | 0.6939 | 0.8436 |
| Otavalo | 0.94 | 0.78 | 0.69 | 2.97 | 11.15 | 0.0214 | 0.4761 | 0.8496 |
| **Loja** | **0.56** | **0.52** | **0.52** | **8.14** | **36.05** | **0.0557** | **0.7020** | **0.3073** |
| Calvas | 0.59 | 0.51 | 0.48 | 5.31 | 19.82 | 0.0130 | 1.0000 | 0.6392 |
| Catamayo | 0.32 | 0.26 | 0.27 | 6.65 | 29.11 | 0.0000 | 0.1932 | 0.4276 |
| Paltas | 0.54 | 0.51 | 0.45 | 5.56 | 20.44 | 0.0245 | 0.7392 | 0.6669 |
| Puyango | 0.41 | 0.41 | 0.38 | 6.52 | 26.26 | 0.0307 | 0.5878 | 0.3436 |
| Saraguro | 0.85 | 0.70 | 0.59 | 3.91 | 13.67 | 0.0140 | 0.5949 | 0.7846 |
| Zapotillo | 0.73 | 0.61 | 0.55 | 3.35 | 9.54 | 0.0000 | 0.4027 | 0.8674 |
| **Babahoyo** | **0.65** | **0.59** | **0.55** | **5.84** | **23.98** | **0.0573** | **0.5881** | **0.5550** |
| Baba | 0.50 | 0.35 | 0.43 | 3.96 | 15.50 | 0.0000 | 0.0000 | 0.7943 |
| Puebloviejo | 0.53 | 0.41 | 0.49 | 4.46 | 17.97 | 0.0000 | 0.0351 | 0.7379 |
| Quevedo | 0.63 | 0.54 | 0.52 | 5.62 | 23.25 | 0.0128 | 0.4563 | 0.6358 |
| Urdaneta | 0.47 | 0.36 | 0.44 | 5.03 | 20.43 | 0.0052 | 0.1297 | 0.6996 |
| Ventanas | 0.46 | 0.43 | 0.38 | 6.16 | 24.79 | 0.0375 | 0.2944 | 0.5924 |
| Vinces | 0.56 | 0.48 | 0.52 | 5.60 | 23.18 | 0.0000 | 0.3798 | 0.4845 |
| Buena Fe | 0.32 | 0.29 | 0.30 | 5.92 | 24.80 | 0.0000 | 0.0436 | 0.4183 |
| Valencia | 0.52 | 0.42 | 0.40 | 5.28 | 22.36 | 0.0201 | 0.3134 | 0.5378 |
| **Portoviejo** | **0.73** | **0.65** | **0.58** | **5.28** | **21.12** | **0.0541** | **0.5862** | **0.6561** |
| Chone | 0.63 | 0.54 | 0.47 | 5.61 | 23.71 | 0.0608 | 0.5266 | 0.5856 |
| El Carmen | 0.77 | 0.58 | 0.57 | 3.87 | 16.41 | 0.0000 | 0.4464 | 0.6152 |
| Jipijapa | 0.70 | 0.60 | 0.54 | 4.13 | 14.89 | 0.0302 | 0.5438 | 0.6867 |
| Junin | 0.55 | 0.39 | 0.43 | 4.26 | 17.41 | 0.0000 | 0.0000 | 0.7919 |

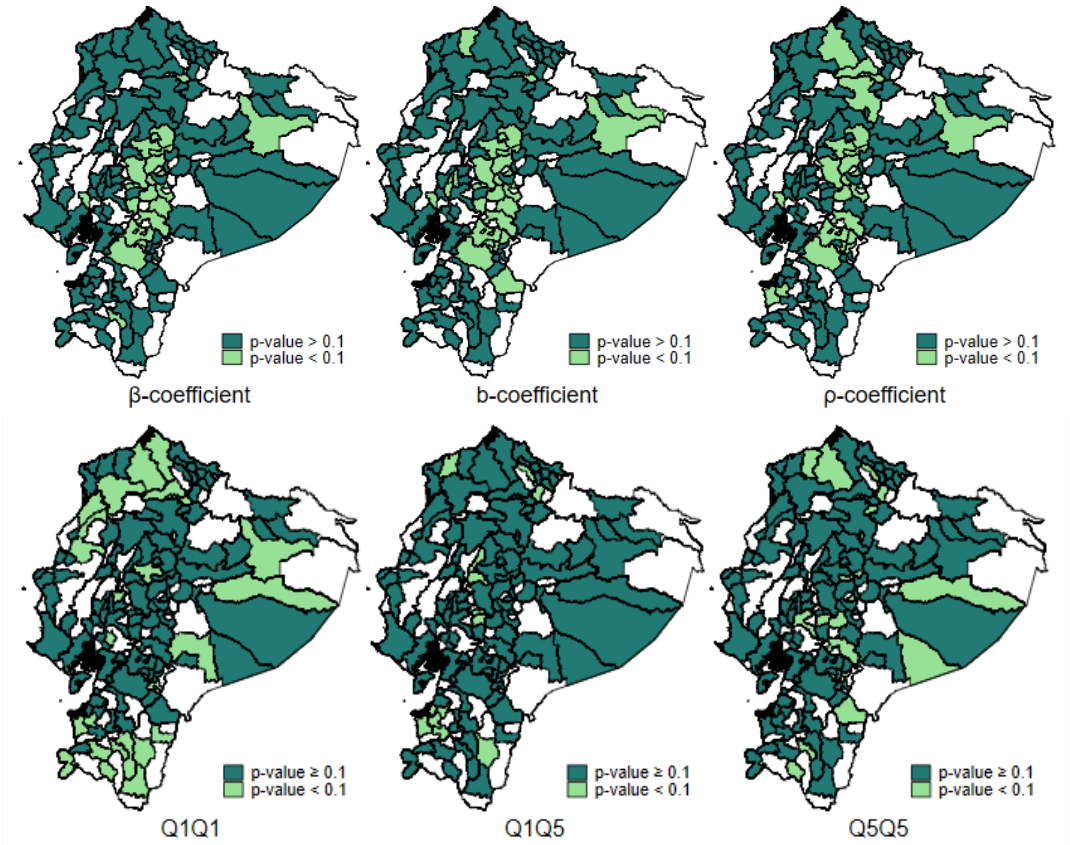
Notes: Capitals are in bold.

Table A.2.2. Measures of intergenerational mobility at the canton level (Continued)

| Canton | β | b | ρ | α | σ | Q1Q5 | Q5Q5 | Q1Q1 |
|---|---|---|---|---|---|---|---|---|
| Manta | 0.63 | 0.55 | 0.53 | 5.73 | 24.10 | 0.0157 | 0.5983 | 0.5069 |
| Montecristi | 0.68 | 0.56 | 0.47 | 5.34 | 23.15 | 0.0832 | 0.3543 | 0.6309 |
| Sucre | 0.60 | 0.48 | 0.48 | 4.47 | 17.44 | 0.0000 | 0.2517 | 0.7710 |
| Tosagua | 0.64 | 0.49 | 0.50 | 3.29 | 11.13 | 0.0207 | 0.2844 | 0.8478 |
| Pedernales | 0.77 | 0.65 | 0.57 | 3.18 | 11.56 | 0.0310 | 0.5530 | 0.6971 |
| **Morona** | **0.61** | **0.47** | **0.53** | **7.42** | **34.82** | **0.0232** | **0.6630** | **0.3551** |
| Gualaquiza | 0.43 | 0.35 | 0.30 | 5.86 | 24.56 | 0.0227 | 0.0000 | 0.5266 |
| Sucua | 0.72 | 0.62 | 0.65 | 4.82 | 18.47 | 0.0000 | 0.4747 | 0.5257 |
| Taisha | 0.55 | 0.50 | 0.31 | 5.72 | 25.53 | 0.0145 | 0.6429 | 0.4386 |
| **Tena** | **0.60** | **0.52** | **0.54** | **6.44** | **27.87** | **0.0701** | **0.5786** | **0.3479** |
| Archidona | 0.74 | 0.63 | 0.66 | 5.72 | 23.85 | 0.0348 | 0.2439 | 0.4899 |
| **Pastaza** | **0.75** | **0.62** | **0.57** | **5.40** | **22.53** | **0.0341** | **0.6073** | **0.5838** |
| Mera | 0.58 | 0.50 | 0.65 | 8.06 | 37.28 | 0.0934 | 0.5710 | 0.4246 |
| Arajuno | 0.52 | 0.47 | 0.34 | 6.47 | 28.67 | 0.0319 | 0.0000 | 0.3749 |
| **Quito** | **0.61** | **0.58** | **0.63** | **6.56** | **26.49** | **0.0271** | **0.6304** | **0.5585** |
| Cayambe | 0.67 | 0.64 | 0.58 | 5.50 | 20.62 | 0.0203 | 0.3682 | 0.6584 |
| Mejia | 0.56 | 0.49 | 0.48 | 6.20 | 26.90 | 0.0000 | 0.2445 | 0.3547 |
| Pedro Moncayo | 0.65 | 0.48 | 0.50 | 3.55 | 14.27 | 0.0000 | 0.0000 | 0.8476 |
| Rumiñahui | 0.55 | 0.57 | 0.62 | 8.01 | 32.62 | 0.0179 | 0.7834 | 0.4360 |
| S. M. de Bancos | 0.53 | 0.38 | 0.45 | 3.86 | 14.07 | 0.0105 | 0.2762 | 0.8607 |
| **Ambato** | **0.72** | **0.66** | **0.62** | **5.69** | **22.84** | **0.0367** | **0.6315** | **0.5431** |
| Baños | 0.63 | 0.57 | 0.47 | 5.72 | 22.79 | 0.0000 | 0.4095 | 0.6820 |
| Quero | 0.39 | 0.27 | 0.34 | 4.29 | 15.93 | 0.0301 | 0.0000 | 0.8895 |
| Pelileo | 0.33 | 0.26 | 0.31 | 5.53 | 21.10 | 0.0164 | 0.1056 | 0.6996 |
| S. de Pillaro | 0.70 | 0.58 | 0.60 | 4.71 | 20.01 | 0.0077 | 0.6108 | 0.4075 |
| **Zamora** | **0.64** | **0.60** | **0.54** | **6.69** | **27.88** | **0.0589** | **0.3388** | **0.4541** |
| Yanzatza | 0.62 | 0.49 | 0.49 | 5.07 | 21.74 | 0.0124 | 0.3437 | 0.3119 |
| Palanda | 0.34 | 0.33 | 0.33 | 5.82 | 23.73 | 0.0064 | 0.2097 | 0.2533 |
| **San Cristobal** | **0.36** | **0.36** | **0.37** | **9.54** | **43.51** | **0.1800** | **0.5790** | **0.1140** |
| Isabela | 0.42 | 0.33 | 0.46 | 8.48 | 41.90 | 0.0000 | 0.4837 | 0.0000 |
| Santa Cruz | 0.49 | 0.45 | 0.48 | 8.11 | 36.38 | 0.0401 | 0.5710 | 0.1524 |
| **Lago Agrio** | **0.63** | **0.54** | **0.46** | **5.26** | **20.90** | **0.0370** | **0.4883** | **0.6008** |
| Shushufindi | 0.45 | 0.37 | 0.40 | 6.19 | 26.83 | 0.0347 | 0.1602 | 0.3825 |
| **Orellana** | **0.47** | **0.41** | **0.42** | **6.48** | **28.23** | **0.0341** | **0.4192** | **0.3905** |
| J. de los Sachas | 0.55 | 0.40 | 0.40 | 5.41 | 24.38 | 0.0162 | 0.0000 | 0.4879 |
| Loreto | 0.36 | 0.33 | 0.31 | 5.88 | 24.26 | 0.0230 | 0.0000 | 0.4275 |
| **Santo Domingo** | **0.53** | **0.45** | **0.45** | **5.92** | **25.38** | **0.0324** | **0.3936** | **0.5157** |
| La Concordia | 0.47 | 0.41 | 0.38 | 5.95 | 25.45 | 0.0461 | 0.2212 | 0.4077 |
| **Santa Elena** | **0.55** | **0.49** | **0.42** | **5.29** | **19.38** | **0.0248** | **0.4449** | **0.5719** |
| La Libertad | 0.48 | 0.39 | 0.44 | 5.96 | 26.40 | 0.0000 | 0.2017 | 0.3074 |
| Salinas | 0.66 | 0.59 | 0.51 | 4.99 | 19.00 | 0.0156 | 0.3503 | 0.7800 |
| Ecuador | 0.66 | 0.58 | 0.57 | 5.44 | 22.09 | 0.0230 | 0.3689 | 0.5200 |

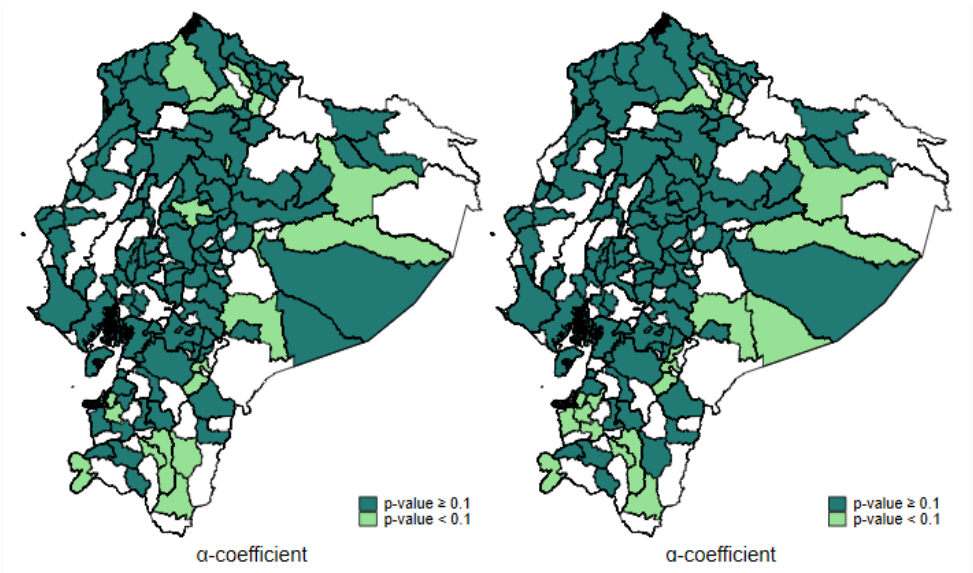
Notes: Capitals are in bold.

Figure A.2.3. Local spatial correlation of intergenerational mobility measures with contiguity spatial weights matrix




Notes: The figure presents the spatial distribution of local Moran's I statistic for the origin-dependence and positional measures of mobility. Regions shaded in lighter green correspond to clusters of high-high values, i.e. where cantons with high values of the corresponding mobility measure are surrounded by similarly high-valued neighbors. It can be read as indicating localized clusters of intergenerational persistence either due to origin dependence ($\beta, \rho, b$) or due to persistence at the bottom (Q1Q1), top (Q5Q5) or low possibilities of (Q1Q5). Darker shaded areas indicate regions where spatial association is not statistically significant.

Figure A.2. 3. Local spatial correlation of intergenerational mobility measures with contiguity spatial weights matrix (Continued)




Notes: The figure presents the spatial distribution of local Moran's I statistic for the absolute measures of mobility. Regions shaded in lighter green correspond to clusters of low-low values, i.e. where cantons with low values of the corresponding mobility measure are surrounded by similarly low-valued neighbors. It can be read as indicating localized clusters of intergenerational persistence. Darker shaded areas indicate regions where spatial association is not statistically significant.

# 3. Gendered Pathways to Intergenerational Mobility: The Role of Cognitive and Noncognitive Skills[3]

## 3.1. Introduction

The increasing recognition that skills are fundamental to social and economic outcomes has fueled interest in their gendered distribution. Extensive research on cognitive skill proficiency reveals large gender gaps that vary across countries, life stages and skill domains (Encinas-Martin & Cherian, 2023). For example, among secondary school-aged children, females tend to outperform males in reading, while the reverse holds true for numeracy. As students approach university age, the reading gap narrows significantly, reaching near parity, whereas the gender gap in numeracy tends to widen with age (Borgonovi et al., 2021).

Likewise, noncognitive skills such as personality, motivation, interests, and beliefs considerably differ by gender (Rammstedt et al., 2017). Therefore, researchers have called for their measurement and study, and several influential national and international surveys have started to include these measures in their questionnaires (Rammstedt et al. 2017). Gender gaps in this domain are more consistent across countries. Except for the trait open to experience, where little to no gender differences are found, women usually score higher in agreeableness, conscientiousness and extroversion and lower in emotional stability (Flinn et al. 2025; Weisberg et al., 2011).

The power of cognitive skills as predictors of life outcomes has been documented in multiple studies. Hanushek et al. (2015) find that a one-standard-deviation rise in numeracy skills can yield up to an 28% increase in wages among workers aged 35–54. Furthermore, Vera-Toscano et al. (2017) identify a positive and significant association between cognitive skills and two social outcomes: volunteering and interpersonal trust. Further evidence of how cognitive skills relate to educational, job and health indicators

[3] This study is coauthored with Raul Ramos, my advisor. This work was supported by the Ministerio de Ciencia e Innovación [grant number PID2023-146073NB-I00, MCIN/AEI/10.13039/501100011033].

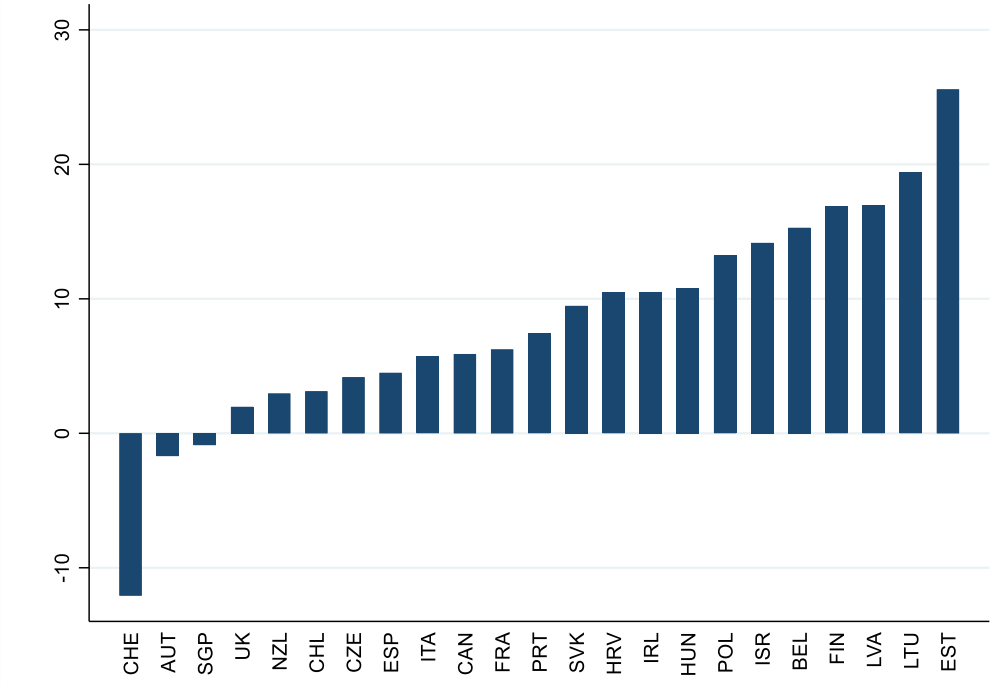
is presented in both cycles of the Survey of Adult Skills, conducted as part of the OECD Programme for the International Assessment of Adult Competencies (PIAAC) (OECD, 2013; 2024). The relevance of noncognitive skills has also been widely examined, with studies showing their strong association with wages, job stability (Flinn et al., 2025), health indicators, life satisfaction and job performance (Rammstedt et al., 2017) as well as other life outcomes such as labor market participation, employability and trust (Palczynkska & Swist 2018).

Empirical studies demonstrate that since both cognitive and noncognitive of skills are substantially associated, the effects of the latter may be overestimated if noncognitive skills are omitted (Rammstedt et al., 2017).When comparing both types of skills, authors find that while noncognitive can be at least as important (Heckman & Kautz, 2012), they can outperform the explanatory power of cognitive skills in subjective outcomes (Palczynkska & Swist 2018).

As the health, work and educational outcomes that have been linked to skills are in general desirable, gender gaps in skills are "pervasive" to achieving gender parity (Battisti, Fedorets & Kinne 2023). One relevant outcome where strong gender disparities are observed is educational achievement and attainment. It is widely known that women outperform men, a pattern often referred to as "the boy problem" (Delaney & Devereux, 2021). Data from the second cycle of PIAAC (OECD, 2024) shows that in most countries, women are more likely to complete higher education than men (Figure 3.1), a pattern that started in high income economies back in the 1960s.

Not only the share of women who attain tertiary education is higher, but they are also more likely to achieve this when compared to their previous generation (Narayan et al., 2018, p. 23). Recent contributions in the literature of intergenerational mobility reveal persistent yet complex gender disparities, with the direction of advantage varying by the measure and indicator. Focusing on education as the indicator of mobility, women consistently outperform men across high-income economies (Hu & Qian, 2023; Duong, 2024) and in some developing economies (Leone, 2021; Torche, 2015). Furthermore, while trends for women point to increasing mobility in multiple measures, the trends for men are mixed (Van der Weide et al., 2024). This suggests that the "boy problem" may extend to an intergenerational phenomenon.

Figure 3.1.Gender gaps in tertiary education attainment




Notes: The gender gap is calculated as the difference in attainment between females and males in percentage points. Positive (negative) values mean a higher proportion of women (men) attain tertiary education.

Much of the existing research on the role of skills has focused on the relationship between skills and educational attainment, while the link between skills and educational mobility has received comparatively less attention due to data limitations. For example, Landersø and Heckman (2017) suggest that better proficiency in cognitive skills does not automatically translate into higher educational attainment it depends heavily on country-specific incentives to pursue further education. Aceujo and James (2021) further show that verbal skills are more influential than numerical skills in determining college completion, hence representing a driver of women's advantage in this outcome. In elite universities, Edwards et al. (2022) find that noncognitive skills, specifically high levels of Conscientiousness, can compensate for the academic penalties produced by social origin of first-generation university students.

A key contribution regarding gender disparities by Becker et al. (2010) posits that differences in attainment are partly driven by lower educational costs for women, owing to their higher cognitive and noncognitive skills. Skills such as organization, diligence, and self-discipline reduce the non-monetary costs of schooling by lowering its cognitive demands. This perspective has contributed to a growing literature seeking to

understand why boys are increasingly being "left behind" in educational systems (Fortin et al., 2015). Noncognitive skills are in fact at the core of this research line, showing strong explanatory power across all levels of schooling (see Delaney & Devereux, 2021 for a review).

The link between skills and intergenerational mobility has been comparatively less explored. For example, Blanden et al. (2007) estimate that cognitive and noncognitive skills contribute 6 and 7 percent, respectively, to earnings mobility in the United States. More recently, research rooted in psychology has focused on the intergenerational transmission of these skills. Studies show a strong correlation between parents' and children's cognitive skills (around 0.50), while the transmission of noncognitive traits tends to be weaker (up to 0.25) (Anger, 2011; Mood et al., 2012). These patterns are often seen as indicative of the greater malleability of noncognitive skills. However, Grönqvist et al. (2017) suggest that the transmission of both types of skills tends to be similar when methodological biases are accounted for. Additionally, some personality traits (e.g. Open-mindedness and Conscientiousness) show growth during adolescence, especially between ages 16 and 20 (Vecchione et al., 2012). These findings, beyond showing that skills are transferrable, point to the importance of the education system in shaping how skill disparities evolve and influence intergenerational mobility (Hanushek et al., 2021).

The OECD (2024) cautions that persistent gaps in skills may negatively impact social and economic mobility and pose a threat to social cohesion (OECD, 2024, p. 25). Yet, the extent to which differences in cognitive and noncognitive skills contribute to gender disparities in intergenerational mobility remains an open question. We aim to contribute to this literature by examining the gender gaps in cognitive and noncognitive skills, identifying which of them can be associated with the gender gaps in intergenerational mobility and to what extent they contribute to these disparities. To this end, we take advantage of the data from the second cycle of the PIAAC assessment to study 23 OECD countries, which presents information on cognitive and noncognitive skills suitable for comparison across countries. We calculate 4 different measures of mobility and find that in all these countries males have lower educational mobility, but in Switzerland. We then conduct a statistical decomposition analysis to identify the contribution of skills to these disparities. Our results reveal a large variation across countries, where cognitive skills are the largest drivers of gender differences in educational mobility, followed by noncognitive skills, which can be as relevant as household background in some cases.

The remainder of the study is structured as follows. Section 3.2 describes the data source and methodological considerations. Section 3.3 presents the empirical approach. Section 3.4 discusses descriptive evidence of the gender gaps in intergenerational mobility, cognitive and noncognitive skills. Section 3.5 proceeds to present the association and contribution of skills to mobility. Section 3.6 provides concluding remarks. Section 3.7 provides the Appendix with detailed information on the presented results.

## 3.2. Data and methods

### 3.2.1. Data source

The data source used in this study is the second cycle of the Programme for the International Assessment of Adult Competencies (PIAAC), delivered from September 2022 to August 2023 to the adult population aged 16 to 65 living in participating countries. PIAAC gathers information on key cognitive and workplace skills necessary for individuals to participate successfully in the economy. The program adopts a stratified sampling design that is country-specific but comply with the PIAAC Technical Standards and Guidelines such that the data is representative of the adult population and its quality allows for international comparisons (OECD, 2022).

Respondents go through a background questionnaire that lasts approximately 45 minutes, and a tablet-based assessment of three key cognitive skills: literacy, numeracy and problem solving in technology-rich settings with a duration of approximately 60 minutes. The background questionnaire collects information about the respondent's education and training, as well as employment history, job conditions, and workplace skills utilization. It also gathers socioeconomic information, including linguistic and migration background, family structure and parental information. This study uses the scores of literacy and numeracy skills. Each of them is assessed on a 500-point scale. Based on the PIAAC methodology, where every skill is a latent variable, the dataset provides 10 plausible values for each skill and respondent. We use *piaactools* Stata package to obtain unbiased estimates of the descriptive statistics of skills. All other estimates are obtained using final replication weights.

This study will take advantage of one of the novelties of the second cycle of PIAAC, which is the assessment of noncognitive skills and specifically of personality traits. This is done through the application of the BFI-2-XS, the extra short adaptation of the Big Five Inventory-2 (BFI-2). The form is incorporated in the background questionnaire and covers the five domains in the Big Five Taxonomy: Extraversion,

Agreeableness, Conscientiousness, Negative Emotionality, and Open-Mindedness. It consists of 15 items – three by domain – where the traits are assessed on a 5-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree). National adaptations of the instrument were conducted by the PIAAC Consortium (Rammstedt et al. 2024), ensuring cross-country comparisons. PIAAC directly provides the respondent's z-scores on the test, which we incorporate directly into our analyses.

There were 31 participating countries in the second cycle of PIAAC, out of which 28 countries implemented the Big Five module (with the exception of the United States, Korea and Japan). Due to lack of access to the information of parental education (Denmark, Norway and Sweden) and of covariates used in the analysis in some countries, the total number of countries that we are able to incorporate in the study is 23. Other restrictions in our sample include the following. First, to measure mobility we should consider lifetime educational achievement. Hence, we limit our sample to those aged 25-65, as they are the most likely to have completed their formal education. They represent 85 percent of the sample. Second, a new feature of PIAAC is that a small percentage of adults who lacked the necessary language proficiency for the background questionnaire or the cognitive assessment were unable to participate. A very short "doorstep interview" with personal information was delivered to be used in the later generation of plausible values in cognitive skills for them. However, due to lack of parental information, we exclude them. This represents approximately 1.5 percent of the sample. Second, we focus exclusively on native-born adults to avoid distortion in our sample for two reasons. First, there may be greater difficulty among immigrants in responding accurately to cognitive skill assessments. Second, the measurement of educational attainment often differs significantly between native and immigrant populations, potentially affecting the comparability of the data. This restriction represents a further reduction of 11 percent of the sample. All in all, we are left with 72 percent of the sample in the selected countries.

Table A. 3.1 in the Appendix provides an overview of the definitions of the explanatory variables used for the decomposition analysis. Table A. 3.2 in the Appendix displays descriptive statistics of the selected variables by country. With our sample definition, we are left with a total sample size ranging from approximately 2,000 to 5,000 individuals per country apart from Canada (n=8,000). The total number of observations is 88,893 for the 23 countries analyzed in the study. Men and women are equally represented across countries and in some, women make up to 60 percent of the sample (Ireland, Latvia, Lithuania). In general, a larger share of the sample of both children and parents is concentrated in the secondary education level and are more or less

equally distributed across age groups, although in some countries there is a larger share of respondents aged 55 to 64.

### 3.2.2. Measures of mobility

In the measurement of mobility, a key decision is what is the reference level of parental education. While there is research pointing to different results when considering mothers' education as opposed to fathers' education (Hu & Qian, 2023), we do not make this distinction and take the joint parental education as a variable that captures the education level of the most educated parent, either mother or father.

There are numerous measures and definitions of intergenerational mobility, each with its own interpretation, advantages and disadvantages. In depth discussions of this can be found in e.g., Jantti and Jenkins (2015) and Fields and Ok (1999). We use four measures that capture the origin-dependence and the positional concept of mobility. The dependence concept conveys only information about the degree to which children and parental outcomes are associated. The standard measures in this category are the regression and correlation coefficients between parental and children's educational levels. As both measures inform about persistence, following Van der Weide et al. (2024) we calculate and present 1-COR and 1-BETA, to be directly interpreted as higher values indicating higher mobility (lower associations).

The positional concept of mobility informs about movements along the educational distribution from parents to children, i.e., whether children move lower or higher the social ladder. To this aim, we construct a variable of upward mobility that indicates whether the respondent attains a higher education than their most educated parent, and one variable of downward mobility that indicates whether the respondent attains a lower education than their most educated parent. Comparable results in terms of these measures of educational mobility are presented by Oberdabernig and Schneebaum (2017) and Lee and Ding (2020, p. 189).

The four measures were based on two variables that capture the education level of parents and children in three levels, respectively. Both parental and the respondent's education is measured sing the International Standard Classification of Education (ISCED) levels. For children, PIAAC provides multiple variables of education levels, all of which do so with multiple categories. However, for parents, there is only one variable that measures separately for father or male guardian and mother or female guardian their education level through three categories indicating whether the parent/guardian: i) has not attained upper secondary, ii) has attained secondary or post-

secondary, non-tertiary, iii) has attained tertiary. We combine the two variables into one that depicts the highest education level of either parent. This approach is widely used in intergenerational mobility research and applies the dominance principle developed in sociology (Erikson, 1984).

We then use children's education and group into three categories comparable to the parental categories, as follows: i) ISCED 1, 2, 3C short, i.e. individual has not attained upper secondary, ii) ISCED 3A-B, C long, ISCED 4A-B-C, i.e. individual has attained upper secondary or post-secondary, non-tertiary, iii) ISCED 5B, ISCED 5A and ISCED 5A-6, i.e., individual has attained tertiary.

## 3.3. Empirical approach

To understand the difference in the probability of intergenerational mobility between males and females, we apply the Oaxaca-Blinder decomposition technique (Blinder 1973; Oaxaca 1973). To carry out this exercise, we select the two positional measures of intergenerational mobility. Hence, we are looking to decompose the difference between daughters and sons in the probability of having higher (upward) or lower (downward) education than the most educated parent.

The decomposition method is used to analyze differences in an outcome variable between two groups by separating the observed gap into two components. The explained component (also called the endowment effect) captures the part of the difference attributable to variations in the distribution of observable characteristics across the two groups. This reflects how differences in endowments, such as cognitive and noncognitive skills, contribute to the overall gap. The unexplained component accounts for differences in the returns to these characteristics, representing factors such as structural inequalities, discrimination, or unobserved heterogeneity, that are not directly linked to the distribution of explanatory variables,

Given the nature of our variables of intergenerational mobility, we will follow the approach by Yun (2004), who proposes an application of the Oaxaca-Blinder decomposition for nonlinear models. The approach starts by estimating a logit model for males and females separately in each country in our sample, as represented by

$$\mathrm{P}(Y = 1|X) = \Lambda(X'\beta) \tag{3.1}$$

Where $\Lambda$ is the logistic function linking the probability of upward (or downward) mobility $(Y = 1)$ to the covariates included in $X$. The mobility gap between females and males is then decomposed into

$$\mathrm{P}(Y^f = 1 \big| X^f) - \mathrm{P}(Y^m = 1 | X^m) = \underbrace{\left[ \overline{\Lambda(X^f \beta^m)} - \overline{\Lambda(X^m \beta^m)} \right]}_{explained} +$$

$$\underbrace{\left[ \overline{\Lambda(X^f \beta^f)} - \overline{\Lambda(X^f \beta^m)} \right]}_{unexplained} \tag{3.2}$$

Where for $i$ individuals, $\overline{\Lambda(X\beta)} = 1/N \sum_i^N (X_i \hat{\beta})$.

We use the standard Oaxaca command by Jann (2008), which has been extended for the application of this approach and allows to conduct both the overall decomposition of the gap and the detailed decomposition for the explained and unexplained components. Furthermore, by adopting the approach by Yun (2004), the command addresses the path dependency problem and identification problem, whereby the results are not sensitive to the order in which the explanatory variables enter the decomposition and to the choice of the base category of dummy regressors, respectively.

As covariates in $X$ we include the variables listed in Table A. 3.1 and Table A. 3.2, which apart from cognitive and noncognitive skills cover the respondent's age and retrospective information about the household when the respondent was 14. The latter aims to control for characteristics that the literature of intergenerational mobility has traditionally found relevant to the analysis (e.g. Chetty et al., 2014).

For the detailed decomposition, we group the variables in the following four categories of variables: *age* (age groups in 10-year bands), *household background* (books at home, parental occupation and number of siblings at home when the respondent was 14), *cognitive skills* (numeracy and literacy scores) and *noncognitive skills* (the Big 5 scores). Scores for numeracy and literacy in the decomposition are introduced as the average of the 10 plausible values provided by PIAAC.

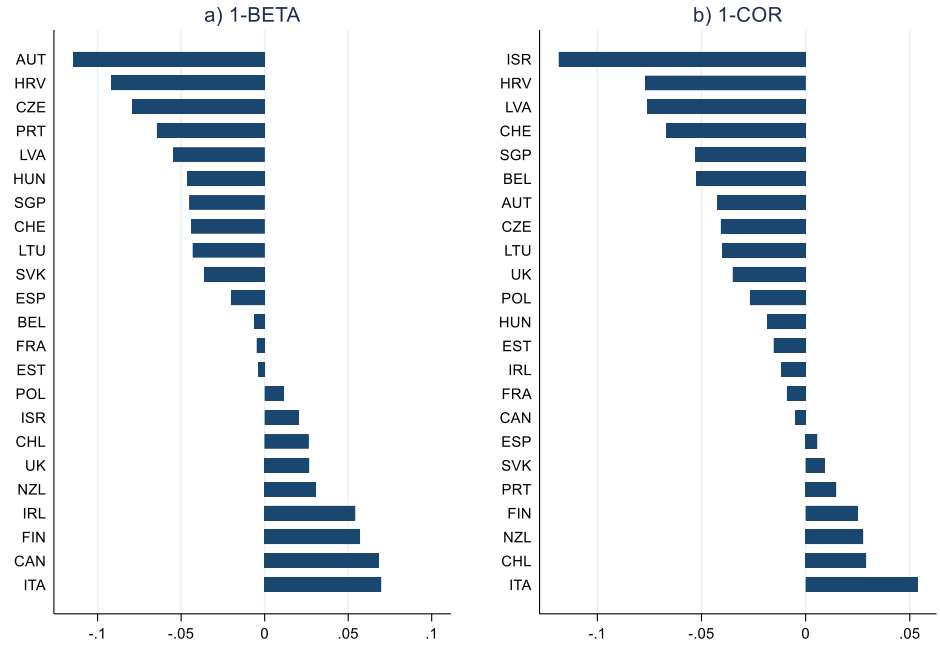
## 3.4. Gender gaps in skills and intergenerational mobility

### 3.4.1. Gender differences in intergenerational mobility

In this section we present evidence of the gender differences in educational mobility. Table A. 3.6 shows the numerical information summarized in the following figures. Figure 3.2 the gaps for 1-BETA in the left panel (a) and 1-COR in the right panel (b). The figure shows that men experience higher values in these measures of mobility. In panel a, males' mobility is higher in 14 countries, and in panel b it is in 16 countries.

Countries that stand for males' high mobility are Croatia, Latvia and Austria, while countries where female's high mobility is stands out are Italy, Finland and New Zealand. Therefore, by this indicator men hold an advantage in intergenerational mobility in more than half the considered countries, although this advantage does not speak of movement along the education distribution.

Figure 3.2. Gender gaps in dependence measures of intergenerational mobility




Notes: The gender gap is calculated as the difference in the corresponding measures between females and males. Positive (negative) values mean mobility is higher for women (men).

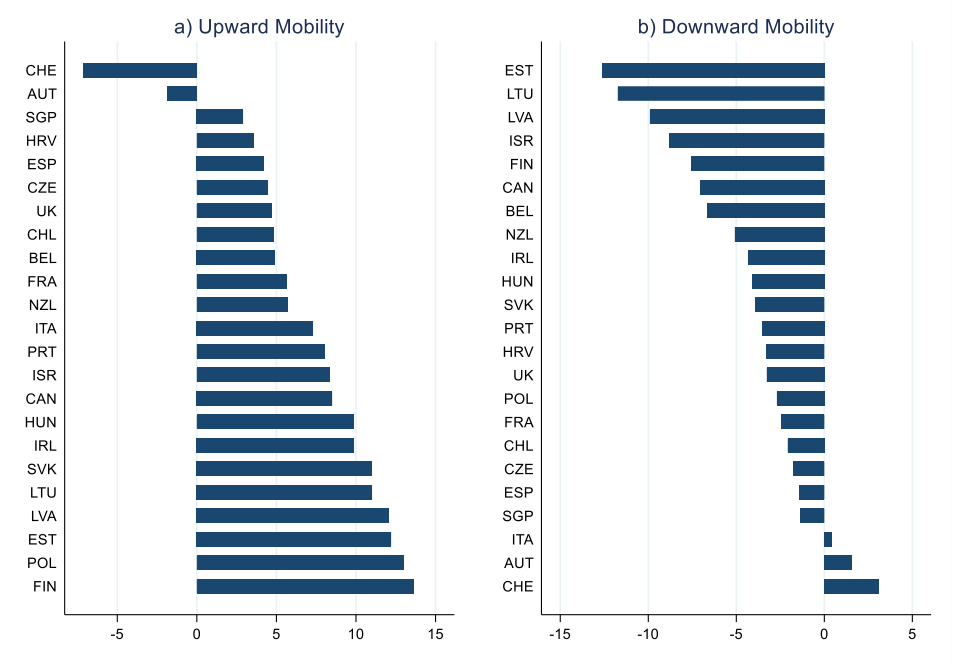
In Figure 3.3 we show the gap in directional measures of intergenerational mobility. In the left panel (a) shows the gap in upward mobility, a measure that reflects the difference between the percentage of males and females attaining higher education levels than their most educated parent. We observe that females are at advantage with respect to men in 21 countries. We also see that this advantage in favor of them is greater than when it is in favor of men

The opposite is true in the right panel (b), where downward mobility is displayed. This captures the difference between the percentage of adult males and females having lower educational levels than their parents and, in this case, across 20 countries males are more likely than women to move downward. In this indicator, the percentage of females moving downward surpasses that of men by up to 3 percent (Switzerland),

while in countries where males move downward surpasses that of women by up to 12 percent (Estonia). Hence, not only are men more propense to downward mobility across countries but this happens with higher strength.

Notably, in countries such as Estonia, where women exhibit among the highest probability of upward mobility, men tend to show among the highest probabilities of downward mobility, indicating a more pronounced disadvantage for males in these contexts. Although this inverse association between upward and downward mobility is the usual, it is not the norm. For instance, males' disadvantages in downward mobility is relatively low in Poland, but females still have the second-highest advantage in upward mobility. This pattern may be explained, among other things, by the share of people not moving upward or downward but keeping the same educational level as the parental.

Figure 3.3. Gender gaps in positional measures of intergenerational mobility




Notes: The gender gap is calculated as the difference in scores between females and males in percentage points. Positive (negative) values mean mobility is higher for women (men).

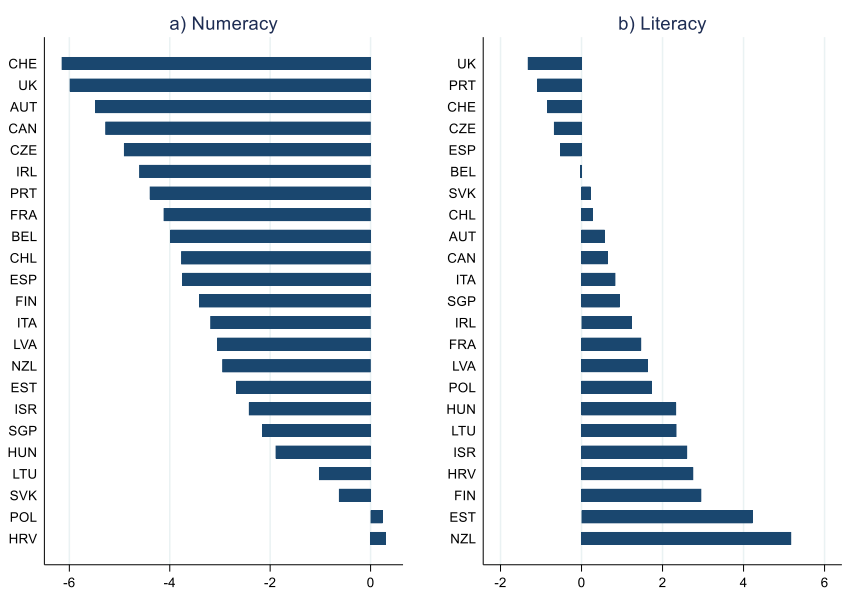
Taking together, the results in Figure 3.2 and in Figure 3.3 suggest that using different measures helps for a comprehensive understanding of gender disparities. While the first measure pointed out to an advantage held by men, with more mobility in terms of low association to parental education, this does not necessarily mean that men are more likely to having higher educational achievement than their parents. Instead, with the information presented, we see that they move more, but in the direction of lower

attainment. As a result, the persistence observed in daughters' status could be interpreted as a positive finding. In fact, they are more able to keep parental status or improve it. This is consistent with the literature on "males being left behind" (Delaney & Devereux, 2021).

### 3.4.2. Gender differences in cognitive skills

Figure 3.4 displays how numeracy and literacy proficiency vary by gender across countries. The differences are displayed in percentage terms considering females as the reference category. The detailed information is presented on Table A. 3.3 in the Appendix. The first point to note is that the numeracy gaps are larger than those in literacy. Second, numeracy gaps are in favor of males while literacy gaps in favor of females for the most part. The female advantage in literacy is found in 17 countries, while the male advantage is found in 21 countries.

Figure 3.4. Gender gaps in cognitive skills




Notes: The gender gap is calculated as the difference in scores between females and males in percentage points. Positive (negative) values mean mobility is higher for women (men).

The OECD (2016) defines numeracy as *the ability to access, use, interpret, and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life* (p. 48). The numeracy gap across countries amounts to males performing on average 3.3 percent higher than

females on these skills, which is 8.9 points on the 500-point scale. This gap can double in the cases of Switzerland and the United Kingdom and becomes statistically non-significant in countries like Slovak Republic, Polonia and Croatia

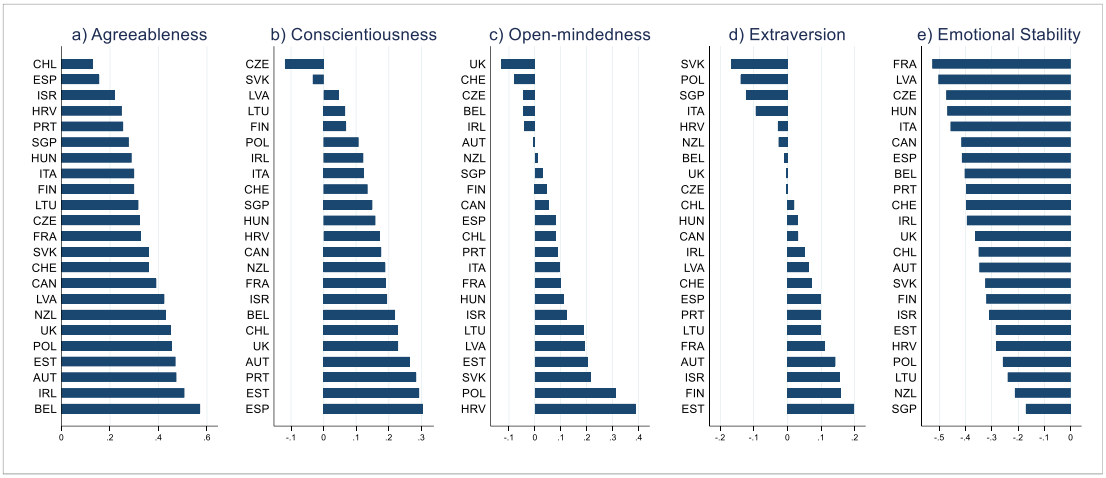
On the other hand, women and men perform very similarly across countries in literacy skills. This skill is defined as *the ability to understand, evaluate, use, and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential* (OECD, 2016, p. 38). Overall, the literacy gap is approximately 1.2 percent or 3 points on the 500-point-scale. It shrinks in countries like Spain, Belgium, Slovak Republic, Chile and Austria, while it rises to its highest figures in New Zealand and Estonia with more than 4 percent or 12 points.

### 3.4.3. Gender differences in noncognitive skills

The Big Five personality traits are defined by Weisberg et al. (2021) as follows. Agreeableness encompasses traits associated with altruism, including empathy and kindness. It reflects a tendency to cooperate, foster social harmony, and consider the needs of others, rather than engaging in exploitation or causing harm. Conscientiousness encompasses traits such as self-discipline, organization, and impulse control. It reflects an individual's capacity for self-regulation to adhere to rules and stay committed to their goals. Open-mindedness encompasses imagination, creativity and intellectual curiosity, and an appreciation for new experiences. More broadly, it reflects an individual's ability and inclination to engage with and process complex stimuli. Extraversion encompasses sociability, assertiveness, and a tendency toward positive emotions, all of which have been associated with heightened sensitivity to rewards. Emotional Stability refers to the predisposition to experience negative emotions and related reactions when faced with perceived threats or punishment. These responses may include anxiety, depression, anger, self-consciousness, and emotional instability.

Figure 3.5 reports the gender disparities in the Big Five personality traits. Positive scores mean that on average women score higher than men in the trait, while negative scores represent that men score higher on the trait. As in related literature (Rammstedt et al., 2025; Flinn et al., 2025), we see that females score substantially higher in Agreeableness (panel a) while scoring lower with respect to males in Emotional Stability (panel e) across all countries in the sample. Details are found in Appendix in Table A. 3.3.

Figure 3.5. Gender gaps in noncognitive skills




Notes: The gender gap is calculated as the difference between women and men in z-scores, as reported in PIAAC. Positive(negative) values mean that women score higher(lower) than men in the trait.

Women being high on Agreeableness suggests that they tend to be more empathetic to others and are more likely to form social and emotional bonds. Rammstedt et al. (2025) and Flinn et al. (2025) find that, high female agreeableness is especially due to high levels of compassion and politeness. On the other hand, men's dominance on Emotional Stability has been associated with lower levels of anxiety, vulnerability and self-consciousness. This has been linked primarily to men being less likely than women to feelings of withdrawal – the tendency to internalize negative emotions – (Flinn et al., 2025).

In the majority of countries (21), females also score high in Conscientiousness. Characteristics of this trait include organization, responsibility and productiveness, with the latter showing smaller gender gaps (Rammstedt et al., 2025). In our sample, the two countries where males score high on Conscientiousness are Slovak Republic and Czech Republic, the former being a negligible difference.

In contrast to Agreeableness, Emotional Stability, and Conscientiousness, the cross-country patterns for Open-mindedness and Extraversion (panels c and d) show less pronounced gender differences and in eight to ten countries, these are not statistically significant (Table A. 3.3). Regarding Open-mindedness, women score low with respect to men in six countries, out of which the difference is significant only in the UK. However, in most of them, this is not due to men exhibiting high levels of Open-mindedness; rather, both men and women score below the population average, but men are closer to it. Regarding Extraversion there are also heterogenous patterns. In this domain,

significant differences are found both in favor of women and men: in seven countries men score in the trait, while women score higher in eleven

All in all, there is great variation in the size of the gaps by domains and countries. By domain, variation in the gaps across countries is higher for Agreeableness and Open-mindedness (sd>0.1). In terms of size, however, disparities are largest in Emotional Stability and Agreeableness, going up to -5 and 6 standard deviations, respectively. The gaps are notably lower for the remaining three traits. By country, there is no pattern across domains. That is, no country can be characterized by the largest gender differences in personality overall. Instead, the size of the disparities are country and domain specific. As an example, France, Hungary and Italy show the largest gender differences in Emotional Stability, but in the other domains, gaps are relatively lower with respect to the rest of the countries. This heterogeneity, as argued by Rammstedt et al. (2025), would reflect substantial cultural differences in the development of personality.

## 3.5. The relationship between skills and intergenerational mobility

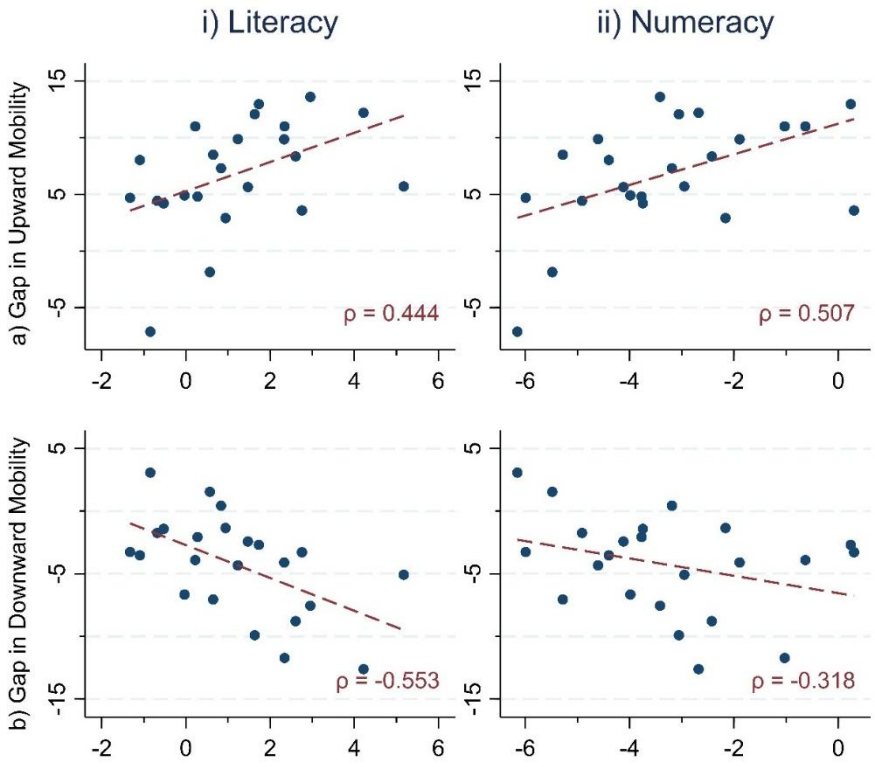
### 3.5.1. Descriptive results

In this section we present a first exploration of how the gender gap in educational mobility is associated with the gaps in cognitive and noncognitive skills. Recall from Figure 3.3 that upward mobility is larger for women, while downward mobility is larger for men, resulting in an overall positive scenario for women. Figure 3.6 plots the relationship between these measures of intergenerational mobility and the disparities in literacy and numeracy skills, respectively. With respect to the gap in upward mobility, we observe a positive association, while the oppositive is observed for the gap in downward mobility.

This entails that the advantage of women in educational mobility relative to men increases in countries where (i) the female advantage in literacy skills is higher and (ii) the male advantage in numeracy is lower. These patterns support prior studies documenting that cognitive skills are associated with intergenerational mobility in different ways. Specifically, Aceujo and James (2021) show that literacy-related skills, namely verbal proficiency, disproportionately influence the gender gap in university enrollment and completion. Our results may shed light on how this in turn affects intergenerational mobility prospects for women. On the other hand, we also see that the smaller

male advantage in numeracy may enable pathways for women's educational mobility. We return to this in the discussion of how numeracy is found to affect the decomposition of the gender gap.

Figure 3.6. Gender gaps in cognitive skills and in intergenerational mobility




Notes: The gender gap is calculated as the difference between women and men in percentage points. Positive (negative) values mean mobility (or the skill) is higher for women (men).

We now turn our attention to Figure 3.7, which plots the relationship between the measures of intergenerational mobility and the Big Five traits. Prior research shows that compared to cognitive skills, noncognitive skills present lower correlations with indicators of educational achievement (Rammstedt et al. 2024) including educational mobility (Mood et al., 2011). Our results show that the trait most associated with the female advantage in upward mobility is Open-mindedness, followed by Conscientiousness (top panel, a); while the trait that stands out with the male disadvantage in downward mobility is Extraversion and, to a similar extent, Open-mindedness (panel b).

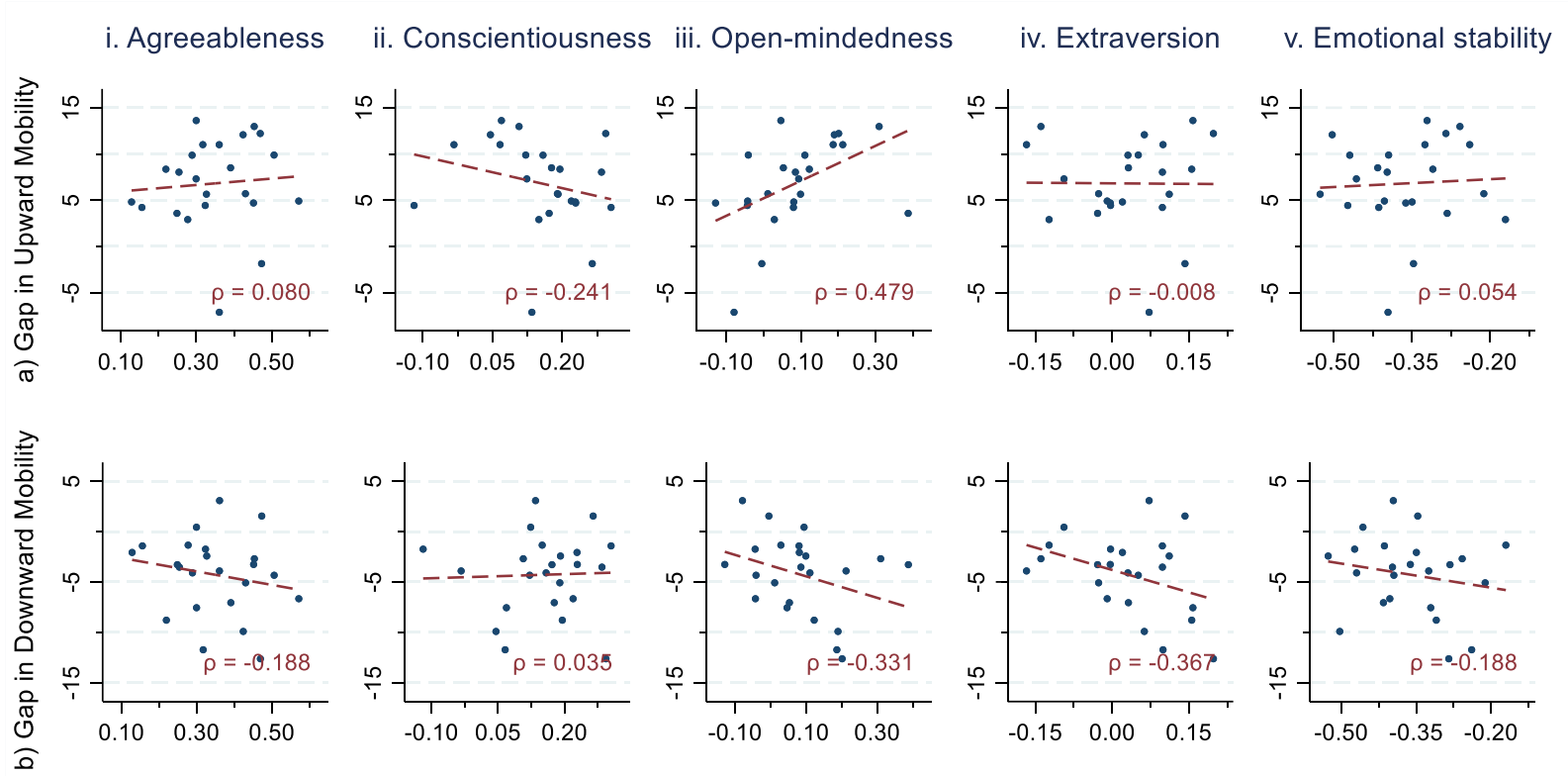
Psychological research in fact predicts that Open-mindedness and Conscientiousness are highly related to educational outcomes (Van Eijck & De Graaf, 2004), and recent research backs this up (Rammstedt et al. 2024). Characteristics of

Conscientiousness include productiveness, responsibility and organization (Rammstedt et al. 2025), all of which have been associated with better labor market outcomes (Flinn et al., 2025) and could certainly be related to improved educational outcomes such as it is the case of educational mobility. When looking at the correlation between upward mobility and Conscientiousness, indeed we also find a positive association ($p=0.39$). However, when looking at the gaps in both variables, the oppositive emerges.

With respect to Open-mindedness, the gender gaps observed were less pronounced yet in most countries were in favor of women as well. Panel a in Figure 3.7 shows that it is positively associated with their advantage in upward mobility. Individuals characterized by openness to experience are led by intellectual curiosity and creative imagination. Therefore, the higher are women characterized by this; it could be expected that the larger is their advantage in educational mobility with respect to men.

Lastly, characteristics of Extraversion include sociability, assertiveness and energy. The former being a characteristic where females score higher (Rammstedt et al. 2025). Although it has been associated to a lower extent with educational outcomes, this trait has been found to influence women's employment outcomes through their initial human capital. This preliminary result may be suggestive that it also works in favor of them through decreasing their probability of lower attainment than their parents.

Figure 3.7. Gender gap in noncognitive skills and in intergenerational mobility




Notes: The gender gap is calculated as the difference between women and men in percentage points for the measures of mobility, and in z-scores for the Big 5. Positive (negative) values mean mobility (or the trait) is higher for women (men).

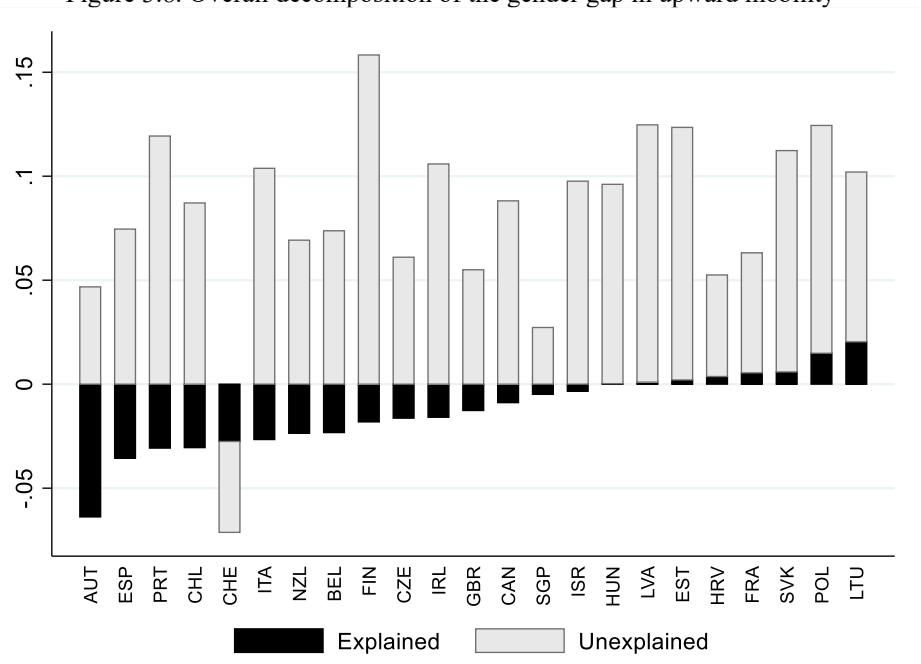
## 3.5.2. Decomposition upward mobility

Figure 3.8 summarizes the decomposition analysis for the measure of upward mobility, i.e., the probability of attaining a higher education level than their parents. Numerical results for the separate logit estimations are displayed in Appendix

Table A. 3.4 and Table A. 3.5 for females and males, respectively. These show that the gender gap in upward mobility is statistically significant in 19 countries, and non-significant in four countries (Austria, Croatia, Singapore and the UK). In 18 of these, women experience the advantage in mobility, while only in Switzerland men are more likely to surpass their parents' level of education.

Both explained and unexplained parts of the gender gap in upward mobility are statistically significant, especially the latter. In terms of their relative contribution to the overall gap in absolute terms, we observe that the explained part is smaller in all cases. Yet it varies widely across countries, ranging from representing 1 percent (Hungary, Latvia) to approximately 50 and 60 percent of the unexplained part (Spain and Switzerland, respectively).

Figure 3.8. Overall decomposition of the gender gap in upward mobility



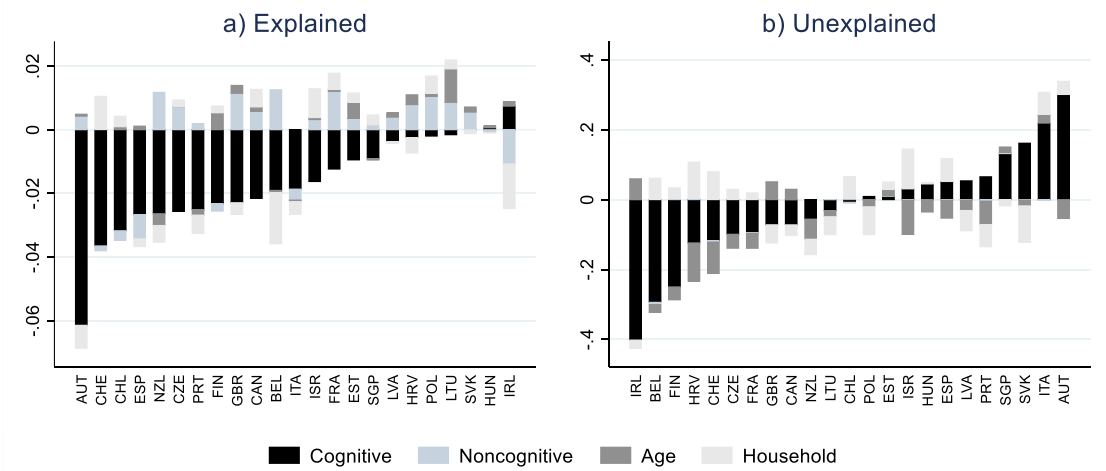

Notes: Oaxaca Blinder decomposition of gender differences in upward mobility as females-males, for individuals aged 25 to 65. Explanatory variables used: age groups, books in household, parental occupation, number of siblings, numeracy scores, literacy scores, Big 5 scores.

Furthermore, Figure 3.8 shows that in most countries the explained part is negative, while the unexplained part is positive (except in Switzerland). This means that the endowment of observable characteristics decreases females' higher probability of upward mobility, while the rewards to these characteristics increase it. On the other hand, we have eight countries contrary to this trend. In the first group, Spain stands out as a notable example where the explained component is negative, indicating that the endowment of characteristics reduces the female advantage in upward mobility. In the second group, where the distribution of characteristics contributes to the mobility advantage held by women, we find countries such as Lithuania and Poland.

Given the sizes of both components of the gap, even in the first group of countries where the characteristics would predict a lower advantage for women, this effect is offset by the unexplained component, which suggests that overall, the differential returns to these characteristics contribute to a net widening of the gap in favor of women. This tells us that in absence of differences in the rewards to endowments, endowments will decrease the female advantage in mobility in favor of males.

Figure 3.9 presents how the covariates contribute to the explained (panel a) and the unexplained part of the gap (panel b) grouped into categories. The numerical detail of each individual variable is presented in Appendix Table A. 3.6.

Figure 3.9. Detailed decomposition of the gender gap in upward mobility




Notes: Oaxaca Blinder decomposition of gender differences in upward mobility as females-males, for individuals aged 25 to 65, grouped as follows: cognitive (numeracy and literacy scores), noncognitive (Big 5 scores), Age (age groups in 10-year bands), Household (books in household, parental occupation, number of siblings)

In both panels, it stands out the role of cognitive skills as the largest driver of both components of the gap in upward across countries. In the explained component, noncognitive skills are the second contributor, whereas in the unexplained component, households' characteristics are salient and the role of noncognitive skills is negligible.

Within the explained part, the role of cognitive skills is more than double the contribution of noncognitive skills, and the latter are nearly equivalent to the contribution of household characteristics. There are six countries where the contribution of noncognitive skills outweighs that of cognitive (Croatia, Ireland, Latvia, Lithuania, Poland and Slovak Republic). Furthermore, while cognitive skills impact is in general negative[4], the impact of noncognitive skills is positive when significant, pointing that the latter contribute to the female advantage in mobility although to a lower extent than the role of cognitive skills counterbalances that advantage. The latter effect is the largest in countries such as Austria, Switzerland, Chile, Spain and New Zealand, while the contribution of noncognitive skills prevail in countries like Belgium, France, New Zealand, Poland and the UK.

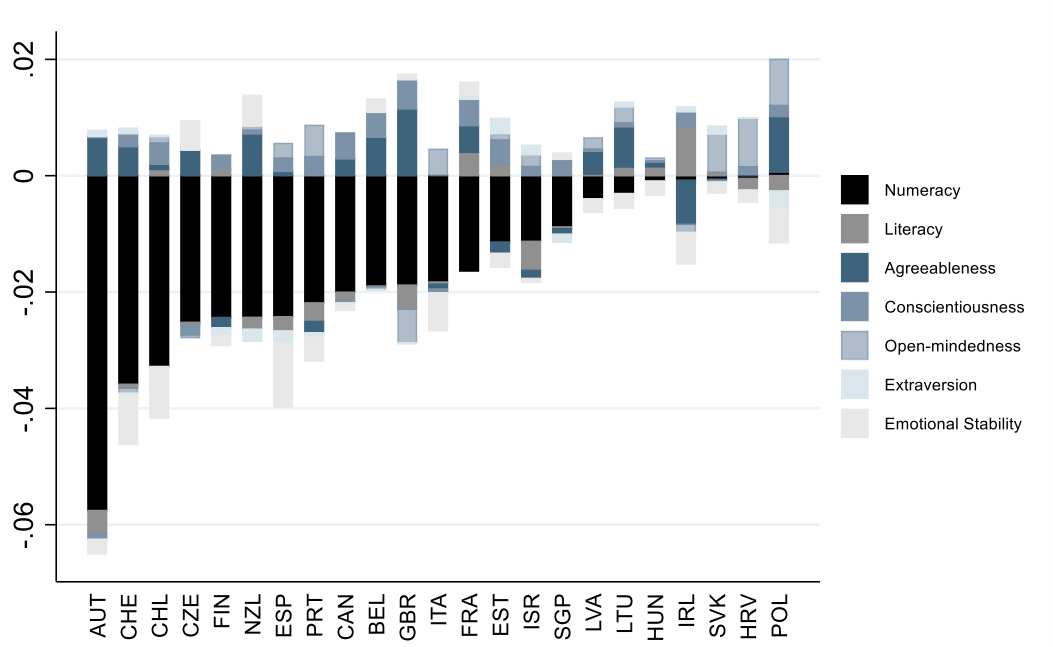
To delve deeper into the role of cognitive and noncognitive skills, Figure 3.10 (detailed in Table A. 3.6) presents the contribution of these skills to the explained part of the disparities in upward mobility. We observe that within the group of cognitive skills; it is numeracy proficiency the one driving the effect. Numeracy skills always display a statistically significant and negative sign, whereas the contribution of literacy proficiency to the gender gap in mobility ranges from small to null. The latter adds to the previous discussion in Section 4.1., where both literacy and numeracy disparities were correlated with the disparities in upward mobility. When examining the logit regressions for males and females separately (Table A. 3.4 and Table A. 3.5), literacy skills are positively associated with women's upward mobility but negatively associated with men's. Hence, the results cohere those by Aceujo and James (2021) on the importance of literacy for women's educational attainment. However, since we are using pooled coefficients for the decomposition, the two may attenuate the overall contribution of literacy to the gender disparities in upward mobility, since the opposing effects tend to offset each other. On the other hand, numeracy skills contribute positively to their

[4] In fact, cognitive skills are associated with a higher likelihood of women attaining more education than their parents relative to men in only two countries—Ireland and Hungary. However, the magnitude of this effect is minimal.

separate probabilities of upward mobility for both men and women, with a slightly stronger effect for men.

The fact that larger differences in numeracy decreases the probability of upward mobility for women aligns with the descriptive findings (Section 3.5.1). In fact, countries with the largest gaps in numeracy (favoring men), are those where women's face the lowest advantage in upward mobility (Switzerland, UK, Austria). Conversely, in countries where men's advantage in numeracy over women are the smallest, women tent to experience the largest advantage in mobility (Slovak Republic, Poland, Lithuania). These patterns suggest that strengthening numeracy skills may be a key pathway to enhancing women's educational mobility. For instance, narrower numeracy gaps likely reflect broader societal shifts toward gender equality, which could foster women's participation in higher education through multiple mechanisms: reducing stereotyping and institutional barriers in in some male-dominated fields, and reconfigured societal expectations (Charles & Bradley, 2009).

Figure 3.10. Contribution of cognitive and noncognitive skills to the explained part of the gender gap in upward mobility




Notes: Oaxaca Blinder decomposition of gender differences in upward mobility as females-males, for individuals aged 25 to 65. Detailed decomposition of categories of cognitive (numeracy and literacy scores) and noncognitive skills (Big 5 scores) contributing to explained part.

On the side of noncognitive skills, Poland stands out as the country where all Big Five are significant contributors to the gap. In the rest of countries, the main contributor is Open-mindedness, followed by Conscientiousness. Both favor the female advantage in upward mobility. This is in line with the descriptive results plotted in Figure 3.7 for the former, while for Open-mindedness, the analysis shows that the relationship changes once we are controlling for a range of characteristics. It should also be noted that in most countries, the contribution of noncognitive skills outperforms that of literacy skills.

Regarding the unexplained part of the gap, within the category of cognitive skills, numeracy proficiency appears a relevant driver in some countries, while in the category of household characteristics, parental occupation has a role that in some countries supports the female advantage. However, these factors are only statistically significant in a small group of countries.

### 3.5.3. Decomposition downward mobility

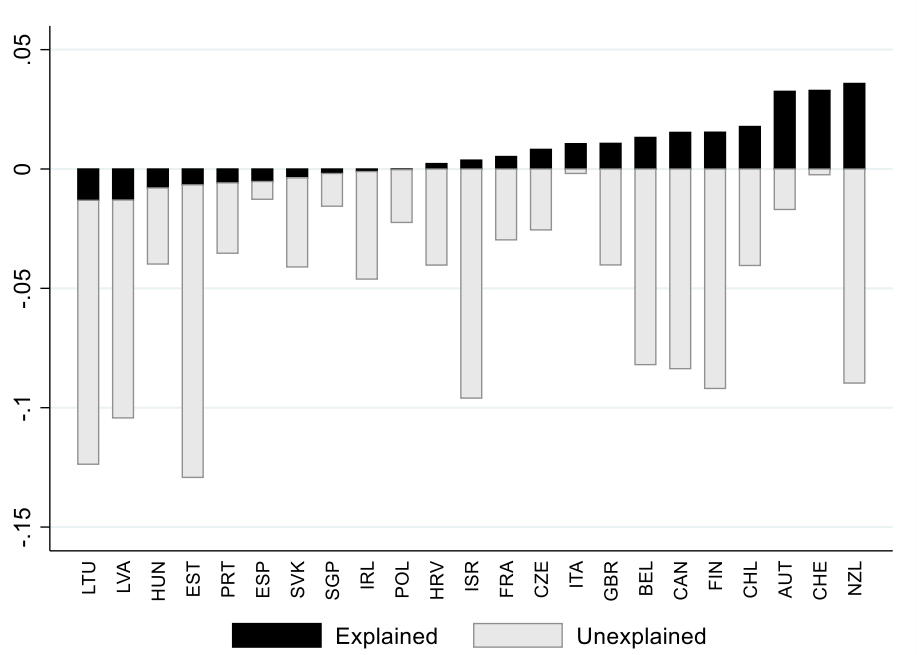
The analysis of the gender gap in downward mobility in Section 3.4.1 (Figure 3.3) revealed that females were less likely than men to achieve lower education levels than their parents. In this case, a negative gap implies that this probability is higher for males, i.e. a male disadvantage. In 4 out of the 23 countries, the gap is statistically non-significant (Table A. 3.3): Chile, Italy, Spain, the UK. Out of this, in 17 countries men exhibit a higher risk of downward mobility compared to women, while in Austria and Switzerland the opposite occurs.

Like in the case of upward mobility, the decomposition exercise summarized in Figure 3.11 reveals that the distribution of characteristics is able to explain only a share of the gap, while the unexplained part stands out in all countries. The exception to this is Austria, Italy and Switzerland, where the explained part outweighs the unexplained part in absolute terms. For the rest of countries, the former represents from 1 percent (Poland) to 40 percent (New Zealand) of the size of the unexplained part. The decomposition results are presented in detail in Appendix Table A. 3.9. Numerical results for the separate logit estimations are displayed in Appendix Table A. 3.7 and Table A. 3.8 for females and males, respectively.

The direction in which the endowment of characteristics operates also varies across countries. In half of the countries, the distribution of characteristics reinforces the higher probability of men's downward mobility (negative sign). When it operates to diminish this disadvantage, the effects are relatively larger (Switzerland and New

Zealand). However, the differences in returns to these characteristics are in all cases negative and larger, resulting in a net disadvantage for them.

Figure 3.11. Overall decomposition of the gender gap in downward mobility

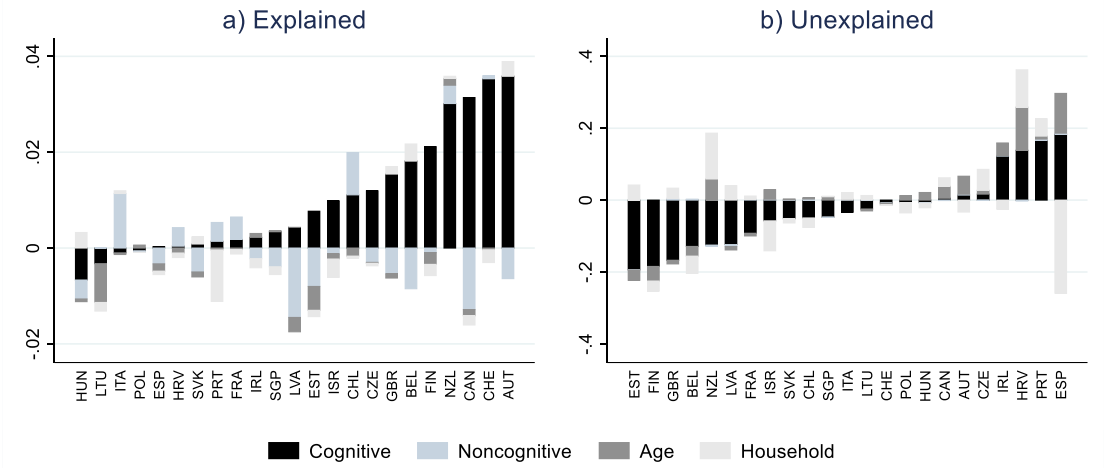



Notes: Oaxaca Blinder decomposition of gender differences in downward mobility as females-males, for individuals aged 25 to 65. Explanatory variables used: age groups, books in household, parental occupation, number of siblings, numeracy scores, literacy scores, Big 5 scores.

Looking at the decomposition by category of variables (Figure 3.12), we find that differences in cognitive skills and noncognitive skills make the biggest contributors to the gender disparities in downward mobility in the explained part. Countries were non-cognitive skills dominate the contribution to the gap include Latvia, Italy, Croatia and Estonia. In the unexplained part, cognitive skills are also predominant, followed by household characteristics, whereas noncognitive have a negligible role.

Cognitive skills predict a reduction in males' probability of attaining lower education than their parents. The only countries where the distribution of cognitive skills reinforces males' disadvantage are Hungary, Lithuania, Italy, and Poland, though in small quantities.

Figure 3.12. Detailed decomposition of the gender gap in downward mobility

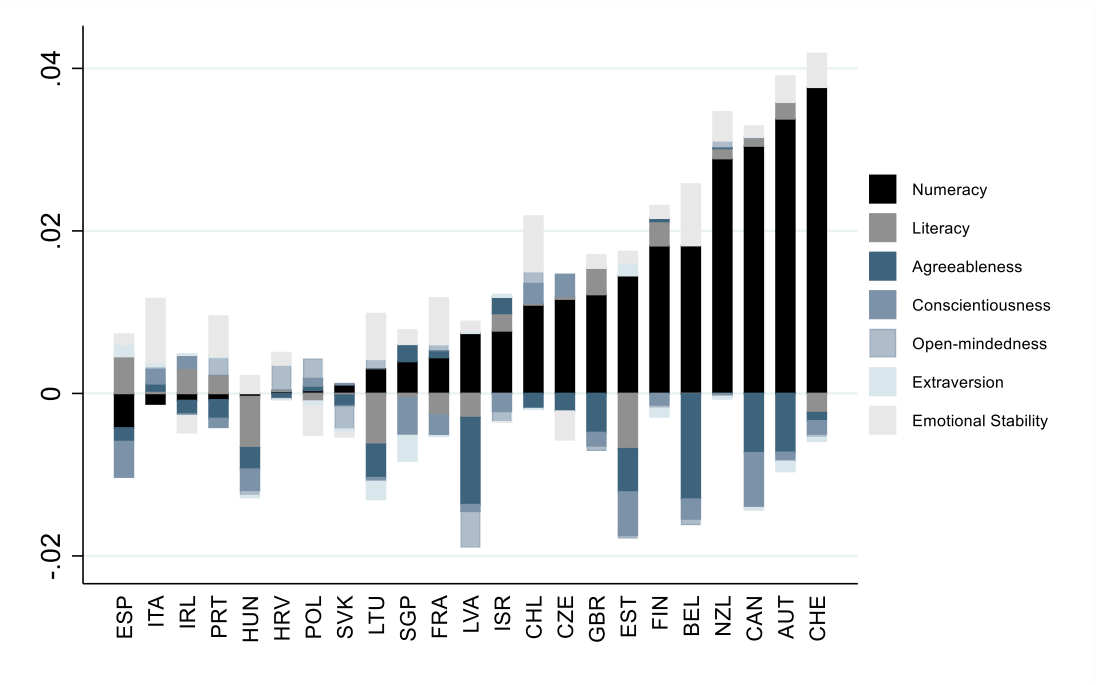



Notes: Oaxaca Blinder decomposition of gender differences in downward mobility as females-males, for individuals aged 25 to 65, grouped as follows: cognitive (numeracy and literacy scores), noncognitive (Big 5 scores), Age (age groups in 10-year bands), Household (books in household, parental occupation, number of siblings)

Delving deeper into the role of cognitive and noncognitive skills, Figure 3.13 (Table A. 3.9) reveals that the effect of cognitive skills is mainly driven by numeracy skills again. Across countries, males' endowment of numeracy skills reduces their probability of downward mobility (positive sign). We also observe that men's endowment of noncognitive and literacy skills with respect to women partially offsets this effect.

The contribution of gender differences in numeracy to the probability of downward mobility is also consistent with the descriptive findings. Specifically, in countries where males have a larger advantage in numeracy, they tend to experience a lower risk of downward mobility (Switzerland, Austria, UK, Czeck Republic). In contrast, in countries where the male advantage in numeracy is smaller, or where women outperform men, men face a greater risk of downward mobility relative to women (Polonia, Croatia, Slovak Republic, Lithuania). This highlights the potential long-term role that building cognitive skills from early ages may have in preventing the gender gap in mobility from widening. As explained by Delaney and Devereux (2021), a policy that has been proved to be efficient in the context of improving boys' school performance is a shift towards emphasizing numerical skills more than verbal skills. Since achievement and attainment are strongly correlated, this could ultimately be beneficial for their educational mobility.

Figure 3.13. Contribution of cognitive and noncognitive skills to the explained part of the gender gap in downward mobility




Notes: Oaxaca Blinder decomposition of gender differences in downward mobility as females-males, for individuals aged 25 to 65. Detailed decomposition of categories of cognitive (numeracy and literacy scores) and noncognitive skills (Big 5 scores) contributing to explained part.

Regarding literacy, it increases males' probability of downward mobility in the following countries: Estonia, France, Hungary, Lithuania, Latvia, Switzerland. Noncognitive skills that play a notable role in male's disadvantage are Agreeableness and Conscientiousness. While the latter was also observed in the descriptive section, we observe that the role of Agreeableness outperforms that of Extraversion now that we are controlling for other characteristics. This is also consistent with the fact that females usually score significantly higher in these traits with respect to males (Rammstedt et al. 2025). A comprehensive view of Figure 3.13, reveals that across half of the countries, the role of these traits is comparable or stronger than that of numeracy. In the rest of the countries where numeracy dominates, the contribution of these noncognitive skills is stronger than that of literacy skills. Comparing Figure 3.10 and Figure 3.13Figure 3.12, we see that the contribution of certain noncognitive skills can be as large as that of cognitive skills, depending on the outcome measure and the country, concurring with existing research by Rammsted et al., (2017; 2024).

## 3.6. Conclusions

Through different measures of intergenerational mobility, this study shows that women hold an advantage in educational intergenerational mobility across 22 of 23 high income countries. Despite daughters' educational attainment is more dependent on their parents' compared to sons, given the trends of the gender gap in educational attainment (Narayan et al., 2018) and that mother-child associations are stronger than father-child (Hu & Qian, 2023), this would often reflect the intergenerational transmission of high educational attainment for women. Furthermore, when they experience intergenerational mobility, daughters are more likely to surpass the attainment of their most educated parent, while sons are more likely to have lower attainment than their parents. We also report the well-known gender differences in cognitive and noncognitive skills and their contribution to the gender differences in intergenerational mobility. Three results stand out from this analysis.

First, as is the case for other adult outcomes, cognitive skills are in most countries more important than noncognitive skills for intergenerational mobility. These are more important than household characteristics when the respondent was a teen, which is usually a prominent determinant of the levels of mobility (Chetty et al., 2014). Furthermore, our results reveal a dual role of numeracy skills in shaping the gendered pathways to educational mobility. The descriptive and decomposition results point that countries where males hold a larger numeracy advantage, their disadvantage in mobility decreases by reducing their risk of downward mobility and increasing their probability of upward mobility relative to women. These patterns suggest the complex relationship of cognitive skills with adult outcomes. On such an outcome is STEM participation. As by the results, it could be that numeracy skills can help male's disadvantage in mobility prospects, while simultaneously hindering females disadvantage in STEM participation (Encinas-Martin & Cherian, 2023). This complexity in turns underscores a challenge for policy design as addressing gaps in numeracy may not yield uniform benefits across outcomes and countries.

Second, when breaking down our results, we find that despite having a smaller explanatory power compared to numeracy, the role of noncognitive skills is more heterogeneous. First, they are more relevant to the gender gap in intergenerational mobility than household characteristics and literacy across most countries. Importantly, in some countries they can be as important as numeracy for downward mobility. Third, they act in favor of the female advantage in educational mobility. This finding supports the cost-related explanation for the "boy problem" of lower attainment, where women's

superior noncognitive skills imply lower costs of schooling (Delaney & Devereux, 2021), allowing them to perform better and as suggested by our results, achieve intergenerational gains. The finding is relevant to policy making as there is evidence suggesting that these skills are not as hereditary as cognitive skills and that they are malleable to some extent (Anger, 2011), hence there is room for building this trait. Our findings point to the relative importance of Conscientiousness and Open-mindedness for upward mobility, in addition to Agreeableness for downward mobility. Regarding Conscientiousness especially, there is broad evidence of effective interventions, modifying it in desirable ways for enhanced educational outcomes (Kim et al, 2016).

Third, we find that there is a sizable portion of the gender gap in mobility that the characteristics included in our analysis are not able to explain, which has also been found in the context of explaining the gap in wages (Paccagnella, 2015). This unexplained component actually acts in favor of women's advantage, which calls for further analysis of other characteristics that may contribute to explain the gap. This includes individual information such as educational aspirations, and contextual information such as gender equality and social policy indicators. Evidence shows that the latter have a role in the differences in intergenerational mobility among natives and migrants, for instance (Shapira, 2012). Since this component of the gender gap in mobility refers to the structure of the returns to education, this finding may also back up the cost-related explanation for the "boy problem", where women's higher educational attainment is motivated not only by the differences in the distribution of their characteristics but also by the differences in how their characteristics are rewarded and values in the education system. Therefore, future work could also expand on this by exploring what is behind the rewarding structure. For instance, specific policies that motivate women's attainment such as affirmative action policies.

To close up, it is important to acknowledge that this study is descriptive in nature and does not allow for causal claims. Establishing causality would require longitudinal data that track individuals' skills and outcomes over time. These data are essential to disentangle questions like whether individuals with higher cognitive skills are more likely to exceed their parents' educational attainment, or whether attaining higher education than one's parents subsequently contributes to the development of cognitive skills. Evidence from research linking childhood data from PISA with adulthood data from PIAAC—for instance Borgonovi et al. (2021)—further underscores the value of a longitudinal perspective since the disparities in numeracy skills tends to widen with age.

# 3.7. Appendix

Table A. 3.1. Definition of covariates

| Variable | Variable definition |
|---|---|
| Respondent's education | Respondent's education level, where 1: has not attained upper secondary; 2: has attained secondary or post-secondary, non tertiary; 3: has attained tertiary |
| Parental education | Highest education level reached by either parent/guardian, where 1: has not attained upper secondary; 2: has attained secondary or post-secondary, non tertiary; 3: has attained tertiary |
| Upward Mobility | Dummy variable equal to 1 if respondent reaches a higher education than that of the highest educated parent/guardian |
| Downward Mobility | Dummy variable equal to 1 if respondent reaches a lower education than that of the highest educated parent/guardian |
| Age | Respondent's age grouped in 1:25-34; 2:35-44; 3:45-54; 4:55-64 |
| Books | Dummy variable equal to 1 if respondent reports having more than 100 books at home at age 14 |
| Parental occupation | Highest occupational category by either parent/guardian, where 1: Skilled occupations; 2: Semi-skilled white-collar occupations; 3: Semi-skilled blue-collar occupations; 4: Elementary occupations |
| N. siblings | Number of siblings reported by respondent at age 14 |
| Literacy | Average of plausible values 1-10 of literacy |
| Numeracy | Average of plausible values 1-10 of numeracy |
| Big 5 | standardized scores of each Big 5 trait as reported by PIAAC (mean = 0, SD ≈ 1) |

Table A. 3.2. Descriptive statistics of covariates

| Gender | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Males** | | | | | | | | | | | | |
| Education levels | | | | | | | | | | | | |
| Primary | 7.8 | 13.5 | 10.9 | 25.4 | 10.1 | 3.3 | 12.7 | 8.2 | 14.2 | 11.8 | 21.9 | 16.2 |
| Secondary | 54.9 | 38.6 | 43.7 | 40.2 | 66.2 | 72.8 | 49.2 | 50.1 | 46.0 | 59.1 | 35.9 | 40.2 |
| Tertiary | 37.4 | 47.9 | 45.4 | 34.4 | 23.7 | 23.9 | 38.1 | 41.7 | 39.7 | 29.0 | 42.3 | 43.6 |
| Parental education | | | | | | | | | | | | |
| Neither parent has upper secondary | 20.1 | 26.7 | 16.3 | 44.9 | 32.2 | 3.0 | 14.5 | 24.0 | 34.6 | 25.9 | 42.8 | 32.3 |
| At least one parent has secondary | 53.3 | 40.7 | 37.2 | 36.8 | 50.3 | 76.1 | 45.2 | 45.6 | 40.7 | 51.1 | 32.9 | 30.5 |
| At least one parent has tertiary | 26.7 | 32.6 | 46.5 | 18.3 | 17.5 | 20.9 | 40.3 | 30.4 | 24.7 | 23.0 | 24.2 | 37.2 |
| Age | | | | | | | | | | | | |
| Age 25-34 | 22.1 | 22.9 | 25.5 | 27.5 | 23.0 | 21.7 | 23.6 | 24.1 | 22.4 | 22.2 | 20.6 | 33.6 |
| Age 35-44 | 21.8 | 23.2 | 24.0 | 27.1 | 25.3 | 26.6 | 28.1 | 23.5 | 25.0 | 25.5 | 27.1 | 26.7 |
| Age 45-54 | 24.2 | 24.0 | 21.6 | 22.8 | 24.4 | 28.2 | 26.0 | 23.2 | 25.3 | 29.7 | 26.6 | 22.6 |
| Age 55 plus | 32.0 | 29.9 | 28.9 | 22.5 | 27.3 | 23.6 | 22.3 | 29.1 | 27.2 | 22.6 | 25.7 | 17.1 |
| Books | | | | | | | | | | | | |
| Books >100 | 30.0 | 28.3 | 37.0 | 9.8 | 12.2 | 53.1 | 63.9 | 50.7 | 33.1 | 48.4 | 26.4 | 36.1 |
| Parental OCC | | | | | | | | | | | | |
| Skilled | 19.2 | 28.2 | 32.6 | 14.4 | 14.6 | 15.4 | 27.3 | 22.6 | 22.5 | 15.9 | 23.4 | 32.6 |
| Semi-skilled white collar | 18.9 | 20.5 | 16.5 | 17.5 | 22.8 | 21.9 | 12.7 | 24.8 | 21.0 | 15.0 | 16.5 | 22.5 |
| Semi-skilled blue collar | 46.7 | 38.2 | 41.0 | 42.7 | 43.6 | 51.7 | 48.9 | 43.3 | 41.5 | 53.5 | 47.4 | 36.8 |
| Elementary | 15.2 | 13.2 | 9.9 | 25.5 | 19.0 | 11.0 | 11.1 | 9.2 | 15.1 | 15.7 | 12.7 | 8.2 |
| Number of siblings | 1.8 | 1.8 | 2.0 | 2.5 | 1.5 | 1.4 | 1.5 | 1.9 | 1.9 | 1.4 | 2.8 | 3.0 |
| Cognitive | | | | | | | | | | | | |
| Literacy | 263.3 | 285.3 | 278.2 | 213.5 | 251.0 | 264.3 | 271.1 | 294.6 | 258.2 | 245.7 | 259.9 | 243.6 |
| Numeracy | 283.1 | 296.1 | 282.1 | 215.1 | 253.1 | 279.1 | 286.2 | 300.5 | 269.1 | 257.9 | 263.2 | 251.0 |
| Noncognitive | | | | | | | | | | | | |
| Agreeableness | -0.282 | -0.234 | -0.180 | -0.024 | -0.108 | -0.130 | -0.198 | -0.136 | -0.169 | -0.101 | -0.160 | -0.063 |
| Conscientiousness | -0.080 | -0.021 | -0.031 | -0.060 | -0.015 | 0.140 | -0.112 | 0.016 | -0.008 | 0.006 | 0.043 | -0.035 |
| Extraversion | -0.065 | -0.007 | 0.003 | 0.009 | -0.004 | 0.003 | -0.085 | -0.095 | -0.052 | -0.029 | -0.086 | -0.074 |
| Emotional stability | 0.222 | 0.222 | 0.192 | 0.163 | 0.131 | 0.246 | 0.172 | 0.200 | 0.249 | 0.236 | 0.232 | 0.159 |
| Open-mindedness | -0.070 | -0.001 | -0.041 | -0.043 | -0.230 | -0.011 | -0.115 | -0.022 | -0.099 | -0.097 | -0.087 | -0.069 |
| n | 1,358 | 1,298 | 3,639 | 1,476 | 1,499 | 1,654 | 2,349 | 1,620 | 2,252 | 1,744 | 1,068 | 1,953 |
| **Females** | | | | | | | | | | | | |

| **Gender** | **AUT** | **BEL** | **CAN** | **CHL** | **HRV** | **CZE** | **EST** | **FIN** | **FRA** | **HUN** | **IRL** | **ISR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Education levels | | | | | | | | | | | | |
| Primary | 14.1 | 9.8 | 8.3 | 23.2 | 10.7 | 5.3 | 7.3 | 3.9 | 13.3 | 12.5 | 13.6 | 7.9 |
| Secondary | 51.3 | 27.1 | 39.6 | 39.2 | 54.9 | 66.8 | 31.9 | 37.7 | 40.8 | 47.8 | 36.6 | 34.4 |
| Tertiary | 34.7 | 63.1 | 52.1 | 37.5 | 34.4 | 27.9 | 60.9 | 58.4 | 45.9 | 39.7 | 49.9 | 57.8 |
| Parental education | | | | | | | | | | | | |
| Neither parent has upper secondary | 20.7 | 27.5 | 20.8 | 50.1 | 30.9 | 5.5 | 15.7 | 24.9 | 35.4 | 29.8 | 46.2 | 31.9 |
| At least one parent has secondary | 56.4 | 35.8 | 37.8 | 33.4 | 50.7 | 75.3 | 45.0 | 49.1 | 41.5 | 50.0 | 28.5 | 31.2 |
| At least one parent has tertiary | 22.9 | 36.7 | 41.4 | 16.5 | 18.4 | 19.2 | 39.2 | 26.0 | 23.2 | 20.1 | 25.3 | 36.9 |
| Age | | | | | | | | | | | | |
| Age 25-34 | 22.6 | 23.6 | 24.7 | 27.6 | 21.7 | 20.4 | 22.9 | 22.8 | 21.7 | 22.2 | 20.4 | 31.6 |
| Age 35-44 | 20.4 | 22.8 | 23.1 | 24.5 | 24.6 | 26.5 | 28.5 | 24.0 | 25.0 | 23.8 | 27.2 | 28.3 |
| Age 45-54 | 24.4 | 23.4 | 21.1 | 23.0 | 23.8 | 28.3 | 25.2 | 21.0 | 25.4 | 29.3 | 25.7 | 22.8 |
| Age 55 plus | 32.6 | 30.3 | 31.1 | 24.9 | 30.0 | 24.7 | 23.4 | 32.1 | 27.8 | 24.8 | 26.6 | 17.3 |
| Books | | | | | | | | | | | | |
| Books >100 | 65.4 | 70.1 | 63.4 | 91.3 | 84.2 | 42.5 | 34.3 | 47.4 | 63.9 | 47.7 | 69.1 | 63.3 |
| Parental OCC | 34.6 | 29.9 | 36.6 | 8.7 | 15.8 | 57.5 | 65.7 | 52.6 | 36.1 | 52.3 | 30.9 | 36.7 |
| Skilled | | | | | | | | | | | | |
| Semi-skilled white collar | 20.3 | 32.4 | 28.9 | 13.2 | 14.8 | 14.0 | 26.0 | 21.6 | 20.1 | 15.1 | 25.6 | 30.9 |
| Semi-skilled blue collar | 17.7 | 19.3 | 19.8 | 18.8 | 20.8 | 22.2 | 12.9 | 23.5 | 20.2 | 16.6 | 16.5 | 21.8 |
| Elementary | 48.0 | 35.8 | 40.5 | 39.9 | 47.4 | 48.9 | 49.8 | 44.5 | 43.2 | 52.1 | 45.6 | 36.3 |
| Parental education | 14.0 | 12.4 | 10.9 | 28.1 | 17.0 | 14.8 | 11.3 | 10.4 | 16.5 | 16.2 | 12.3 | 10.9 |
| Number of siblings | 1.9 | 1.8 | 2.1 | 2.5 | 1.5 | 1.4 | 1.5 | 1.9 | 2.0 | 1.5 | 2.8 | 3.0 |
| Cognitive | | | | | | | | | | | | |
| Literacy | 264.8 | 285.2 | 280.0 | 214.1 | 257.9 | 262.5 | 282.5 | 303.3 | 262.0 | 251.4 | 263.1 | 249.9 |
| Numeracy | 267.5 | 284.3 | 267.2 | 207.0 | 253.8 | 265.4 | 278.5 | 290.2 | 258.1 | 253.0 | 251.1 | 244.9 |
| Noncognitive | | | | | | | | | | | | |
| Agreeableness | 0.191 | 0.338 | 0.211 | 0.105 | 0.141 | 0.194 | 0.271 | 0.164 | 0.158 | 0.188 | 0.347 | 0.156 |
| Conscientiousness | 0.185 | 0.199 | 0.146 | 0.169 | 0.157 | 0.022 | 0.181 | 0.085 | 0.183 | 0.164 | 0.165 | 0.160 |
| Extraversion | 0.078 | -0.017 | 0.035 | 0.029 | -0.033 | 0.000 | 0.113 | 0.063 | 0.059 | 0.002 | -0.035 | 0.081 |
| Emotional stability | -0.125 | -0.181 | -0.224 | -0.186 | -0.151 | -0.227 | -0.113 | -0.121 | -0.277 | -0.233 | -0.162 | -0.151 |
| Open-mindedness | -0.075 | -0.044 | 0.012 | 0.038 | 0.158 | -0.055 | 0.086 | 0.024 | 0.000 | 0.014 | -0.128 | 0.053 |
| n | 1,606 | 1,357 | 4,363 | 2,102 | 1,766 | 2,420 | 2,744 | 1,785 | 2,465 | 1,934 | 1,476 | 1,932 |
| N | 2,964 | 2,655 | 8,002 | 3,578 | 3,265 | 4,074 | 5,093 | 3,405 | 4,717 | 3,678 | 2,544 | 3,885 |

Table A3.2. Descriptive statistics of covariates (Continued)

| Gender | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Males** | | | | | | | | | | | |
| Education levels | | | | | | | | | | | |
| Primary | 38.2 | 11.3 | 13.3 | 21.9 | 8.6 | 51.3 | 9.0 | 11.8 | 36.3 | 3.7 | 14.4 |
| Secondary | 43.7 | 52.3 | 52.8 | 39.0 | 68.5 | 26.4 | 36.1 | 63.4 | 21.9 | 44.6 | 43.7 |
| Tertiary | 18.1 | 36.4 | 34.0 | 39.1 | 22.9 | 22.3 | 54.9 | 24.9 | 41.8 | 51.7 | 41.9 |
| Parental education | | | | | | | | | | | |
| Neither parent has upper secondary | 65.3 | 14.6 | 21.7 | 33.1 | 18.1 | 74.3 | 49.9 | 17.5 | 60.1 | 11.9 | 26.2 |
| At least one parent has secondary | 27.9 | 52.7 | 40.5 | 27.9 | 72.7 | 13.9 | 31.6 | 66.5 | 20.1 | 59.0 | 46.4 |
| At least one parent has tertiary | 6.7 | 32.8 | 37.8 | 39.1 | 9.2 | 11.8 | 18.5 | 16.0 | 19.8 | 29.1 | 27.4 |
| Age | | | | | | | | | | | |
| Age 25-34 | 19.2 | 23.0 | 23.5 | 27.3 | 22.8 | 16.7 | 26.4 | 22.6 | 18.5 | 24.8 | 25.1 |
| Age 35-44 | 21.9 | 26.9 | 24.5 | 20.3 | 30.1 | 22.8 | 21.4 | 27.8 | 22.6 | 21.4 | 21.5 |
| Age 45-54 | 28.4 | 25.2 | 25.4 | 24.3 | 23.5 | 28.9 | 22.0 | 25.3 | 29.6 | 23.4 | 24.7 |
| Age 55 plus | 30.6 | 24.9 | 26.7 | 28.1 | 23.6 | 31.6 | 30.2 | 24.3 | 29.3 | 30.5 | 28.7 |
| Books | | | | | | | | | | | |
| Books >100 | 81.8 | 46.3 | 73.6 | 62.2 | 84.4 | 82.2 | 91.0 | 74.3 | 71.2 | 55.8 | 63.8 |
| Parental OCC | 18.2 | 53.7 | 26.4 | 37.8 | 15.6 | 17.8 | 9.0 | 25.7 | 28.8 | 44.2 | 36.2 |
| Skilled | | | | | | | | | | | |
| Semi-skilled white collar | 16.8 | 23.9 | 19.5 | 26.5 | 11.3 | 18.6 | 28.1 | 16.4 | 18.6 | 33.2 | 27.4 |
| Semi-skilled blue collar | 21.3 | 14.7 | 10.8 | 15.2 | 9.2 | 21.4 | 24.1 | 16.0 | 20.7 | 23.4 | 26.1 |
| Elementary | 37.8 | 44.3 | 45.4 | 46.3 | 68.7 | 40.3 | 32.9 | 51.0 | 41.3 | 34.2 | 31.3 |
| Parental education | 24.1 | 17.1 | 24.4 | 12.0 | 10.8 | 19.7 | 14.9 | 16.7 | 19.3 | 9.2 | 15.1 |
| Number of siblings | 1.7 | 1.3 | 1.6 | 2.3 | 1.9 | 1.9 | 2.3 | 1.9 | 2.0 | 1.8 | 1.8 |
| Cognitive | | | | | | | | | | | |
| Literacy | 245.5 | 244.1 | 233.5 | 262.6 | 232.1 | 237.9 | 254.7 | 254.1 | 253.4 | 281.9 | 278.8 |
| Numeracy | 250.2 | 266.3 | 245.4 | 264.3 | 236.8 | 247.8 | 276.1 | 261.7 | 260.7 | 301.4 | 279.8 |
| Noncognitive | | | | | | | | | | | |
| Agreeableness | -0.151 | -0.181 | -0.157 | -0.231 | -0.227 | -0.088 | -0.157 | -0.140 | -0.066 | -0.167 | -0.199 |
| Conscientiousness | 0.006 | 0.040 | -0.006 | 0.019 | -0.023 | -0.048 | 0.014 | 0.088 | -0.076 | -0.056 | -0.034 |
| Extraversion | 0.063 | -0.020 | -0.063 | 0.025 | 0.075 | -0.097 | 0.044 | 0.090 | -0.076 | -0.027 | -0.026 |
| Emotional stability | 0.228 | 0.274 | 0.113 | 0.146 | 0.119 | 0.206 | 0.125 | 0.193 | 0.188 | 0.254 | 0.168 |
| Open-mindedness | -0.068 | -0.112 | -0.136 | -0.023 | -0.200 | -0.126 | -0.092 | -0.109 | -0.072 | -0.008 | 0.009 |
| n | 1,097 | 2,288 | 1,960 | 1,102 | 2,053 | 825 | 1,610 | 1,970 | 1,992 | 1,809 | 1,528 |

| Gender | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Females** | | | | | | | | | | | |
| Education levels | | | | | | | | | | | |
| Primary | 33.7 | 9.7 | 7.4 | 19.9 | 5.2 | 46.5 | 9.9 | 9.7 | 32.0 | 6.0 | 11.3 |
| Secondary | 42.7 | 37.3 | 42.6 | 32.2 | 59.7 | 23.8 | 33.8 | 56.5 | 21.6 | 54.4 | 44.1 |
| Tertiary | 23.6 | 53.0 | 50.0 | 47.9 | 35.1 | 29.8 | 56.3 | 33.8 | 46.3 | 39.6 | 44.6 |
| Parental education | | | | | | | | | | | |
| Neither parent has upper secondary | 66.0 | 15.4 | 25.4 | 39.9 | 20.4 | 77.3 | 51.0 | 19.7 | 60.7 | 12.3 | 28.7 |
| At least one parent has secondary | 26.7 | 55.2 | 40.7 | 23.7 | 70.1 | 13.6 | 32.6 | 66.1 | 19.7 | 59.6 | 46.2 |
| At least one parent has tertiary | 7.2 | 29.4 | 33.9 | 36.4 | 9.5 | 9.2 | 16.5 | 14.2 | 19.6 | 28.1 | 25.2 |
| Age | | | | | | | | | | | |
| Age 25-34 | 18.6 | 22.0 | 21.7 | 24.9 | 22.4 | 16.4 | 26.5 | 21.7 | 17.1 | 24.3 | 25.3 |
| Age 35-44 | 20.8 | 25.8 | 21.5 | 23.5 | 27.6 | 22.4 | 19.8 | 27.3 | 22.7 | 22.0 | 21.5 |
| Age 45-54 | 28.8 | 26.0 | 25.9 | 23.5 | 24.2 | 28.6 | 21.4 | 24.7 | 29.4 | 24.6 | 24.7 |
| Age 55 plus | 31.9 | 26.2 | 30.9 | 28.2 | 25.8 | 32.6 | 32.3 | 26.3 | 30.8 | 29.1 | 28.5 |
| Books | | | | | | | | | | | |
| Books >100 | 81.1 | 41.6 | 72.5 | 58.0 | 83.0 | 83.2 | 91.0 | 68.8 | 70.9 | 56.6 | 61.0 |
| Parental OCC | 18.9 | 58.4 | 27.5 | 42.0 | 17.0 | 16.8 | 9.0 | 31.2 | 29.1 | 43.4 | 39.0 |
| Skilled | | | | | | | | | | | |
| Semi-skilled white collar | 18.4 | 23.6 | 19.2 | 27.0 | 10.1 | 14.3 | 25.9 | 16.2 | 20.4 | 29.9 | 28.2 |
| Semi-skilled blue collar | 19.8 | 13.3 | 11.2 | 19.2 | 10.0 | 18.4 | 25.9 | 15.7 | 18.4 | 25.9 | 23.4 |
| Elementary | 37.6 | 43.7 | 43.4 | 38.7 | 67.9 | 43.1 | 30.7 | 51.2 | 41.8 | 32.3 | 33.8 |
| Parental education | 24.3 | 19.4 | 26.2 | 15.1 | 12.0 | 24.2 | 17.6 | 16.9 | 19.4 | 11.9 | 14.6 |
| Number of siblings | 1.7 | 1.4 | 1.6 | 2.4 | 2.0 | 2.1 | 2.5 | 1.8 | 2.0 | 1.8 | 1.8 |
| Cognitive | | | | | | | | | | | |
| Literacy | 247.6 | 248.1 | 238.9 | 276.2 | 236.1 | 235.3 | 257.1 | 254.7 | 252.1 | 279.5 | 275.1 |
| Numeracy | 242.2 | 258.2 | 242.9 | 256.5 | 237.4 | 236.9 | 270.1 | 260.0 | 250.9 | 282.8 | 263.1 |
| Noncognitive | | | | | | | | | | | |
| Agreeableness | 0.149 | 0.244 | 0.160 | 0.200 | 0.226 | 0.166 | 0.120 | 0.221 | 0.090 | 0.194 | 0.252 |
| Conscientiousness | 0.130 | 0.086 | 0.060 | 0.208 | 0.084 | 0.237 | 0.164 | 0.055 | 0.229 | 0.078 | 0.195 |
| Extraversion | -0.031 | 0.043 | 0.036 | -0.001 | -0.064 | 0.001 | -0.079 | -0.077 | 0.022 | 0.045 | -0.029 |
| Emotional stability | -0.229 | -0.229 | -0.126 | -0.066 | -0.139 | -0.191 | -0.046 | -0.132 | -0.225 | -0.142 | -0.194 |
| Open-mindedness | 0.026 | 0.078 | 0.051 | -0.011 | 0.110 | -0.041 | -0.063 | 0.104 | 0.008 | -0.087 | -0.120 |
| n | 1,154 | 3,315 | 3,276 | 1,588 | 2,171 | 1,154 | 1,526 | 2,440 | 2,313 | 1,823 | 2,039 |
| N | 2,251 | 5,603 | 5,236 | 2,690 | 4,224 | 1,979 | 3,136 | 4,410 | 4,305 | 3,632 | 3,567 |

Table A. 3.3. Gender differences in measures of educational mobility, cognitive and noncognitive skills

| Country | Measures of mobility | | | | Cognitive skills | | Noncognitive skills | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-BETA | 1-COR | Downward | Upward | Literacy | Numeracy | Agreeabl. | Consc. | Extrav. | Emot. S. | Open-m. |
| Austria | -0.115*** | -0.042*** | 1.54* | -1.86 | 1.50 | -15.52*** | 0.47*** | 0.26*** | 0.14*** | -0.35*** | 0.00 |
| Belgium | -0.006 | -0.052 | -6.66*** | 4.91** | -0.10 | -11.80*** | 0.57*** | 0.22*** | -0.01 | -0.40*** | -0.04 |
| Canada | 0.068* | -0.005* | -7.05*** | 8.50*** | 1.80*** | -14.90*** | 0.39*** | 0.18*** | 0.03 | -0.42*** | 0.05 |
| Chile | 0.026 | 0.029 | -2.07 | 4.81** | 0.59* | -8.11*** | 0.13*** | 0.23*** | 0.02 | -0.35*** | 0.08 |
| Croatia | -0.092*** | -0.077*** | -3.28*** | 3.58 | 6.92*** | 0.76 | 0.25*** | 0.17*** | -0.03 | -0.28*** | 0.39*** |
| Czech Republic | -0.079* | -0.041* | -1.74*** | 4.43*** | -1.80* | -13.71*** | 0.32*** | -0.12* | 0.00* | -0.47*** | -0.04 |
| Estonia | -0.004 | -0.015 | -12.62*** | 12.21*** | 11.44*** | -7.66*** | 0.47*** | 0.29*** | 0.20*** | -0.28*** | 0.20*** |
| Finland | 0.057* | 0.025* | -7.55*** | 13.61*** | 8.71*** | -10.27*** | 0.30*** | 0.07* | 0.16*** | -0.32*** | 0.05 |
| France | -0.005 | -0.009 | -2.43** | 5.65*** | 3.80*** | -11.09*** | 0.33*** | 0.19*** | 0.11*** | -0.53*** | 0.10*** |
| Hungary | -0.046* | -0.018* | -4.10*** | 9.86*** | 5.74*** | -4.88*** | 0.29*** | 0.16*** | 0.03 | -0.47*** | 0.11*** |
| Ireland | 0.054 | -0.012* | -4.33*** | 9.88*** | 3.21 | -12.13*** | 0.51*** | 0.12*** | 0.05 | -0.39*** | -0.04 |
| Israel | 0.020 | -0.119 | -8.79*** | 8.35*** | 6.35** | -6.08*** | 0.22*** | 0.20*** | 0.16*** | -0.31*** | 0.12*** |
| Italy | 0.070 | 0.054 | 0.43 | 7.30** | 2.05 | -7.98*** | 0.30*** | 0.12** | -0.09** | -0.46*** | 0.09** |
| Latvia | -0.055* | -0.076* | -9.91*** | 12.08*** | 3.99*** | -8.14 | 0.42*** | 0.05*** | 0.06*** | -0.50*** | 0.19*** |
| Lithuania | -0.043 | -0.040** | -11.73*** | 11.01*** | 5.47** | -2.52*** | 0.32*** | 0.07*** | 0.10*** | -0.24*** | 0.19*** |
| New Zealand | 0.031 | 0.028 | -5.08** | 5.70*** | 13.59** | -7.80*** | 0.43*** | 0.19*** | -0.03 | -0.21*** | 0.01 |
| Poland | 0.011 | -0.027 | -2.69*** | 12.97*** | 4.02** | 0.56 | 0.45*** | 0.11*** | -0.14*** | -0.26*** | 0.31*** |
| Portugal | -0.064 | 0.015 | -3.53*** | 8.03*** | -2.60 | -10.90*** | 0.25*** | 0.28*** | 0.10** | -0.40*** | 0.09* |
| Singapore | -0.045** | -0.053** | -1.35** | 2.91 | 2.40 | -5.97*** | 0.28*** | 0.15*** | -0.12*** | -0.17*** | 0.03 |
| Slovak Republic | -0.036 | 0.009 | -3.91*** | 11.00*** | 0.57 | -1.65 | 0.36*** | -0.03 | -0.17*** | -0.32*** | 0.21*** |
| Spain | -0.020 | 0.006 | -1.42 | 4.21** | -1.34 | -9.77*** | 0.16*** | 0.30*** | 0.10*** | -0.41*** | 0.08* |
| Switzerland | -0.044 | -0.067 | 3.07** | -7.12*** | -2.38 | -18.54*** | 0.36*** | 0.13*** | 0.07** | -0.40*** | -0.08 |
| United Kingdom | 0.027 | -0.035 | -3.27 | 4.70 | -3.70** | -16.77*** | 0.45*** | 0.23*** | 0.00 | -0.36*** | -0.13*** |

Notes: Significance level gap *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.4. Logit estimation of upward mobility for females

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | 0.179*** | 0.186*** | 0.819*** | 0.379*** | 0.057*** | -0.246*** | 0.397*** | 0.785*** | 0.230*** | 0.366*** | 0.531*** | 0.098*** |
| | (0.005) | (0.006) | (0.003) | (0.003) | (0.007) | (0.004) | (0.012) | (0.006) | (0.002) | (0.004) | (0.007) | (0.005) |
| Age 45-54 | 0.087*** | 0.902*** | 0.912*** | 0.588*** | -0.127*** | -0.606*** | 0.832*** | 1.453*** | 0.494*** | 0.214*** | 0.483*** | 0.125*** |
| | (0.005) | (0.006) | (0.003) | (0.003) | (0.007) | (0.005) | (0.013) | (0.007) | (0.002) | (0.004) | (0.007) | (0.005) |
| Age 55 plus | 0.513*** | 1.221*** | 1.259*** | 0.187*** | 0.109*** | -0.235*** | 1.901*** | 1.890*** | 0.586*** | 0.788*** | 0.813*** | 0.116*** |
| | (0.005) | (0.006) | (0.003) | (0.003) | (0.007) | (0.005) | (0.014) | (0.007) | (0.002) | (0.004) | (0.007) | (0.006) |
| Books (Yes) | -0.431*** | -0.532*** | -0.581*** | -0.959*** | -0.756*** | -0.167*** | -0.494*** | -0.577*** | -0.539*** | -0.202*** | -0.850*** | -0.568*** |
| | (0.004) | (0.005) | (0.002) | (0.004) | (0.008) | (0.003) | (0.009) | (0.004) | (0.001) | (0.003) | (0.005) | (0.004) |
| Semi-skilled white | 0.556*** | 1.647*** | 0.947*** | 1.317*** | 1.668*** | 0.639*** | 1.187*** | 1.539*** | 1.194*** | 1.581*** | 1.047*** | 1.871*** |
| | (0.006) | (0.006) | (0.003) | (0.004) | (0.011) | (0.006) | (0.015) | (0.007) | (0.002) | (0.006) | (0.007) | (0.006) |
| Semi-skilled blue | 0.741*** | 2.303*** | 1.243*** | 1.704*** | 1.677*** | 0.895*** | 1.657*** | 1.841*** | 1.548*** | 2.092*** | 1.174*** | 1.737*** |
| | (0.005) | (0.006) | (0.003) | (0.004) | (0.011) | (0.005) | (0.012) | (0.006) | (0.002) | (0.005) | (0.006) | (0.005) |
| Elementary | 0.973*** | 2.352*** | 1.872*** | 1.626*** | 2.330*** | 1.048*** | 1.827*** | 1.558*** | 1.710*** | 2.499*** | 1.251*** | 2.181*** |
| | (0.007) | (0.007) | (0.003) | (0.004) | (0.012) | (0.006) | (0.016) | (0.008) | (0.002) | (0.007) | (0.008) | (0.007) |
| N. of siblings | 0.038*** | -0.066*** | -0.100*** | -0.049*** | -0.105*** | 0.056*** | -0.030*** | -0.072*** | -0.038*** | -0.162*** | -0.056*** | 0.302*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) | (0.004) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) |
| Literacy | -0.008*** | 0.001*** | -0.005*** | 0.001*** | -0.003*** | 0.000 | 0.002*** | 0.004*** | 0.007*** | 0.006*** | 0.007*** | -0.008*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | 0.021*** | 0.006*** | 0.010*** | 0.008*** | 0.006*** | 0.013*** | 0.006*** | 0.005*** | 0.003*** | 0.005*** | -0.002*** | 0.011*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | 0.009*** | -0.046*** | -0.007*** | 0.008*** | 0.026*** | 0.110*** | -0.049*** | 0.006*** | 0.017*** | 0.082*** | -0.072*** | 0.011*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) |
| Conscientiousness | 0.083*** | 0.061*** | 0.252*** | 0.032*** | 0.098*** | 0.075*** | 0.071*** | 0.217*** | 0.056*** | 0.064*** | 0.116*** | -0.048*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.004) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) |
| Extraversion | -0.011*** | 0.054*** | -0.092*** | 0.108*** | -0.116*** | -0.093*** | 0.089*** | -0.046*** | -0.058*** | -0.136*** | 0.143*** | 0.069*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.004) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) |
| Emot. S. | 0.084*** | -0.071*** | 0.090*** | 0.168*** | 0.063*** | -0.076*** | 0.072*** | 0.123*** | 0.047*** | 0.156*** | 0.121*** | 0.026*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) |
| Open-mindedness | 0.163*** | 0.144*** | -0.040*** | 0.020*** | 0.223*** | 0.169*** | 0.005 | -0.057*** | 0.041*** | 0.143*** | 0.097*** | 0.121*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) |
| Intercept | -5.046*** | -4.348*** | -3.327*** | -3.549*** | -2.606*** | -5.473*** | -4.236*** | -4.884*** | -3.872*** | -4.921*** | -2.106*** | -2.917*** |
| | (0.017) | (0.018) | (0.008) | (0.008) | (0.020) | (0.014) | (0.036) | (0.021) | (0.006) | (0.013) | (0.019) | (0.016) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A3.4. Logit estimation of upward mobility for females (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | 0.228*** | 0.530*** | 0.042*** | 0.049*** | 0.317*** | 0.316*** | 0.609*** | 0.009* | 0.305*** | 0.092*** | 0.380*** |
| | (0.002) | (0.010) | (0.009) | (0.008) | (0.002) | (0.006) | (0.008) | (0.005) | (0.002) | (0.006) | (0.002) |
| Age 45-54 | 0.161*** | 0.412*** | 0.616*** | -0.061*** | 0.073*** | -0.354*** | 0.904*** | 0.026*** | 0.397*** | 0.014** | 0.782*** |
| | (0.002) | (0.011) | (0.009) | (0.008) | (0.002) | (0.005) | (0.009) | (0.005) | (0.002) | (0.006) | (0.002) |
| Age 55 plus | -0.271*** | 0.946*** | 1.339*** | 0.300*** | 0.489*** | -0.559*** | 0.641*** | 0.279*** | 0.258*** | 0.094*** | 1.057*** |
| | (0.002) | (0.011) | (0.009) | (0.008) | (0.002) | (0.006) | (0.009) | (0.006) | (0.002) | (0.006) | (0.002) |
| Books (Yes) | -0.391*** | -0.471*** | -0.537*** | -0.783*** | 0.188*** | -1.207*** | -0.941*** | -0.269*** | -0.542*** | -0.425*** | -0.515*** |
| | (0.002) | (0.008) | (0.007) | (0.006) | (0.002) | (0.006) | (0.009) | (0.004) | (0.002) | (0.004) | (0.002) |
| Semi-skilled white | 0.780*** | 1.185*** | 1.360*** | 1.007*** | 0.915*** | 1.166*** | 0.713*** | 0.383*** | 0.824*** | 0.847*** | 0.238*** |
| | (0.002) | (0.012) | (0.012) | (0.009) | (0.003) | (0.006) | (0.007) | (0.007) | (0.002) | (0.006) | (0.002) |
| Semi-skilled blue | 0.841*** | 1.447*** | 1.641*** | 0.998*** | 0.960*** | 0.956*** | 1.138*** | 0.751*** | 1.313*** | 1.186*** | 0.682*** |
| | (0.002) | (0.010) | (0.010) | (0.007) | (0.003) | (0.006) | (0.008) | (0.006) | (0.002) | (0.006) | (0.002) |
| Elementary | 0.670*** | 1.886*** | 2.275*** | 0.890*** | 0.926*** | 1.001*** | 0.655*** | 0.569*** | 1.067*** | 1.693*** | 0.973*** |
| | (0.002) | (0.012) | (0.011) | (0.009) | (0.003) | (0.007) | (0.009) | (0.007) | (0.002) | (0.007) | (0.002) |
| N. of siblings | -0.208*** | -0.124*** | -0.024*** | -0.164*** | 0.105*** | -0.408*** | 0.077*** | 0.056*** | -0.133*** | 0.114*** | 0.075*** |
| | (0.001) | (0.003) | (0.003) | (0.003) | (0.001) | (0.001) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Literacy | 0.001*** | -0.003*** | 0.004*** | 0.000 | -0.004*** | 0.010*** | 0.001*** | 0.011*** | 0.005*** | 0.002*** | 0.002*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | 0.010*** | 0.011*** | 0.002*** | 0.005*** | 0.005*** | 0.009*** | 0.007*** | 0.000* | 0.011*** | 0.007*** | 0.005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | -0.055*** | 0.192*** | 0.120*** | -0.009*** | 0.042*** | -0.137*** | -0.089*** | -0.014*** | 0.088*** | -0.006*** | 0.032*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Conscientiousness | -0.074*** | 0.100*** | 0.032*** | 0.060*** | 0.123*** | 0.015*** | 0.182*** | 0.085*** | 0.001 | 0.040*** | 0.057*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Extraversion | 0.004*** | 0.017*** | 0.004 | 0.024*** | 0.117*** | -0.004** | 0.096*** | -0.056*** | -0.055*** | 0.126*** | 0.076*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Emot. S. | 0.050*** | 0.068*** | 0.065*** | -0.063*** | 0.151*** | 0.064*** | -0.104*** | 0.068*** | 0.162*** | 0.072*** | 0.012*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Open-mindedness | 0.179*** | 0.188*** | 0.098*** | 0.045*** | 0.173*** | 0.279*** | -0.037*** | 0.162*** | 0.285*** | 0.070*** | 0.157*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Intercept | -3.186*** | -3.677*** | -3.939*** | -1.805*** | -2.035*** | -4.481*** | -2.764*** | -4.068*** | -5.118*** | -4.054*** | -3.056*** |
| | (0.005) | (0.028) | (0.024) | (0.021) | (0.006) | (0.015) | (0.020) | (0.017) | (0.006) | (0.018) | (0.006) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.5. Logit estimation of upward mobility for males

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | 0.135*** | 0.232*** | 0.306*** | 0.155*** | 0.189*** | -0.382*** | 0.134*** | 0.683*** | 0.342*** | 0.322*** | 0.062*** | 0.631*** |
| | (0.005) | (0.006) | (0.003) | (0.003) | (0.008) | (0.005) | (0.014) | (0.007) | (0.002) | (0.005) | (0.007) | (0.005) |
| Age 45-54 | 0.638*** | 1.033*** | 0.979*** | 0.453*** | 0.429*** | -0.128*** | 0.813*** | 1.780*** | 0.896*** | 0.435*** | 0.522*** | 0.896*** |
| | (0.005) | (0.006) | (0.003) | (0.003) | (0.008) | (0.005) | (0.014) | (0.007) | (0.002) | (0.005) | (0.007) | (0.005) |
| Age 55 plus | 1.026*** | 1.431*** | 1.108*** | 0.573*** | 1.231*** | 0.648*** | 1.808*** | 2.346*** | 0.852*** | 1.305*** | 0.251*** | 1.034*** |
| | (0.005) | (0.006) | (0.003) | (0.004) | (0.008) | (0.005) | (0.015) | (0.007) | (0.002) | (0.005) | (0.007) | (0.006) |
| Books (Yes) | -0.760*** | -0.397*** | -0.616*** | -0.453*** | -0.599*** | -0.100*** | -0.597*** | -0.446*** | -0.763*** | -0.330*** | -0.578*** | -0.520*** |
| | (0.004) | (0.005) | (0.002) | (0.004) | (0.010) | (0.004) | (0.010) | (0.005) | (0.002) | (0.003) | (0.006) | (0.005) |
| Semi-skilled white | 0.799*** | 1.204*** | 0.946*** | 0.721*** | 0.668*** | 0.559*** | 1.082*** | 1.244*** | 1.003*** | 1.459*** | 1.014*** | 1.009*** |
| | (0.006) | (0.006) | (0.003) | (0.004) | (0.011) | (0.006) | (0.017) | (0.007) | (0.002) | (0.007) | (0.008) | (0.006) |
| Semi-skilled blue | 0.317*** | 1.783*** | 1.153*** | 1.498*** | 0.855*** | 0.849*** | 1.538*** | 1.695*** | 1.514*** | 2.020*** | 1.179*** | 1.624*** |
| | (0.005) | (0.005) | (0.003) | (0.004) | (0.010) | (0.006) | (0.013) | (0.007) | (0.002) | (0.006) | (0.006) | (0.006) |
| Elementary | 0.845*** | 1.971*** | 1.519*** | 1.589*** | 1.398*** | 1.199*** | 1.946*** | 1.955*** | 1.878*** | 2.564*** | 1.025*** | 1.735*** |
| | (0.007) | (0.007) | (0.004) | (0.004) | (0.011) | (0.007) | (0.017) | (0.009) | (0.002) | (0.007) | (0.008) | (0.008) |
| N. of siblings | 0.083*** | -0.062*** | 0.022*** | -0.103*** | 0.102*** | -0.122*** | -0.023*** | -0.139*** | -0.029*** | -0.093*** | -0.037*** | 0.199*** |
| | (0.001) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.004) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) |
| Literacy | -0.012*** | -0.000*** | -0.004*** | -0.006*** | -0.001*** | 0.003*** | -0.001** | -0.003*** | 0.003*** | 0.005*** | 0.009*** | -0.005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | 0.019*** | 0.012*** | 0.011*** | 0.015*** | 0.005*** | 0.013*** | 0.008*** | 0.017*** | 0.008*** | 0.005*** | 0.002*** | 0.006*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | 0.128*** | 0.163*** | 0.124*** | 0.052*** | -0.012*** | 0.100*** | 0.008 | -0.090*** | 0.082*** | 0.044*** | -0.049*** | -0.093*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) |
| Conscientiousness | -0.116*** | 0.153*** | 0.104*** | 0.124*** | 0.009*** | 0.134*** | 0.079*** | 0.129*** | 0.119*** | -0.008*** | 0.104*** | 0.136*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) |
| Extraversion | 0.061*** | -0.031*** | 0.018*** | 0.106*** | 0.076*** | -0.099*** | 0.030*** | -0.042*** | 0.118*** | 0.006*** | -0.027*** | 0.100*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) |
| Emot. S. | 0.030*** | 0.003 | -0.059*** | 0.060*** | 0.006** | -0.075*** | 0.006 | -0.078*** | -0.090*** | 0.050*** | -0.002 | 0.000 |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.002) | (0.002) |
| Open-mindedness | 0.053*** | 0.030*** | -0.052*** | 0.067*** | 0.013*** | 0.001 | 0.060*** | 0.099*** | -0.027*** | 0.040*** | 0.045*** | 0.022*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.003) | (0.002) | (0.005) | (0.002) | (0.001) | (0.002) | (0.002) | (0.002) |
| Intercept | -3.781*** | -5.898*** | -4.160*** | -3.685*** | -3.337*** | -6.837*** | -4.618*** | -7.023*** | -4.718*** | -5.335*** | -4.193*** | -3.172*** |
| | (0.015) | (0.017) | (0.008) | (0.008) | (0.021) | (0.016) | (0.038) | (0.021) | (0.006) | (0.013) | (0.019) | (0.014) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A.3.5. Logit estimation of upward mobility for males (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | -0.198*** | 0.377*** | -0.116*** | -0.468*** | 0.237*** | 0.402*** | 0.198*** | -0.123*** | 0.389*** | 0.309*** | 0.130*** |
| | (0.002) | (0.012) | (0.011) | (0.010) | (0.002) | (0.006) | (0.007) | (0.006) | (0.002) | (0.006) | (0.002) |
| Age 45-54 | 0.022*** | 0.736*** | 0.874*** | 0.720*** | 0.215*** | 0.312*** | 1.159*** | 0.026*** | 0.610*** | 0.587*** | 0.576*** |
| | (0.002) | (0.012) | (0.010) | (0.009) | (0.002) | (0.006) | (0.008) | (0.006) | (0.002) | (0.006) | (0.002) |
| Age 55 plus | -0.193*** | 1.392*** | 1.589*** | 1.026*** | 0.847*** | -0.090*** | 0.499*** | 0.777*** | 0.815*** | 0.774*** | 0.590*** |
| | (0.002) | (0.013) | (0.010) | (0.009) | (0.002) | (0.006) | (0.008) | (0.006) | (0.002) | (0.006) | (0.002) |
| Books (Yes) | -0.642*** | -0.357*** | -0.252*** | -0.792*** | 0.406*** | -0.828*** | -0.948*** | 0.074*** | -0.462*** | -0.639*** | -0.562*** |
| | (0.002) | (0.008) | (0.008) | (0.007) | (0.003) | (0.006) | (0.009) | (0.005) | (0.002) | (0.004) | (0.002) |
| Semi-skilled white | 0.183*** | 1.359*** | 1.296*** | 1.207*** | 1.516*** | 0.943*** | 0.684*** | 0.815*** | 0.692*** | 0.970*** | 0.808*** |
| | (0.002) | (0.016) | (0.015) | (0.010) | (0.004) | (0.006) | (0.007) | (0.008) | (0.002) | (0.005) | (0.002) |
| Semi-skilled blue | 0.434*** | 1.703*** | 1.563*** | 0.885*** | 1.464*** | 0.938*** | 1.012*** | 1.041*** | 1.124*** | 1.030*** | 0.775*** |
| | (0.002) | (0.013) | (0.012) | (0.008) | (0.004) | (0.006) | (0.007) | (0.007) | (0.002) | (0.005) | (0.002) |
| Elementary | 0.515*** | 2.110*** | 2.207*** | 0.981*** | 1.628*** | 0.577*** | 0.863*** | 1.056*** | 1.051*** | 1.760*** | 0.980*** |
| | (0.002) | (0.015) | (0.013) | (0.011) | (0.004) | (0.007) | (0.008) | (0.008) | (0.003) | (0.008) | (0.002) |
| N. of siblings | -0.157*** | -0.068*** | 0.147*** | -0.056*** | 0.037*** | -0.194*** | 0.118*** | 0.142*** | -0.248*** | -0.017*** | 0.119*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Literacy | 0.003*** | 0.007*** | -0.001*** | -0.003*** | -0.003*** | 0.003*** | -0.004*** | 0.003*** | 0.006*** | 0.000 | 0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | 0.004*** | 0.000 | 0.007*** | 0.009*** | 0.005*** | 0.014*** | 0.009*** | 0.004*** | 0.010*** | 0.010*** | 0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | 0.033*** | 0.013*** | 0.132*** | 0.141*** | 0.195*** | 0.042*** | 0.027*** | 0.000 | -0.035*** | 0.121*** | 0.158*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Conscientiousness | 0.007*** | 0.149*** | 0.053*** | -0.053*** | 0.149*** | 0.112*** | 0.019*** | 0.096*** | 0.069*** | 0.135*** | 0.142*** |
| | (0.001) | (0.004) | (0.004) | (0.004) | (0.001) | (0.002) | (0.003) | (0.003) | (0.001) | (0.002) | (0.001) |
| Extraversion | 0.009*** | -0.082*** | 0.106*** | 0.295*** | 0.110*** | -0.213*** | 0.089*** | -0.014*** | -0.145*** | 0.015*** | 0.027*** |
| | (0.001) | (0.004) | (0.004) | (0.004) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Emot. S. | 0.080*** | 0.073*** | 0.045*** | -0.112*** | 0.037*** | 0.054*** | 0.019*** | 0.012*** | 0.089*** | 0.145*** | -0.059*** |
| | (0.001) | (0.005) | (0.004) | (0.004) | (0.001) | (0.002) | (0.003) | (0.003) | (0.001) | (0.002) | (0.001) |
| Open-mindedness | 0.276*** | 0.125*** | 0.056*** | 0.056*** | 0.110*** | 0.323*** | 0.116*** | 0.229*** | 0.146*** | 0.039*** | 0.174*** |
| | (0.001) | (0.004) | (0.004) | (0.003) | (0.001) | (0.002) | (0.003) | (0.002) | (0.001) | (0.002) | (0.001) |
| Intercept | -2.310*** | -4.539*** | -4.989*** | -3.018*** | -3.003*** | -5.488*** | -2.263*** | -4.422*** | -5.164*** | -4.429*** | -3.641*** |
| | (0.005) | (0.030) | (0.027) | (0.024) | (0.006) | (0.015) | (0.017) | (0.018) | (0.006) | (0.017) | (0.006) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.6. Detailed Oaxaca decomposition of upward mobility

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Probability** | | | | | | | | | | | | |
| Females | 0.322*** | 0.426*** | 0.338*** | 0.484*** | 0.384*** | 0.214*** | 0.395*** | 0.505*** | 0.487*** | 0.411*** | 0.509*** | 0.432*** |
| | (0.012) | (0.013) | (0.013) | (0.015) | (0.013) | (0.010) | (0.009) | (0.012) | (0.011) | (0.011) | (0.016) | (0.013) |
| Males | 0.339*** | 0.375*** | 0.259*** | 0.427*** | 0.331*** | 0.169*** | 0.272*** | 0.365*** | 0.423*** | 0.315*** | 0.419*** | 0.338*** |
| | (0.014) | (0.013) | (0.012) | (0.017) | (0.014) | (0.011) | (0.009) | (0.011) | (0.011) | (0.011) | (0.018) | (0.013) |
| Difference | -0.017 | 0.050*** | 0.079*** | 0.057** | 0.053*** | 0.045*** | 0.123*** | 0.140*** | 0.063*** | 0.096*** | 0.090*** | 0.094*** |
| | (0.018) | (0.018) | (0.018) | (0.023) | (0.019) | (0.015) | (0.013) | (0.016) | (0.016) | (0.015) | (0.024) | (0.018) |
| Explained | -0.064*** | -0.023*** | -0.009 | -0.031*** | 0.004 | -0.016*** | 0.002 | -0.018** | 0.005 | 0.000 | -0.016 | -0.003 |
| | (0.010) | (0.009) | (0.009) | (0.008) | (0.008) | (0.006) | (0.008) | (0.009) | (0.009) | (0.007) | (0.013) | (0.007) |
| Unexplained | 0.047** | 0.074*** | 0.088*** | 0.087*** | 0.049** | 0.061*** | 0.121*** | 0.158*** | 0.058*** | 0.096*** | 0.106*** | 0.098*** |
| | (0.020) | (0.020) | (0.019) | (0.024) | (0.021) | (0.015) | (0.015) | (0.018) | (0.018) | (0.017) | (0.026) | (0.019) |
| **Explained part** | | | | | | | | | | | | |
| Age 35-44 | -0.001 | 0.000 | -0.001*** | -0.002* | 0.000 | 0.000* | 0.000 | 0.001*** | 0.000** | 0.000 | 0.001* | 0.001* |
| | (0.001) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.007) | (0.001) | (0.000) |
| Age 45-54 | 0.001** | -0.002*** | -0.002*** | 0.001*** | 0.000 | -0.000** | -0.001 | -0.005*** | -0.002*** | 0.000 | -0.002*** | -0.001** |
| | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.000) |
| Age 55 plus | 0.000*** | 0.002*** | 0.004*** | 0.002** | 0.003*** | 0.000 | 0.006 | 0.009*** | 0.002*** | 0.001 | 0.002*** | 0.000** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.004) | (0.001) | (0.001) | (0.023) | (0.001) | (0.000) |
| Books (Yes) | -0.006*** | -0.002*** | 0.000** | 0.001*** | -0.004*** | -0.001 | -0.001 | -0.002*** | -0.005*** | 0.000 | -0.010*** | 0.001*** |
| | (0.001) | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.002) | (0.010) | (0.002) | (0.000) |
| Semi-skilled white | -0.001*** | -0.003*** | 0.004*** | 0.004*** | -0.005*** | 0.000*** | 0.000 | -0.004*** | -0.001*** | 0.001 | 0.001*** | -0.004*** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.022) | (0.000) | (0.001) |
| Semi-skilled blue | 0.002*** | -0.008*** | -0.000*** | -0.010*** | 0.009*** | -0.004*** | 0.004 | 0.005*** | 0.007*** | -0.001 | -0.003*** | 0.001*** |
| | (0.000) | (0.001) | (0.000) | (0.001) | (0.002) | (0.001) | (0.003) | (0.000) | (0.002) | (0.024) | (0.000) | (0.000) |
| Elementary | -0.003*** | -0.003*** | 0.002*** | 0.009*** | -0.005*** | 0.006*** | 0.000 | 0.004*** | 0.005*** | 0.001 | -0.003*** | 0.010*** |
| | (0.001) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.002) | (0.015) | (0.001) | (0.003) |
| N. of siblings | 0.001 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | -0.000*** | 0.000 | 0.000 | 0.001 | 0.002*** |
| | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) | (0.006) | (0.001) | (0.000) |
| Literacy score | -0.004*** | 0.000 | -0.002 | 0.001 | -0.002 | 0.000 | 0.002 | 0.001 | 0.004*** | 0.002 | 0.008** | -0.005 |
| | (0.001) | (0.000) | (0.001) | (0.001) | (0.003) | (0.001) | (0.003) | (0.003) | (0.002) | (0.033) | (0.004) | (0.003) |
| Numeracy score | -0.058*** | -0.019*** | -0.020** | -0.033*** | -0.000** | -0.025*** | -0.011 | -0.024*** | -0.016* | -0.001 | -0.001 | -0.011** |
| | (0.007) | (0.006) | (0.008) | (0.007) | (0.000) | (0.005) | (0.012) | (0.005) | (0.009) | (0.019) | (0.007) | (0.006) |
| Agreeableness | 0.007 | 0.007 | 0.003 | 0.001 | 0.000 | 0.004 | -0.002 | -0.002 | 0.005 | 0.001 | -0.008 | -0.001 |
| | (0.005) | (0.005) | (0.003) | (0.002) | (0.002) | (0.003) | (0.004) | (0.003) | (0.003) | (0.018) | (0.007) | (0.002) |
| Conscientiousness | -0.001 | 0.004* | 0.004*** | 0.004 | 0.001 | -0.002* | 0.004 | 0.002*** | 0.004** | 0.000 | 0.003* | 0.002 |
| | (0.003) | (0.002) | (0.001) | (0.003) | (0.002) | (0.001) | (0.004) | (0.001) | (0.002) | (0.004) | (0.002) | (0.002) |
| Extraversion | 0.001 | 0.000 | 0.000 | 0.000* | 0.000 | 0.000 | 0.003 | -0.001 | 0.001 | 0.000 | 0.001 | 0.002 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.002) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.002) | (0.001) | (0.001) | (0.003) | (0.001) | (0.001) |
| Emot. S. | -0.002 | 0.002 | -0.001 | -0.009** | -0.002 | 0.005 | -0.002 | -0.002 | 0.002 | -0.002 | -0.005 | -0.001 |
| | (0.004) | (0.004) | (0.003) | (0.004) | (0.003) | (0.004) | (0.003) | (0.003) | (0.005) | (0.047) | (0.005) | (0.003) |
| Open-mindedness | 0.000* | -0.001 | 0.000 | 0.001 | 0.008* | -0.000* | 0.001 | 0.000 | 0.000 | 0.001 | -0.001 | 0.002 |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.005) | (0.000) | (0.002) | (0.000) | (0.001) | (0.011) | (0.001) | (0.001) |
| **Unexplained part** | | | | | | | | | | | | |
| Age 35-44 | 0.002 | -0.002 | 0.024 | 0.013 | -0.008 | 0.005 | 0.014 | 0.005 | -0.006 | 0.002 | 0.029 | -0.030** |
| | (0.012) | (0.015) | (0.016) | (0.017) | (0.018) | (0.010) | (0.012) | (0.013) | (0.012) | (0.012) | (0.021) | (0.014) |
| Age 45-54 | -0.025** | -0.007 | -0.003 | 0.007 | -0.033** | -0.017 | 0.001 | -0.014 | -0.021* | -0.013 | -0.002 | -0.036*** |
| | (0.013) | (0.015) | (0.013) | (0.017) | (0.017) | (0.011) | (0.011) | (0.012) | (0.012) | (0.014) | (0.021) | (0.012) |
| Age 55 plus | -0.031* | -0.014 | 0.008 | -0.019 | -0.068*** | -0.027*** | 0.004 | -0.028 | -0.015 | -0.024** | 0.032 | -0.032*** |
| | (0.017) | (0.019) | (0.019) | (0.016) | (0.018) | (0.010) | (0.010) | (0.017) | (0.013) | (0.012) | (0.021) | (0.010) |
| Books (Yes) | 0.020 | -0.009 | 0.003 | -0.011 | -0.006 | -0.005 | 0.013 | -0.013 | 0.017 | 0.013 | -0.018 | -0.004 |
| | (0.014) | (0.015) | (0.017) | (0.008) | (0.014) | (0.016) | (0.019) | (0.019) | (0.013) | (0.018) | (0.017) | (0.018) |
| Semi-skilled white | -0.008 | 0.019 | 0.000 | 0.025 | 0.052* | 0.002 | 0.002 | 0.014 | 0.008 | 0.004 | 0.001 | 0.039** |
| | (0.011) | (0.014) | (0.010) | (0.016) | (0.029) | (0.011) | (0.007) | (0.013) | (0.011) | (0.011) | (0.013) | (0.015) |
| Semi-skilled blue | 0.038 | 0.042 | 0.007 | 0.019 | 0.090 | 0.003 | 0.011 | 0.012 | 0.003 | 0.008 | -0.001 | 0.008 |
| | (0.028) | (0.026) | (0.022) | (0.033) | (0.057) | (0.023) | (0.020) | (0.023) | (0.020) | (0.035) | (0.029) | (0.021) |
| Elementary | 0.003 | 0.010 | 0.007 | 0.002 | 0.040 | -0.002 | -0.002 | -0.007 | -0.005 | -0.002 | 0.006 | 0.009 |
| | (0.010) | (0.010) | (0.008) | (0.023) | (0.024) | (0.007) | (0.005) | (0.007) | (0.009) | (0.012) | (0.011) | (0.008) |
| N. of siblings | -0.016 | -0.001 | -0.048 | 0.030 | -0.071** | 0.032 | -0.002 | 0.025 | -0.003 | -0.020 | -0.012 | 0.062 |
| | (0.029) | (0.034) | (0.035) | (0.050) | (0.035) | (0.023) | (0.018) | (0.029) | (0.026) | (0.022) | (0.062) | (0.060) |
| Literacy score | 0.198 | 0.109 | -0.013 | 0.341 | -0.175 | -0.099 | 0.131 | 0.433 | 0.220 | 0.042 | -0.128 | -0.189 |
| | (0.261) | (0.354) | (0.301) | (0.304) | (0.295) | (0.188) | (0.209) | (0.271) | (0.247) | (0.239) | (0.393) | (0.220) |
| Numeracy score | 0.103 | -0.403 | -0.059 | -0.349 | 0.051 | -0.001 | -0.121 | -0.683*** | -0.315 | 0.002 | -0.274 | 0.220 |
| | (0.270) | (0.333) | (0.281) | (0.279) | (0.307) | (0.187) | (0.215) | (0.260) | (0.224) | (0.220) | (0.336) | (0.203) |
| Agreeableness | 0.001 | -0.004 | 0.000 | 0.000 | 0.000 | 0.001 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| | (0.001) | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.001) | (0.004) | (0.002) |
| Conscientiousness | 0.002 | -0.002 | 0.001 | -0.002 | 0.002 | -0.001 | 0.000 | 0.001 | -0.001 | 0.001 | 0.000 | -0.004* |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) | (0.000) | (0.001) | (0.002) | (0.002) | (0.004) | (0.002) |
| Extraversion | -0.000* | 0.000 | -0.001 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | -0.001** | 0.000* | -0.001 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) |
| Emot. S. | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.002 | 0.000 | 0.001 | 0.002 | 0.000 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) |
| Open-mindedness | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | -0.001 | 0.000 |
| | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) | (0.001) | (0.002) | (0.001) |
| Intercept | -0.238 | 0.335* | 0.161 | 0.031 | 0.175 | 0.171 | 0.071 | 0.411** | 0.177 | 0.082 | 0.472** | 0.053 |
| | (0.182) | (0.185) | (0.166) | (0.178) | (0.180) | (0.107) | (0.113) | (0.172) | (0.136) | (0.133) | (0.207) | (0.156) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A.3.6. Detailed Oaxaca decomposition of upward mobility (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Probability** | | | | | | | | | | | |
| Females | 0.464*** | 0.403*** | 0.376*** | 0.402*** | 0.421*** | 0.425*** | 0.647*** | 0.358*** | 0.468*** | 0.320*** | 0.433*** |
| | (0.016) | (0.011) | (0.010) | (0.023) | (0.012) | (0.014) | (0.013) | (0.012) | (0.012) | (0.012) | (0.013) |
| Males | 0.387*** | 0.279*** | 0.274*** | 0.356*** | 0.297*** | 0.337*** | 0.625*** | 0.246*** | 0.429*** | 0.392*** | 0.391*** |
| | (0.016) | (0.012) | (0.012) | (0.024) | (0.011) | (0.017) | (0.013) | (0.012) | (0.013) | (0.012) | (0.015) |
| Difference | 0.077*** | 0.125*** | 0.102*** | 0.046 | 0.124*** | 0.089*** | 0.022 | 0.112*** | 0.039** | -0.071*** | 0.042** |
| | (0.023) | (0.016) | (0.016) | (0.033) | (0.016) | (0.022) | (0.018) | (0.018) | (0.017) | (0.017) | (0.020) |
| Explained | -0.027*** | 0.001 | 0.020*** | -0.024 | 0.015*** | -0.031*** | -0.005 | 0.006 | -0.036*** | -0.028*** | -0.013 |
| | (0.009) | (0.008) | (0.006) | (0.021) | (0.005) | (0.007) | (0.006) | (0.006) | (0.007) | (0.009) | (0.011) |
| Unexplained | 0.104*** | 0.124*** | 0.082*** | 0.069* | 0.110*** | 0.119*** | 0.027 | 0.106*** | 0.075*** | -0.044** | 0.055** |
| | (0.024) | (0.018) | (0.017) | (0.036) | (0.018) | (0.023) | (0.020) | (0.019) | (0.018) | (0.019) | (0.023) |
| **Explained part** | | | | | | | | | | | |
| Age 35-44 | 0.000 | 0.000 | 0.000 | -0.001 | -0.001** | 0.000 | -0.001** | 0.000 | -0.000*** | 0.000 | 0.000* |
| | (0.000) | (0.002) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age 45-54 | 0.000 | 0.001 | 0.001*** | -0.003 | 0.000 | 0.000 | -0.001*** | 0.000 | 0.000 | 0.001** | -0.002*** |
| | (0.000) | (0.003) | (0.000) | (0.002) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age 55 plus | -0.001 | 0.001 | 0.010*** | 0.000** | 0.002*** | -0.002* | 0.001*** | 0.002*** | 0.001*** | -0.001*** | 0.004*** |
| | (0.000) | (0.006) | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) |
| Books (Yes) | -0.000*** | -0.001 | -0.000*** | -0.003*** | 0.001** | 0.001*** | 0.000* | -0.001 | 0.000*** | 0.001*** | -0.003*** |
| | (0.000) | (0.007) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.001) |
| Semi-skilled white | -0.002*** | -0.001 | 0.001*** | 0.006*** | 0.002*** | -0.006*** | 0.003*** | -0.000*** | -0.004*** | 0.005*** | -0.004*** |
| | (0.001) | (0.006) | (0.000) | (0.001) | (0.000) | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) | (0.001) |
| Semi-skilled blue | 0.000** | 0.000 | -0.005*** | -0.014*** | -0.001*** | 0.004*** | -0.004*** | -0.000** | 0.001*** | -0.005*** | 0.006*** |
| | (0.000) | (0.002) | (0.001) | (0.003) | (0.000) | (0.001) | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) |
| Elementary | 0.000 | 0.003 | 0.008*** | 0.007*** | 0.003*** | 0.006*** | 0.003*** | 0.001*** | 0.001*** | 0.010*** | -0.001*** |
| | (0.000) | (0.014) | (0.001) | (0.002) | (0.000) | (0.002) | (0.001) | (0.000) | (0.000) | (0.001) | (0.000) |
| N. of siblings | -0.002*** | 0.000 | 0.000 | -0.001* | 0.001** | -0.011*** | 0.002* | -0.000** | -0.001*** | 0.000 | -0.000* |
| | (0.001) | (0.002) | (0.000) | (0.001) | (0.000) | (0.002) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Literacy score | 0.000 | 0.000 | 0.001 | -0.002 | -0.003** | -0.003* | 0.000 | 0.001** | -0.002** | -0.001 | -0.004 |
| | (0.000) | (0.002) | (0.002) | (0.005) | (0.001) | (0.002) | (0.001) | (0.000) | (0.001) | (0.002) | (0.004) |
| Numeracy score | -0.018*** | -0.004 | -0.003* | -0.024* | 0.001*** | -0.022*** | -0.009** | -0.001 | -0.024*** | -0.036*** | -0.019* |
| | (0.006) | (0.018) | (0.002) | (0.013) | (0.000) | (0.006) | (0.004) | (0.001) | (0.005) | (0.010) | (0.011) |
| Agreeableness | -0.001 | 0.004 | 0.007*** | 0.007 | 0.010** | -0.002 | -0.001 | 0.000 | 0.001 | 0.005 | 0.011* |
| | (0.003) | (0.019) | (0.003) | (0.008) | (0.004) | (0.003) | (0.002) | (0.004) | (0.001) | (0.004) | (0.006) |
| Conscientiousness | -0.001 | 0.000 | 0.001 | 0.001 | 0.002** | 0.003 | 0.003* | 0.000 | 0.002 | 0.002* | 0.005 |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.001) | (0.003) | (0.001) | (0.000) | (0.003) | (0.001) | (0.003) |
| Extraversion | 0.000 | 0.000 | 0.001 | -0.002 | -0.003** | -0.001 | -0.001 | 0.001 | -0.002** | 0.001* | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) |
| Emot. S. | -0.006 | -0.002 | -0.002 | 0.005 | -0.006** | -0.004 | 0.001 | -0.002 | -0.011*** | -0.009** | 0.001 |
| | (0.006) | (0.009) | (0.002) | (0.005) | (0.002) | (0.004) | (0.001) | (0.003) | (0.004) | (0.004) | (0.004) |
| Open-mindedness | 0.005*** | 0.002 | 0.003* | 0.001 | 0.008*** | 0.005*** | 0.000 | 0.007*** | 0.003*** | -0.001 | -0.006*** |
| | (0.001) | (0.009) | (0.002) | (0.001) | (0.002) | (0.001) | (0.000) | (0.002) | (0.000) | (0.001) | (0.002) |
| **Unexplained part** | | | | | | | | | | | |
| Age 35-44 | 0.021 | 0.007 | 0.006 | 0.020 | 0.005 | -0.004 | 0.018 | 0.007 | -0.004 | -0.011 | 0.012 |
| | (0.016) | (0.014) | (0.012) | (0.018) | (0.014) | (0.017) | (0.011) | (0.014) | (0.012) | (0.013) | (0.014) |
| Age 45-54 | 0.009 | -0.015 | -0.011 | -0.038* | -0.007 | -0.038* | -0.012 | 0.000 | -0.013 | -0.032** | 0.011 |
| | (0.020) | (0.014) | (0.013) | (0.022) | (0.012) | (0.021) | (0.015) | (0.013) | (0.016) | (0.015) | (0.016) |
| Age 55 plus | -0.006 | -0.022 | -0.012 | -0.038 | -0.018 | -0.026 | 0.009 | -0.024* | -0.034** | -0.047** | 0.028 |
| | (0.023) | (0.014) | (0.013) | (0.023) | (0.012) | (0.023) | (0.019) | (0.013) | (0.016) | (0.020) | (0.018) |
| Books (Yes) | 0.011 | -0.012 | -0.014 | 0.001 | -0.008 | -0.013 | 0.000 | -0.018 | -0.005 | 0.022 | 0.004 |
| | (0.013) | (0.021) | (0.012) | (0.029) | (0.009) | (0.014) | (0.007) | (0.012) | (0.013) | (0.020) | (0.019) |
| Semi-skilled white | 0.028* | -0.005 | 0.001 | -0.006 | -0.012 | 0.008 | 0.002 | -0.013 | 0.005 | -0.007 | -0.031** |
| | (0.017) | (0.009) | (0.008) | (0.015) | (0.008) | (0.017) | (0.013) | (0.010) | (0.012) | (0.014) | (0.014) |
| Semi-skilled blue | 0.035 | -0.021 | 0.006 | 0.009 | -0.071 | 0.001 | 0.008 | -0.028 | 0.017 | 0.012 | -0.006 |
| | (0.029) | (0.023) | (0.026) | (0.034) | (0.050) | (0.033) | (0.016) | (0.029) | (0.023) | (0.018) | (0.018) |
| Elementary | 0.009 | -0.007 | 0.003 | -0.002 | -0.017* | 0.017 | -0.007 | -0.015 | 0.001 | -0.001 | 0.000 |
| | (0.020) | (0.010) | (0.015) | (0.013) | (0.010) | (0.019) | (0.011) | (0.011) | (0.012) | (0.008) | (0.010) |
| N. of siblings | -0.020 | -0.014 | -0.047** | -0.046 | 0.027 | -0.077* | -0.021 | -0.030 | 0.049 | 0.055 | -0.017 |
| | (0.039) | (0.020) | (0.023) | (0.059) | (0.027) | (0.039) | (0.047) | (0.029) | (0.030) | (0.035) | (0.036) |
| Literacy score | -0.120 | -0.474** | 0.208 | 0.130 | -0.009 | 0.312 | 0.244 | 0.357 | -0.020 | 0.101 | -0.174 |
| | (0.303) | (0.208) | (0.228) | (0.475) | (0.182) | (0.300) | (0.250) | (0.281) | (0.261) | (0.327) | (0.386) |
| Numeracy score | 0.339 | 0.528** | -0.239 | -0.186 | 0.019 | -0.246 | -0.112 | -0.195 | 0.072 | -0.219 | 0.101 |
| | (0.296) | (0.212) | (0.215) | (0.417) | (0.163) | (0.268) | (0.246) | (0.266) | (0.263) | (0.328) | (0.333) |
| Agreeableness | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.002 | 0.000 | 0.000 | 0.000 | -0.001 | -0.002 |
| | (0.001) | (0.001) | (0.000) | (0.002) | (0.001) | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) | (0.001) |
| Conscientiousness | -0.002 | -0.001 | 0.000 | 0.003 | 0.000 | -0.002 | 0.004 | 0.000 | -0.001 | 0.000 | -0.002 |
| | (0.002) | (0.001) | (0.001) | (0.006) | (0.001) | (0.003) | (0.002) | (0.002) | (0.001) | (0.000) | (0.003) |
| Extraversion | 0.000 | 0.000 | 0.000 | -0.004 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.003) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) |
| Emot. S. | 0.000 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | -0.001 | 0.000 | 0.000 | -0.002 | 0.002 |
| | (0.001) | (0.002) | (0.001) | (0.004) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) |
| Open-mindedness | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | 0.001 | 0.002 | 0.000 | -0.001 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.000) | (0.000) | (0.001) | (0.000) |
| Intercept | -0.202 | 0.159 | 0.182 | 0.227 | 0.201 | 0.189 | -0.106 | 0.067 | 0.010 | 0.087 | 0.128 |
| | (0.185) | (0.130) | (0.130) | (0.224) | (0.124) | (0.193) | (0.135) | (0.148) | (0.156) | (0.213) | (0.188) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.7. Logit estimation of downward mobility for females

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | -0.258*** | -0.726*** | -0.137*** | -0.010** | -0.011 | -0.008 | -0.877*** | -1.153*** | -0.383*** | -0.447*** | -0.074*** | -1.079*** |
| | (0.007) | (0.010) | (0.003) | (0.005) | (0.012) | (0.006) | (0.015) | (0.009) | (0.003) | (0.007) | (0.011) | (0.010) |
| Age 45-54 | 0.070*** | -0.463*** | -0.413*** | -0.661*** | 0.024* | -0.177*** | -1.140*** | -1.876*** | -0.528*** | -0.021*** | -0.566*** | -0.608*** |
| | (0.006) | (0.009) | (0.004) | (0.006) | (0.013) | (0.006) | (0.016) | (0.012) | (0.003) | (0.006) | (0.013) | (0.009) |
| Age 55 plus | -0.159*** | -1.109*** | -0.348*** | -0.687*** | -0.143*** | 0.167*** | -2.124*** | -1.617*** | -0.738*** | -0.381*** | -0.307*** | -0.021** |
| | (0.007) | (0.010) | (0.004) | (0.006) | (0.013) | (0.006) | (0.021) | (0.010) | (0.003) | (0.007) | (0.013) | (0.009) |
| Books (Yes) | 0.109*** | -0.579*** | 0.417*** | 0.465*** | 0.644*** | 0.074*** | 0.307*** | 0.092*** | 0.514*** | 0.475*** | 0.391*** | 0.270*** |
| | (0.005) | (0.009) | (0.003) | (0.006) | (0.011) | (0.005) | (0.013) | (0.008) | (0.002) | (0.006) | (0.009) | (0.007) |
| Semi-skilled white | -0.421*** | -0.319*** | -0.659*** | -0.528*** | -0.756*** | -0.511*** | 0.026 | -0.547*** | -0.358*** | -0.012 | 0.083*** | -1.244*** |
| | (0.007) | (0.009) | (0.004) | (0.006) | (0.013) | (0.006) | (0.018) | (0.009) | (0.003) | (0.008) | (0.011) | (0.010) |
| Semi-skilled blue | -0.394*** | -0.973*** | -0.659*** | -1.260*** | -0.999*** | -1.324*** | -0.688*** | -1.525*** | -1.051*** | -0.617*** | -0.845*** | -1.107*** |
| | (0.006) | (0.009) | (0.003) | (0.005) | (0.012) | (0.006) | (0.015) | (0.010) | (0.003) | (0.007) | (0.010) | (0.008) |
| Elementary | -0.631*** | -1.264*** | -0.585*** | -1.242*** | -1.493*** | -1.482*** | -0.542*** | -0.972*** | -0.857*** | -1.223*** | -1.053*** | -1.717*** |
| | (0.008) | (0.013) | (0.004) | (0.006) | (0.018) | (0.008) | (0.022) | (0.013) | (0.004) | (0.010) | (0.017) | (0.016) |
| N. of siblings | -0.087*** | -0.008*** | 0.117*** | 0.077*** | -0.212*** | 0.086*** | 0.051*** | 0.114*** | 0.068*** | 0.071*** | 0.047*** | -0.233*** |
| | (0.002) | (0.003) | (0.001) | (0.002) | (0.005) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Literacy | 0.010*** | 0.001*** | 0.007*** | -0.010*** | 0.002*** | 0.001*** | -0.007*** | -0.003*** | -0.014*** | -0.009*** | -0.005*** | 0.008*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | -0.021*** | -0.018*** | -0.019*** | -0.004*** | -0.009*** | -0.012*** | -0.010*** | -0.011*** | -0.002*** | -0.001*** | -0.005*** | -0.015*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | -0.199*** | -0.139*** | -0.067*** | 0.061*** | -0.168*** | -0.194*** | -0.023*** | -0.035*** | 0.025*** | -0.207*** | 0.117*** | 0.199*** |
| | (0.002) | (0.004) | (0.001) | (0.002) | (0.005) | (0.002) | (0.006) | (0.004) | (0.001) | (0.003) | (0.005) | (0.004) |
| Conscientiousness | -0.009*** | -0.110*** | -0.379*** | 0.134*** | 0.078*** | -0.127*** | -0.111*** | -0.199*** | -0.071*** | -0.166*** | -0.358*** | -0.099*** |
| | (0.002) | (0.004) | (0.001) | (0.002) | (0.005) | (0.002) | (0.006) | (0.004) | (0.001) | (0.003) | (0.004) | (0.004) |
| Extraversion | -0.036*** | -0.020*** | -0.125*** | -0.145*** | 0.166*** | 0.020*** | 0.005 | -0.144*** | 0.183*** | -0.117*** | -0.013*** | 0.071*** |
| | (0.002) | (0.003) | (0.001) | (0.002) | (0.005) | (0.002) | (0.006) | (0.004) | (0.001) | (0.003) | (0.004) | (0.003) |
| Emot. S. | -0.101*** | -0.207*** | -0.054*** | -0.108*** | -0.089*** | 0.077*** | 0.024*** | -0.040*** | -0.296*** | -0.028*** | -0.015*** | -0.092*** |
| | (0.002) | (0.004) | (0.001) | (0.002) | (0.005) | (0.002) | (0.006) | (0.004) | (0.001) | (0.003) | (0.004) | (0.004) |
| Open-mindedness | -0.189*** | 0.077*** | 0.030*** | 0.288*** | -0.150*** | 0.041*** | -0.069*** | 0.131*** | 0.097*** | -0.054*** | -0.204*** | -0.159*** |
| | (0.002) | (0.004) | (0.001) | (0.002) | (0.005) | (0.002) | (0.006) | (0.004) | (0.001) | (0.003) | (0.004) | (0.004) |
| Intercept | 1.630*** | 3.429*** | 1.432*** | 1.385*** | 0.264*** | 1.386*** | 3.655*** | 3.107*** | 2.234*** | 0.473*** | 0.474*** | 0.778*** |
| | (0.019) | (0.027) | (0.009) | (0.013) | (0.031) | (0.016) | (0.045) | (0.031) | (0.008) | (0.018) | (0.032) | (0.025) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A.3.7. Logit estimation of downward mobility for females (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | -0.714*** | -0.400*** | -0.352*** | 0.128*** | -0.414*** | -0.363*** | 0.377*** | 0.021** | -0.158*** | -0.436*** | -0.097*** |
| | (0.004) | (0.015) | (0.011) | (0.011) | (0.005) | (0.013) | (0.027) | (0.009) | (0.004) | (0.008) | (0.003) |
| Age 45-54 | -0.543*** | -0.353*** | -0.257*** | -0.141*** | -0.224*** | -0.840*** | -0.277*** | -0.034*** | -0.148*** | -0.312*** | -0.406*** |
| | (0.003) | (0.015) | (0.011) | (0.011) | (0.005) | (0.015) | (0.030) | (0.010) | (0.004) | (0.008) | (0.003) |
| Age 55 plus | -0.880*** | -1.238*** | -1.405*** | -0.204*** | -0.812*** | -1.038*** | -1.118*** | -0.735*** | -0.684*** | -0.119*** | -0.627*** |
| | (0.004) | (0.018) | (0.013) | (0.011) | (0.006) | (0.017) | (0.035) | (0.012) | (0.004) | (0.007) | (0.003) |
| Books (Yes) | -0.048*** | 0.308*** | 0.217*** | 0.206*** | 0.253*** | 0.546*** | 0.516*** | 0.540*** | 0.480*** | 0.449*** | 0.292*** |
| | (0.003) | (0.012) | (0.010) | (0.008) | (0.005) | (0.013) | (0.030) | (0.008) | (0.003) | (0.006) | (0.002) |
| Semi-skilled white | -0.572*** | -0.285*** | -0.359*** | -0.679*** | -0.976*** | 0.549*** | -0.094*** | -0.285*** | -0.483*** | -0.528*** | -0.261*** |
| | (0.003) | (0.017) | (0.014) | (0.012) | (0.006) | (0.015) | (0.028) | (0.010) | (0.003) | (0.007) | (0.003) |
| Semi-skilled blue | -1.254*** | -0.673*** | -0.700*** | -0.338*** | -1.636*** | -0.672*** | -0.193*** | -1.404*** | -1.240*** | -0.638*** | -0.725*** |
| | (0.003) | (0.014) | (0.011) | (0.009) | (0.005) | (0.017) | (0.028) | (0.010) | (0.003) | (0.007) | (0.003) |
| Elementary | -1.794*** | -0.518*** | -1.175*** | -0.366*** | -2.106*** | -0.319*** | -0.894*** | -1.824*** | -1.753*** | -1.212*** | -0.559*** |
| | (0.005) | (0.018) | (0.014) | (0.012) | (0.008) | (0.020) | (0.035) | (0.014) | (0.005) | (0.011) | (0.004) |
| N. of siblings | 0.145*** | -0.037*** | 0.125*** | 0.054*** | 0.018*** | -0.241*** | -0.183*** | 0.101*** | -0.124*** | -0.047*** | 0.004*** |
| | (0.001) | (0.005) | (0.004) | (0.003) | (0.002) | (0.005) | (0.009) | (0.003) | (0.001) | (0.003) | (0.001) |
| Literacy | -0.002*** | -0.001*** | -0.011*** | -0.007*** | 0.010*** | 0.004*** | -0.007*** | -0.002*** | -0.013*** | 0.005*** | -0.007*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | -0.002*** | -0.012*** | -0.004*** | -0.006*** | -0.017*** | -0.006*** | -0.013*** | -0.014*** | 0.002*** | -0.017*** | -0.009*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | -0.071*** | -0.377*** | -0.097*** | 0.088*** | -0.185*** | -0.168*** | 0.199*** | 0.035*** | -0.198*** | -0.050*** | 0.043*** |
| | (0.001) | (0.006) | (0.004) | (0.004) | (0.002) | (0.005) | (0.011) | (0.004) | (0.001) | (0.003) | (0.001) |
| Conscientiousness | 0.341*** | -0.230*** | 0.030*** | -0.067*** | -0.344*** | 0.131*** | -0.482*** | -0.109*** | 0.000 | -0.156*** | -0.031*** |
| | (0.001) | (0.006) | (0.005) | (0.004) | (0.002) | (0.006) | (0.011) | (0.004) | (0.001) | (0.003) | (0.001) |
| Extraversion | -0.222*** | 0.055*** | -0.107*** | -0.005 | -0.120*** | 0.018*** | 0.363*** | 0.035*** | 0.059*** | -0.260*** | -0.050*** |
| | (0.001) | (0.005) | (0.005) | (0.004) | (0.002) | (0.005) | (0.010) | (0.004) | (0.001) | (0.003) | (0.001) |
| Emot. S. | -0.228*** | 0.112*** | -0.217*** | -0.069*** | -0.311*** | 0.086*** | -0.245*** | -0.056*** | 0.017*** | -0.059*** | 0.059*** |
| | (0.001) | (0.006) | (0.004) | (0.004) | (0.002) | (0.005) | (0.010) | (0.004) | (0.001) | (0.003) | (0.001) |
| Open-mindedness | 0.253*** | -0.212*** | -0.124*** | 0.067*** | -0.269*** | -0.139*** | -0.214*** | -0.210*** | 0.008*** | 0.153*** | 0.094*** |
| | (0.001) | (0.006) | (0.005) | (0.004) | (0.002) | (0.006) | (0.011) | (0.004) | (0.001) | (0.003) | (0.001) |
| Intercept | -0.892*** | 1.832*** | 2.139*** | 1.634*** | -0.074*** | -2.378*** | 1.465*** | 1.939*** | 1.464*** | 2.076*** | 2.581*** |
| | (0.009) | (0.039) | (0.031) | (0.025) | (0.012) | (0.040) | (0.060) | (0.026) | (0.009) | (0.022) | (0.009) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.8. Logit estimation of downward mobility for males

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | -0.317*** | 0.064*** | -0.230*** | -0.164*** | -0.606*** | 0.062*** | -0.330*** | -0.494*** | -0.103*** | -0.283*** | 0.019** | -0.912*** |
| | (0.006) | (0.007) | (0.003) | (0.004) | (0.010) | (0.006) | (0.012) | (0.007) | (0.003) | (0.005) | (0.009) | (0.006) |
| Age 45-54 | -0.779*** | -0.484*** | -0.639*** | -0.650*** | -0.316*** | 0.006 | -0.908*** | -0.898*** | -0.441*** | -0.544*** | -0.341*** | -0.970*** |
| | (0.007) | (0.007) | (0.003) | (0.005) | (0.010) | (0.006) | (0.013) | (0.008) | (0.003) | (0.006) | (0.010) | (0.007) |
| Age 55 plus | -0.540*** | -0.665*** | -1.011*** | -0.670*** | -1.264*** | -0.380*** | -2.127*** | -1.442*** | -0.666*** | -0.847*** | -1.993*** | -1.466*** |
| | (0.007) | (0.007) | (0.003) | (0.005) | (0.014) | (0.006) | (0.017) | (0.008) | (0.003) | (0.006) | (0.013) | (0.009) |
| Books (Yes) | 0.663*** | 0.541*** | 0.235*** | 0.618*** | -0.301*** | 0.393*** | 0.236*** | 0.571*** | 0.370*** | 0.871*** | 0.265*** | 0.437*** |
| | (0.005) | (0.006) | (0.002) | (0.005) | (0.011) | (0.004) | (0.010) | (0.006) | (0.002) | (0.005) | (0.008) | (0.005) |
| Semi-skilled white | -0.427*** | -0.188*** | -0.277*** | -0.385*** | -0.487*** | -0.976*** | -0.453*** | -0.531*** | -0.150*** | -0.320*** | -0.159*** | -0.595*** |
| | (0.007) | (0.007) | (0.003) | (0.006) | (0.010) | (0.005) | (0.014) | (0.007) | (0.003) | (0.006) | (0.010) | (0.006) |
| Semi-skilled blue | -0.594*** | -1.090*** | -0.536*** | -0.629*** | -1.701*** | -1.978*** | -0.809*** | -1.456*** | -0.895*** | -0.803*** | -0.614*** | -1.171*** |
| | (0.006) | (0.007) | (0.002) | (0.005) | (0.011) | (0.005) | (0.011) | (0.007) | (0.003) | (0.006) | (0.009) | (0.006) |
| Elementary | -0.910*** | -0.803*** | -0.583*** | -0.587*** | -2.889*** | -1.763*** | -1.440*** | -2.208*** | -0.884*** | -1.351*** | -1.102*** | -1.486*** |
| | (0.009) | (0.008) | (0.004) | (0.006) | (0.021) | (0.008) | (0.020) | (0.015) | (0.004) | (0.009) | (0.014) | (0.012) |
| N. of siblings | 0.009*** | 0.086*** | -0.001 | -0.009*** | -0.070*** | 0.041*** | 0.023*** | 0.186*** | -0.029*** | 0.141*** | 0.128*** | 0.004 |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.004) | (0.002) | (0.004) | (0.002) | (0.001) | (0.002) | (0.003) | (0.002) |
| Literacy | 0.008*** | 0.004*** | -0.001*** | 0.005*** | -0.001*** | -0.004*** | -0.001** | 0.007*** | -0.005*** | -0.012*** | -0.015*** | 0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | -0.019*** | -0.016*** | -0.011*** | -0.017*** | -0.008*** | -0.007*** | -0.011*** | -0.015*** | -0.006*** | 0.002*** | 0.000 | -0.009*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | -0.117*** | -0.299*** | -0.200*** | -0.361*** | 0.016*** | 0.044*** | -0.074*** | 0.058*** | 0.035*** | -0.019*** | 0.021*** | 0.047*** |
| | (0.002) | (0.003) | (0.001) | (0.002) | (0.004) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Conscientiousness | -0.036*** | -0.109*** | -0.168*** | 0.147*** | -0.064*** | -0.313*** | -0.118*** | -0.179*** | -0.216*** | -0.159*** | -0.221*** | -0.139*** |
| | (0.002) | (0.003) | (0.001) | (0.002) | (0.005) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Extraversion | -0.104*** | 0.053*** | 0.015*** | -0.005** | -0.040*** | 0.127*** | 0.092*** | 0.001 | -0.179*** | -0.023*** | -0.084*** | 0.001 |
| | (0.003) | (0.003) | (0.001) | (0.002) | (0.004) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Emot. S. | -0.059*** | -0.203*** | -0.014*** | -0.427*** | -0.084*** | 0.087*** | -0.052*** | -0.048*** | 0.005*** | -0.055*** | -0.134*** | 0.034*** |
| | (0.002) | (0.003) | (0.001) | (0.002) | (0.005) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Open-mindedness | 0.158*** | 0.254*** | 0.041*** | 0.109*** | 0.353*** | 0.007*** | 0.009* | -0.195*** | 0.072*** | -0.048*** | 0.044*** | -0.057*** |
| | (0.003) | (0.003) | (0.001) | (0.002) | (0.004) | (0.002) | (0.005) | (0.003) | (0.001) | (0.002) | (0.004) | (0.003) |
| Intercept | 1.971*** | 2.069*** | 2.582*** | 1.095*** | 2.020*** | 2.053*** | 3.227*** | 1.419*** | 1.356*** | 0.816*** | 2.224*** | 0.605*** |
| | (0.018) | (0.019) | (0.007) | (0.011) | (0.026) | (0.014) | (0.035) | (0.023) | (0.007) | (0.014) | (0.026) | (0.016) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A3.8. Logit estimation of downward mobility for males (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 35-44 | -0.429*** | -0.186*** | 0.182*** | -0.313*** | -0.641*** | -0.373*** | -0.968*** | 0.057*** | -0.522*** | -0.857*** | -0.501*** |
| | (0.004) | (0.011) | (0.009) | (0.010) | (0.004) | (0.010) | (0.020) | (0.007) | (0.003) | (0.008) | (0.003) |
| Age 45-54 | -0.614*** | -0.442*** | -0.574*** | -0.410*** | -0.858*** | -1.342*** | -2.217*** | -0.254*** | -1.003*** | -0.761*** | 0.032*** |
| | (0.004) | (0.012) | (0.009) | (0.009) | (0.004) | (0.011) | (0.031) | (0.008) | (0.003) | (0.008) | (0.003) |
| Age 55 plus | -0.849*** | -1.013*** | -1.392*** | -0.878*** | -1.472*** | -0.947*** | -0.593*** | -0.738*** | -1.545*** | -1.273*** | -0.405*** |
| | (0.004) | (0.013) | (0.011) | (0.011) | (0.005) | (0.011) | (0.021) | (0.009) | (0.004) | (0.009) | (0.003) |
| Books (Yes) | 1.014*** | 0.175*** | 0.129*** | -0.163*** | 0.683*** | 1.438*** | 0.089*** | 0.360*** | 0.871*** | 0.692*** | 0.747*** |
| | (0.003) | (0.009) | (0.008) | (0.008) | (0.004) | (0.009) | (0.021) | (0.007) | (0.003) | (0.007) | (0.002) |
| Semi-skilled white | -0.009*** | -0.564*** | -0.309*** | -0.336*** | -0.761*** | -0.508*** | -1.352*** | -0.039*** | 0.045*** | -0.786*** | -0.726*** |
| | (0.004) | (0.013) | (0.012) | (0.011) | (0.006) | (0.009) | (0.020) | (0.008) | (0.003) | (0.007) | (0.003) |
| Semi-skilled blue | -0.542*** | -1.053*** | -0.465*** | -0.845*** | -1.364*** | -1.478*** | -1.233*** | -1.186*** | -0.567*** | -1.751*** | -0.635*** |
| | (0.004) | (0.010) | (0.009) | (0.009) | (0.004) | (0.012) | (0.017) | (0.008) | (0.003) | (0.009) | (0.003) |
| Elementary | -1.321*** | -1.348*** | -0.959*** | -1.395*** | -1.632*** | -1.840*** | -1.488*** | -1.023*** | -0.678*** | -1.326*** | -1.791*** |
| | (0.005) | (0.015) | (0.011) | (0.014) | (0.006) | (0.016) | (0.024) | (0.010) | (0.004) | (0.013) | (0.005) |
| N. of siblings | 0.019*** | -0.006 | -0.022*** | -0.086*** | 0.284*** | -0.239*** | 0.107*** | 0.082*** | 0.210*** | 0.085*** | -0.079*** |
| | (0.001) | (0.004) | (0.003) | (0.003) | (0.001) | (0.004) | (0.007) | (0.003) | (0.001) | (0.003) | (0.001) |
| Literacy | -0.014*** | -0.007*** | -0.007*** | 0.009*** | 0.004*** | -0.017*** | -0.002*** | -0.008*** | -0.019*** | 0.012*** | -0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Numeracy | 0.006*** | -0.001*** | -0.006*** | -0.019*** | -0.011*** | 0.004*** | -0.007*** | -0.004*** | 0.004*** | -0.027*** | -0.007*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Agreeableness | 0.232*** | 0.016*** | -0.078*** | -0.089*** | 0.070*** | -0.132*** | 0.111*** | -0.069*** | -0.022*** | 0.007** | -0.208*** |
| | (0.001) | (0.004) | (0.004) | (0.004) | (0.002) | (0.004) | (0.007) | (0.003) | (0.001) | (0.003) | (0.001) |
| Conscientiousness | 0.404*** | -0.064*** | -0.080*** | 0.085*** | -0.118*** | -0.117*** | -0.272*** | -0.099*** | -0.192*** | -0.183*** | -0.072*** |
| | (0.002) | (0.005) | (0.004) | (0.004) | (0.002) | (0.004) | (0.007) | (0.004) | (0.001) | (0.003) | (0.001) |
| Extraversion | 0.073*** | -0.017*** | -0.174*** | 0.065*** | -0.103*** | 0.061*** | 0.397*** | 0.039*** | 0.166*** | 0.105*** | 0.011*** |
| | (0.002) | (0.005) | (0.004) | (0.004) | (0.002) | (0.004) | (0.007) | (0.003) | (0.001) | (0.003) | (0.001) |
| Emot. S. | -0.457*** | -0.101*** | -0.118*** | -0.184*** | -0.294*** | -0.276*** | -0.130*** | 0.079*** | -0.072*** | -0.227*** | -0.158*** |
| | (0.001) | (0.005) | (0.004) | (0.004) | (0.002) | (0.004) | (0.008) | (0.003) | (0.001) | (0.003) | (0.001) |
| Open-mindedness | -0.085*** | -0.114*** | 0.138*** | 0.037*** | -0.138*** | 0.469*** | -0.103*** | -0.164*** | -0.018*** | -0.058*** | -0.029*** |
| | (0.001) | (0.005) | (0.003) | (0.004) | (0.002) | (0.004) | (0.007) | (0.003) | (0.001) | (0.003) | (0.001) |
| Intercept | -0.614*** | 1.760*** | 2.899*** | 2.519*** | -0.102*** | 1.415*** | 0.110*** | 1.558*** | 1.705*** | 3.370*** | 1.783*** |
| | (0.009) | (0.029) | (0.024) | (0.024) | (0.008) | (0.025) | (0.039) | (0.019) | (0.008) | (0.023) | (0.008) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A. 3.9. Detailed Oaxaca decomposition of Downward Mobility

| Variable | AUT | BEL | CAN | CHL | HRV | CZE | EST | FIN | FRA | HUN | IRL | ISR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Probability** | | | | | | | | | | | | |
| Females | 0.154*** | 0.077*** | 0.148*** | 0.087*** | 0.076*** | 0.113*** | 0.129*** | 0.084*** | 0.086*** | 0.084*** | 0.074*** | 0.077*** |
| | (0.010) | (0.008) | (0.011) | (0.008) | (0.007) | (0.008) | (0.006) | (0.007) | (0.007) | (0.006) | (0.010) | (0.008) |
| Males | 0.139*** | 0.146*** | 0.217*** | 0.110*** | 0.114*** | 0.130*** | 0.258*** | 0.160*** | 0.110*** | 0.124*** | 0.121*** | 0.170*** |
| | (0.011) | (0.010) | (0.014) | (0.011) | (0.010) | (0.010) | (0.009) | (0.010) | (0.008) | (0.008) | (0.013) | (0.010) |
| Difference | 0.016 | -0.069*** | -0.068*** | -0.023 | -0.038*** | -0.017 | -0.129*** | -0.077*** | -0.024** | -0.040*** | -0.046*** | -0.092*** |
| | (0.015) | (0.013) | (0.018) | (0.014) | (0.012) | (0.012) | (0.011) | (0.013) | (0.010) | (0.010) | (0.016) | (0.013) |
| Explained | 0.033*** | 0.013 | 0.015 | 0.018*** | 0.002 | 0.008 | -0.007 | 0.015 | 0.005 | -0.008 | -0.001 | 0.004 |
| | (0.010) | (0.010) | (0.012) | (0.006) | (0.006) | (0.006) | (0.009) | (0.010) | (0.007) | (0.005) | (0.009) | (0.007) |
| Unexplained | -0.017 | -0.082*** | -0.084*** | -0.040** | -0.040*** | -0.026* | -0.123*** | -0.092*** | -0.030** | -0.032*** | -0.045** | -0.096*** |
| | (0.020) | (0.017) | (0.022) | (0.017) | (0.014) | (0.014) | (0.014) | (0.017) | (0.012) | (0.011) | (0.018) | (0.014) |
| **Explained part** | | | | | | | | | | | | |
| Age 35-44 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001*** | 0.000 | 0.001** | 0.000 | -0.001 |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) |
| Age 45-54 | -0.000* | 0.001* | 0.001*** | -0.000** | 0.000 | 0.000 | 0.001*** | 0.002*** | 0.000** | 0.000** | 0.000 | 0.001 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.004) | (0.000) |
| Age 55 plus | -0.000* | -0.001*** | -0.003*** | -0.001*** | -0.001 | 0.000 | -0.006*** | -0.004*** | -0.001*** | -0.001*** | 0.001 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) | (0.000) | (0.000) | (0.015) | (0.000) |
| Books (Yes) | 0.002** | 0.000 | 0.000 | -0.000** | 0.000 | 0.001* | 0.001** | 0.001** | 0.001** | 0.003*** | -0.001 | 0.000 |
| | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.015) | (0.000) |
| Semi-skilled white | 0.000* | 0.000 | -0.002** | -0.001* | 0.001 | -0.000*** | 0.000 | 0.001*** | 0.000 | 0.000 | 0.000 | 0.001* |
| | (0.000) | (0.000) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) |
| Semi-skilled blue | -0.001** | 0.002*** | 0.000*** | 0.002*** | -0.003 | 0.005*** | -0.002*** | -0.002*** | -0.002*** | 0.001*** | 0.000 | -0.000* |
| | (0.000) | (0.001) | (0.000) | (0.001) | (0.003) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.007) | (0.000) |
| Elementary | 0.001*** | 0.001*** | -0.001** | -0.002*** | 0.002 | -0.006*** | 0.000 | -0.002*** | -0.001*** | -0.001*** | -0.001 | -0.004 |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.002) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.009) | (0.003) |
| N. of siblings | 0.000 | 0.000 | 0.001 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000** | 0.000 | 0.001** | 0.000 | 0.000 |
| | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.004) | (0.000) |
| Literacy score | 0.002** | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | -0.007* | 0.003 | -0.003** | -0.006*** | 0.003 | 0.002 |
| | (0.001) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.004) | (0.003) | (0.001) | (0.002) | (0.043) | (0.002) |
| Numeracy score | 0.034*** | 0.018*** | 0.030*** | 0.011** | 0.000 | 0.012** | 0.014*** | 0.018*** | 0.004 | 0.000 | -0.001 | 0.008 |
| | (0.007) | (0.006) | (0.010) | (0.004) | (0.000) | (0.005) | (0.004) | (0.006) | (0.003) | (0.001) | (0.010) | (0.006) |
| Agreeableness | -0.007* | -0.013*** | -0.007** | -0.002* | -0.001 | -0.002 | -0.005 | 0.000 | 0.001 | -0.003 | -0.002 | 0.002 |
| | (0.004) | (0.004) | (0.004) | (0.001) | (0.001) | (0.002) | (0.004) | (0.003) | (0.002) | (0.002) | (0.021) | (0.002) |
| Conscientiousness | -0.001 | -0.002 | -0.007*** | 0.002 | 0.000 | 0.003*** | -0.005** | -0.001** | -0.003** | -0.003** | 0.002 | -0.002 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.022) | (0.002) |
| Extraversion | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.002) | (0.001) | (0.001) | (0.000) | (0.002) | (0.001) |
| Emot. S | 0.003 | 0.008* | 0.001 | 0.007** | 0.002 | -0.003 | 0.001 | 0.002 | 0.006 | 0.002 | -0.002 | 0.000 |
| | (0.003) | (0.004) | (0.005) | (0.003) | (0.003) | (0.004) | (0.002) | (0.003) | (0.004) | (0.003) | (0.028) | (0.002) |
| Open-mindedness | | -0.001** | 0.000 | 0.001** | 0.003 | 0.000 | 0.000 | 0.000 | 0.001 | -0.001 | 0.000 | -0.001 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.004) | (0.000) | (0.002) | (0.000) | (0.001) | (0.001) | (0.004) | (0.001) |
| **Unexplained part** | | | | | | | | | | | | |
| Age 35-44 | 0.002 | -0.016* | 0.003 | 0.004 | 0.035 | -0.003 | -0.021** | -0.015* | -0.005 | -0.004 | -0.003 | -0.004 |
| | (0.012) | (0.008) | (0.011) | (0.012) | (0.044) | (0.016) | (0.008) | (0.008) | (0.006) | (0.008) | (0.015) | (0.010) |
| Age 45-54 | 0.030 | 0.000 | 0.006 | 0.000 | 0.019 | -0.009 | -0.008 | -0.020** | -0.001 | 0.014 | -0.006 | 0.008 |
| | (0.024) | (0.009) | (0.010) | (0.012) | (0.029) | (0.018) | (0.008) | (0.009) | (0.006) | (0.010) | (0.016) | (0.009) |
| Age 55 plus | 0.018 | -0.012 | 0.024 | 0.000 | 0.066 | 0.022 | 0.000 | -0.005 | -0.001 | 0.010 | 0.043* | 0.023*** |
| | (0.022) | (0.011) | (0.016) | (0.011) | (0.072) | (0.021) | (0.010) | (0.013) | (0.007) | (0.009) | (0.025) | (0.008) |
| Books (Yes) | -0.027 | -0.030*** | 0.009 | -0.001 | 0.034 | -0.030 | 0.006 | -0.023 | 0.004 | -0.019 | 0.004 | -0.006 |
| | (0.023) | (0.010) | (0.014) | (0.005) | (0.034) | (0.032) | (0.018) | (0.015) | (0.007) | (0.016) | (0.013) | (0.011) |
| Semi-skilled white | 0.000 | -0.002 | -0.009 | -0.003 | -0.013 | 0.017 | 0.008* | 0.000 | -0.003 | 0.005 | 0.004 | -0.013* |
| | (0.011) | (0.007) | (0.008) | (0.010) | (0.024) | (0.017) | (0.005) | (0.008) | (0.005) | (0.006) | (0.010) | (0.008) |
| Semi-skilled blue | 0.014 | 0.004 | -0.006 | -0.026 | 0.073 | 0.054 | 0.008 | -0.003 | -0.004 | 0.009 | -0.011 | 0.002 |
| | (0.030) | (0.013) | (0.016) | (0.017) | (0.095) | (0.053) | (0.014) | (0.017) | (0.010) | (0.018) | (0.021) | (0.013) |
| Elementary | 0.006 | -0.005 | 0.000 | -0.017 | 0.057 | 0.006 | 0.013** | 0.011 | 0.000 | 0.002 | 0.001 | -0.002 |
| | (0.013) | (0.006) | (0.007) | (0.013) | (0.072) | (0.012) | (0.005) | (0.007) | (0.005) | (0.008) | (0.010) | (0.007) |
| N. of siblings | -0.026 | -0.015 | 0.030 | 0.021 | -0.047 | 0.011 | 0.006 | -0.013 | 0.012 | -0.010 | -0.023 | -0.065* |
| | (0.035) | (0.022) | (0.030) | (0.034) | (0.069) | (0.032) | (0.016) | (0.022) | (0.014) | (0.016) | (0.053) | (0.039) |
| Literacy score | 0.113 | -0.085 | 0.272 | -0.337* | 0.199 | 0.220 | -0.237 | -0.308 | -0.159 | 0.061 | 0.261 | 0.081 |
| | (0.266) | (0.186) | (0.274) | (0.186) | (0.490) | (0.317) | (0.172) | (0.219) | (0.130) | (0.157) | (0.337) | (0.161) |
| Numeracy score | -0.099 | -0.044 | -0.267 | 0.288 | -0.061 | -0.204 | 0.043 | 0.124 | 0.067 | -0.067 | -0.139 | -0.139 |
| | (0.243) | (0.171) | (0.257) | (0.188) | (0.448) | (0.315) | (0.175) | (0.211) | (0.119) | (0.145) | (0.268) | (0.140) |
| Agreeableness | -0.001 | 0.002 | 0.000 | 0.002* | -0.003 | -0.002 | 0.001 | 0.000 | 0.000 | -0.001 | 0.002 | 0.001 |
| | (0.002) | (0.003) | (0.001) | (0.001) | (0.003) | (0.002) | (0.001) | (0.001) | (0.000) | (0.001) | (0.004) | (0.002) |
| Conscientiousness | 0.001 | 0.000 | -0.002 | 0.000 | 0.004 | 0.003 | -0.001 | 0.000 | 0.001 | 0.000 | -0.002 | 0.001 |
| | (0.002) | (0.002) | (0.001) | (0.002) | (0.006) | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) | (0.003) | (0.002) |
| Extraversion | 0.000 | 0.000 | -0.001 | -0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001** | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Emot. S | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.000) | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) |
| Open-mindedness | 0.003 | 0.000 | 0.000 | 0.001 | -0.004 | 0.000 | -0.001 | 0.000* | 0.000 | 0.000 | 0.002 | 0.000 |
| | (0.002) | (0.000) | (0.000) | (0.001) | (0.003) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.002) | (0.001) |
| Intercept | -0.050 | 0.119 | -0.145 | 0.029 | -0.400 | -0.110 | 0.059 | 0.161 | 0.059 | -0.032 | -0.179 | 0.016 |
| | (0.163) | (0.090) | (0.133) | (0.107) | (0.512) | (0.186) | (0.089) | (0.121) | (0.059) | (0.081) | (0.189) | (0.099) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

Table A.3.9. Detailed Oaxaca decomposition of Downward Mobility (Continued)

| Variable | ITA | LVA | LTU | NZL | POL | PRT | SGP | SVK | ESP | CHE | GBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Probability** | | | | | | | | | | | |
| Females | 0.058*** | 0.103*** | 0.113*** | 0.155*** | 0.040*** | 0.021*** | 0.018*** | 0.069*** | 0.082*** | 0.139*** | 0.107*** |
| | (0.008) | (0.008) | (0.007) | (0.016) | (0.005) | (0.005) | (0.004) | (0.006) | (0.007) | (0.010) | (0.009) |
| Males | 0.050*** | 0.207*** | 0.237*** | 0.209*** | 0.063*** | 0.056*** | 0.034*** | 0.110*** | 0.095*** | 0.108*** | 0.136*** |
| | (0.008) | (0.012) | (0.012) | (0.023) | (0.006) | (0.009) | (0.005) | (0.009) | (0.008) | (0.008) | (0.012) |
| Difference | 0.009 | -0.104*** | -0.124*** | -0.054** | -0.022*** | -0.035*** | -0.016** | -0.041*** | -0.013 | 0.031** | -0.029** |
| | (0.012) | (0.014) | (0.014) | (0.027) | (0.008) | (0.010) | (0.006) | (0.011) | (0.010) | (0.013) | (0.015) |
| Explained | 0.011* | -0.013 | -0.013* | 0.036* | 0.000 | -0.006 | -0.002 | -0.004 | -0.005 | 0.033*** | 0.011 |
| | (0.006) | (0.010) | (0.007) | (0.021) | (0.003) | (0.004) | (0.002) | (0.004) | (0.004) | (0.008) | (0.009) |
| Unexplained | -0.002 | -0.091*** | -0.111*** | -0.090** | -0.022** | -0.029*** | -0.014** | -0.037*** | -0.007 | -0.002 | -0.040** |
| | (0.014) | (0.016) | (0.015) | (0.041) | (0.009) | (0.011) | (0.006) | (0.011) | (0.011) | (0.017) | (0.017) |
| **Explained part** | | | | | | | | | | | |
| Age 35-44 | 0.000* | 0.001 | 0.000 | 0.000 | -0.001 | 0.000 | 0.001 | 0.000 | 0.000 | -0.000*** | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.011) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age 45-54 | -0.000* | -0.001** | -0.000** | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | -0.001*** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.002) | (0.007) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age 55 plus | -0.001** | -0.003*** | -0.008*** | -0.000* | 0.001 | -0.002 | -0.001 | -0.001*** | -0.002* | 0.000*** | -0.001** |
| | (0.000) | (0.001) | (0.001) | (0.000) | (0.017) | (0.001) | (0.002) | (0.000) | (0.001) | (0.000) | (0.000) |
| Books (Yes) | 0.000 | 0.002* | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 | 0.002** | 0.000 | -0.000*** | 0.001*** |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.007) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) |
| Semi-skilled white | 0.000 | 0.001** | -0.000* | -0.002 | 0.000 | 0.001 | -0.002 | 0.000 | 0.001 | -0.001*** | 0.002** |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.008) | (0.001) | (0.003) | (0.000) | (0.001) | (0.000) | (0.001) |
| Semi-skilled blue | -0.000** | 0.001*** | 0.002*** | 0.006** | 0.000 | -0.002 | 0.002 | 0.000* | -0.000* | 0.002*** | -0.002*** |
| | (0.000) | (0.000) | (0.000) | (0.003) | (0.009) | (0.002) | (0.003) | (0.000) | (0.000) | (0.000) | (0.001) |
| Elementary | 0.000 | -0.003*** | -0.003*** | -0.004** | 0.001 | -0.004 | -0.002 | -0.001*** | -0.001* | -0.003*** | 0.001*** |
| | (0.000) | (0.001) | (0.001) | (0.002) | (0.020) | (0.003) | (0.004) | (0.000) | (0.000) | (0.001) | (0.000) |
| N. of siblings | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | -0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.013) | (0.003) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Literacy score | 0.000 | -0.003* | -0.006** | 0.001 | -0.001 | 0.002 | -0.001 | 0.000 | 0.005** | -0.002** | 0.003 |
| | (0.000) | (0.002) | (0.003) | (0.005) | (0.019) | (0.002) | (0.001) | (0.000) | (0.002) | (0.001) | (0.002) |
| Numeracy score | -0.001 | 0.007 | 0.003* | 0.029** | 0.000 | -0.001 | 0.004 | 0.001* | -0.004 | 0.038*** | 0.012 |
| | (0.003) | (0.006) | (0.002) | (0.015) | (0.007) | (0.005) | (0.010) | (0.001) | (0.004) | (0.008) | (0.009) |
| Agreeableness | 0.001 | -0.011** | -0.004 | 0.000 | 0.001 | -0.002 | 0.002 | -0.001 | -0.002 | -0.001 | -0.005 |
| | (0.002) | (0.004) | (0.003) | (0.008) | (0.012) | (0.003) | (0.006) | (0.003) | (0.001) | (0.002) | (0.003) |
| Conscientiousness | 0.002** | -0.001** | 0.000 | 0.000 | 0.001 | -0.001 | -0.004 | 0.000 | -0.004 | -0.002** | -0.002 |
| | (0.001) | (0.000) | (0.001) | (0.002) | (0.018) | (0.003) | (0.009) | (0.000) | (0.003) | (0.001) | (0.002) |
| Extraversion | 0.001 | 0.000 | -0.002** | 0.000 | -0.001 | 0.000 | -0.003 | 0.000 | 0.002 | 0.000 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.012) | (0.000) | (0.006) | (0.001) | (0.001) | (0.000) | (0.000) |
| Emot. S | 0.008* | 0.001 | 0.006*** | 0.004 | -0.004 | 0.005 | 0.002 | -0.001 | 0.001 | 0.004 | 0.002 |
| | (0.005) | (0.006) | (0.002) | (0.003) | (0.072) | (0.006) | (0.004) | (0.003) | (0.004) | (0.003) | (0.003) |
| Open-mindedness | 0.000 | -0.004* | 0.001 | 0.001 | 0.002 | 0.002 | 0.000 | -0.003* | 0.000 | 0.000 | -0.001 |
| | (0.001) | (0.002) | (0.002) | (0.001) | (0.049) | (0.002) | (0.001) | (0.002) | (0.000) | (0.000) | (0.001) |
| **Unexplained part** | | | | | | | | | | | |
| Age 35-44 | 0.002 | -0.006 | -0.015* | 0.016 | 0.002 | 0.000 | 0.005 | -0.001 | 0.016 | -0.001 | 0.012 |
| | (0.033) | (0.009) | (0.008) | (0.019) | (0.005) | (0.014) | (0.004) | (0.007) | (0.055) | (0.006) | (0.013) |
| Age 45-54 | -0.001 | 0.002 | 0.010 | 0.012 | 0.005 | 0.010 | 0.007 | 0.003 | 0.048 | -0.001 | -0.014 |
| | (0.013) | (0.009) | (0.010) | (0.026) | (0.004) | (0.022) | (0.006) | (0.006) | (0.162) | (0.008) | (0.013) |
| Age 55 plus | 0.000 | -0.006 | -0.001 | 0.031 | 0.005 | -0.002 | -0.003 | 0.000 | 0.047 | -0.003 | -0.008 |
| | (0.011) | (0.011) | (0.013) | (0.026) | (0.005) | (0.023) | (0.006) | (0.008) | (0.162) | (0.024) | (0.015) |
| Books (Yes) | 0.008 | 0.008 | 0.003 | 0.027 | -0.002 | -0.011 | 0.001 | 0.003 | -0.022 | 0.001 | -0.024 |
| | (0.109) | (0.015) | (0.009) | (0.028) | (0.003) | (0.015) | (0.002) | (0.006) | (0.079) | (0.008) | (0.019) |
| Semi-skilled white | 0.004 | 0.004 | -0.001 | -0.010 | -0.001 | 0.014 | 0.005 | -0.002 | -0.020 | -0.001 | 0.015 |
| | (0.061) | (0.006) | (0.005) | (0.015) | (0.002) | (0.016) | (0.004) | (0.004) | (0.066) | (0.004) | (0.014) |
| Semi-skilled blue | 0.010 | 0.017 | -0.013 | 0.036 | -0.006 | 0.023 | 0.006 | -0.007 | -0.053 | -0.003 | -0.004 |
| | (0.144) | (0.014) | (0.015) | (0.033) | (0.012) | (0.043) | (0.005) | (0.012) | (0.165) | (0.026) | (0.015) |
| Elementary | 0.004 | 0.015** | -0.007 | 0.022 | -0.002 | 0.022 | 0.002 | -0.008 | -0.039 | 0.000 | 0.022 |
| | (0.064) | (0.008) | (0.012) | (0.017) | (0.003) | (0.033) | (0.003) | (0.005) | (0.124) | (0.001) | (0.014) |
| N. of siblings | -0.008 | -0.004 | 0.029 | 0.053 | -0.017 | 0.000 | -0.012 | 0.002 | -0.125 | 0.002 | 0.019 |
| | (0.117) | (0.014) | (0.018) | (0.058) | (0.011) | (0.045) | (0.014) | (0.016) | (0.413) | (0.017) | (0.032) |
| Literacy score | -0.114 | 0.164 | -0.112 | -0.745 | 0.046 | 0.335 | -0.024 | 0.103 | 0.279 | 0.019 | -0.096 |
| | (1.580) | (0.169) | (0.196) | (0.574) | (0.059) | (0.400) | (0.064) | (0.121) | (1.064) | (0.146) | (0.345) |
| Numeracy score | 0.081 | -0.288* | 0.087 | 0.620 | -0.052 | -0.169 | -0.024 | -0.155 | -0.096 | -0.027 | -0.072 |
| | (1.119) | (0.165) | (0.185) | (0.540) | (0.057) | (0.259) | (0.054) | (0.109) | (0.516) | (0.209) | (0.297) |
| Agreeableness | 0.000 | -0.004** | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | -0.001 | 0.000 | 0.003 |
| | (0.001) | (0.001) | (0.001) | (0.002) | (0.000) | (0.003) | (0.000) | (0.001) | (0.002) | (0.000) | (0.002) |
| Conscientiousness | 0.000 | -0.001 | 0.001 | -0.004 | 0.000 | 0.003 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 |
| | (0.003) | (0.001) | (0.001) | (0.008) | (0.000) | (0.006) | (0.001) | (0.001) | (0.013) | (0.000) | (0.003) |
| Extraversion | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.001) | (0.000) | (0.000) | (0.003) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) |
| Emot. S | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | -0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| | (0.002) | (0.001) | (0.000) | (0.004) | (0.000) | (0.002) | (0.000) | (0.000) | (0.001) | (0.002) | (0.001) |
| Open-mindedness | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.003) | (0.000) | (0.000) | (0.001) | (0.000) | (0.003) | (0.000) | (0.000) | (0.001) | (0.001) | (0.000) |
| Intercept | 0.011 | 0.007 | -0.093 | -0.147 | 0.001 | -0.256 | 0.023 | 0.023 | -0.046 | 0.012 | 0.104 |
| | (0.168) | (0.088) | (0.101) | (0.200) | (0.035) | (0.300) | (0.032) | (0.058) | (0.262) | (0.092) | (0.149) |

Notes: Significance level *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$

# 4. Leveling the Playing Field: Cognitive Skills and Test Know-How in Standardized Tests[5]

## 4.1. Introduction

Higher education remains highly stratified by such factors as household income, ethnicity, and gender (Blanden et al., 2022). College entrance exams are a significant barrier for many low-income students (UNESCO & IESALC 2020). Scholars have long debated the efficacy of entrance exams, pointing out that they are highly correlated with socioeconomic status and that, therefore, they preserve and, in some cases, expand social disparities (Buchmann et al., 2010; Zwier et al., 2020).

The controversies around college entrance exams were on full display in the United States since COVID. During Covid, most US universities suspended entrance exam requirements, and many adopted policies to eliminate them permanently. MIT created shockwaves in late 2022 when it reinstated entrance exams only to be followed by many of the elite colleges. However, even prior to Covid, entrance exams were under fire. In 2019, a coalition of interest groups sued the University of California claiming that entrance exams discriminated against low-income students and students of color. The settlement in this case led the University of California and eventually the entire state of California to eliminate entrance exams in all public, four-year colleges. Criticism about the validity of entrance exams is not limited to the US experience. Its role has also been debated in other countries such as China, Brazil, Turkey and Chile, with a shared concern for the role of wealth in student outcomes (see summary in Schwartzman and Knobel 2016).

The importance of college exams has led to a significant market for test preparation services. In the US alone, supplementary preparation services form a US$70 billion dollar market, and because of the private costs of these services, the market largely serves middle- to upper-income families. The uneven access to college

[5] This study is coauthored with Eric Bettinger (Stanford University) and María Paz Urgilés (Universidad de Cuenca). This work was supported by Universidad de Cuenca [grant II Convocatoria de Investigación-Vinculación]. The project was led by the doctoral candidate as principal investigator. Ethical approval was granted by the Bioethics Committee of the University of Cuenca and University of Barcelona (IRB No. IRB00003099).

exam preparation services has led many college access programs to create test preparation services that help disadvantaged students improve their performance on college exams.

Messick (1982) hypothesized three mechanisms by which test preparation could reduce gaps in socioeconomic status. The first consists of genuine improvements in skills and abilities related to the test content. The second focuses on understanding the test structure, item types and timing, which improves performance through reducing interferences in the test such as anxiety and stress. The third mechanism is to learn test-taking strategies such as memorizing common answers or improving guess probabilities. We try to distinguish between these mechanisms in a randomized experiment focused on low-income students preparing for college entrance exams in Ecuador.

Ecuador is an interesting case study. The government established entrance exams in 2012 with the aim of adopting the principles of equality of opportunities, meritocracy, and transparency (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT), 2015). Even so, there has been a clear association between socioeconomic status and entrance exams. For example, a majority of high achievers either participate in private courses and tutoring or they took the exam multiple times (Madrid, 2019). In some universities, 75 percent of admitted students participated in some type of private preparation. Such private preparation can be costly and out of reach for low-income students. When established, the Ecuadorian government hoped that college enrollment gaps by socioeconomic status would shrink; however, they have increased. Although Ecuador has less inequality than other Latin America countries in term of access to higher education, the college attendance gap between high and low socioeconomic students remains at 34 percent (Villalobos et al., 2017).

To examine how preparation can influence socioeconomic gaps and why, we conducted a randomized controlled trial within 28 public schools in Ecuador. We focused on making test taking practice accessible to economically underprivileged students. Treated students received training that covered topics on numerical and logical reasoning through both guided and independent practice. Control students did not receive any coaching. The results suggest a significant improvement in scores in a standardized test following the treatment. Higher scores were primarily the result of managing time better during the exam by completing more problems. We discuss the implications of this finding for Ecuador but also more generally, considering the implications for the existence of the exam and the persistent socioeconomic gaps in higher education throughout the world.

The remainder of the study is organized as follows. Section 4.2 offers a brief review of the literature on college entrance exams and a description of the

Ecuadorian context. Section 4.3 outlines the experimental design. Section 4.4 presents the empirical strategy used. Section 4.5. summarizes the main results and examines possible mechanisms of the treatment effect. Section 4.6 offers concluding remarks. Section 4.7. provides an Appendix with complementary figures and tables.

## 4.2. Background and setting

### 4.2.1. College entrance exams

Policymakers and academics have long debated the efficacy of college entrance exams. For example, scholars have criticized college entrance exams claiming that they contribute to rising levels of stress and anxiety in students (Cassady & Johnson, 2002; Embse et al., 2018; Seipp, 1991); narrow the curriculum at schools (Berliner, 2011), fail to predict college success (Bettinger et al., 2013; Belfield & Crosta, 2012), and increase overall inequality (Montgomery & Lily, 2011; Lee et al., 2009).

The relationship between entrance exams and inequality and access has had a special role in the United States, where scholars have questioned whether they discriminate by socioeconomic status and race (Hughey, 2018, Fleming & Garcia, 1998) and whether they provide uneven opportunities to students who can afford to retake the exams (Goodman et al., 2020). Other cross-country studies have found a positive relationship between socioeconomic status and private preparation, and such disparities are stronger in countries with high-stakes testing (Zwier et al., 2020). If this type of preparation indeed enhances performance, it is a contributing factor to the positive and strong relationship between student socioeconomic status and test achievement (Wiseman 2021) and, therefore, may exacerbate educational inequalities (Lee et al., 2009).

There is extensive literature examining the impact of private preparation on exam performance (Lee et al., 2009). When significant, it usually points out that students who participate in these courses score higher and have a higher probability of entering college. The effect has been found to be positive in general (Tansel & Bodur, 2005; Ku et al., 2022; Buchmann et al., 2010) and for specific subgroups such as low achieving students (Zhang, 2013) and those who access high quality services (Loyalka & Zakharov, 2016). In some cases, the results have been indicative of stronger impacts of supplementary services for students from lower socioeconomic backgrounds (Montgomery & Lily, 2011).

The fact that private preparation may enhance performance, but it is not equally accessible for students from all socioeconomic backgrounds highlights the inherent inequities of its effects in favor of wealthier households (Montgomery & Lily,

2011). As such, private tutoring may entail an economic constraint for higher education, even in contexts where college access is tuition-free (Kosunen et al. 2021). This motivates the claim that standardized testing discriminates against disadvantaged groups, reproduces wealth inequalities, and perpetuates inequalities in race and class status (Au, 2013).

Test preparation services often focus on different skills. For example, test preparation services teach academic content and may improve performance by building cognitive knowledge, helping students answer questions more accurately. Additionally, they can teach procedural knowledge about the tests. This procedural knowledge might improve students' strategies in taking the exam understanding question types and structure, pacing, the value of guessing, and other elements of the particular exam. The programs also teach other test-taking skills which are more closely related to content. For instance, strategic guessing is a strategy taught to improve students' chances of answering a problem but requires some knowledge of content to eliminate some possibilities to maximize probabilities. Our study is one of the first to try to distinguish between these competing hypotheses.

### 4.2.2. Setting in Ecuador

Ecuador is a middle-income country that, over the last two decades, has redesigned education at all levels. The country is one of the top investors in education in Latin America, and for example, since 2016, its average expenditure in higher education as a percentage of GDP has been twice the Latin American average (Villalobos et al., 2017; Banco Mundial, 2024). Yet the country still experiences major socioeconomic gaps in access and attainment between urban and rural, public and private, indigenous and non-indigenous students (Madrid, 2019).

With the aim of expanding opportunities for access to higher education, Ecuador established a standardized, college-entrance exam in 2012. Its management was centralized and assigned to the National Secretariat of Higher Education, Science and Technology (SENESCYT) (Burneo & Yunga, 2020). This represented the return of high-stakes testing to Ecuador after its abolition as a response to the 1969 social grievances claiming exams were discriminatory, elitist, and limiting to low socioeconomic status students.

SENESCYT has modified the test on multiple occasions, changing the content and format. Its name also changed from ENES in 2012, to Ser Bachiller in 2017, and then Transformar in 2021. In the midst of our intervention in 2023, the admission process was decentralized, and each higher educational institution could administer its own admissions exam. Throughout the evolution of this national test, however, there has constantly been a demand for supplementary preparation.

Since 2021, Transformar has been a competence-based assessment of verbal, numerical, logical, attention and concentration skills through 160 multiple choice questions (40 per area), each with one correct answer option (SENESCYT, 2022). The exam was free to take, lasted sixty minutes and was administered simultaneously across the nation. Individuals could take the exam in a governmental online platform or in-person at authorized facilities.

Evidence from the 2014 exam showed that the majority of top performing students in the exam come from private and other non-public schools (Zambrano-Ramírez 2016). Some have alleged that the superiority of private schools comes because of extensive school-based preparation or private tutoring, which is more likely to be used by students in private schools (Instituto Nacional de Evaluación Educativa (INEVAL), 2019).

College admissions are made based on a supply and demand scheme. When students register for the Transformar, they select the university and the career to which they aspire. They can rank up to three potential programs. Final admissions scores are the result of weighing college entrance tests and high school graduation scores. Affirmative action policy confers extra points for factors such as ethnicity, residence area and socioeconomic status. Extra-curricular activities do not contribute to admissions decisions. Once the final scores are published, SENESCYT assigns a place by university and by career, using each student's score and career preferences. SENESCYT sends the offer to each student, who then decide whether to accept it. After the first round, SENESCYT conducts a second and third round if needed. After the two rounds, approximately 90 percent of the available slots in higher educational institutions are allocated (SENESCYT, 2022).

## 4.3. Research design

### 4.3.1. Experimental design and population

Our intervention aims to prepare students from underprivileged high schools in Cuenca, Ecuador for standardized tests. Cuenca is the third largest city in the country (Arias et al., 2023). Using national performance rankings of the entrance test scores, we targeted the 32 public schools in the urban area of the city. Students from these public schools come from lower socio-economic backgrounds, have less access to private exam preparation services, and less home and school resources such as internet connections or a study desk (INEVAL, 2019).

We specifically focus on students entering their third year of high school. These students would likely take the college entrance exam by the end of that year, when they are graduating high school. Of Cuenca's 39 public, urban high schools, 32 had

more students in low-performing categories than in high-performing categories according to the INEVAL (2019). The relative ranking across schools has been fairly constant over time.

We invited all 32 schools to participate. Four schools did not reply despite multiple attempts. The other 28 agreed to take part in the study. These 28 schools cover 77 percent of urban public-school students according to the administrative records (MINEDUC, 2023).

Within each participating school, there were two to eight classes. Overall, we had 75 participating classes across the 28 schools. We randomized across classes within each school. Each school created time for the intervention in the classroom and assigned a person to be in charge of assisting the research team in the delivery of consent forms at the school and the student level. Students who did not consent participated in a separate activity under the supervision of the class teacher. Less than 1% of students did not consent.

Prior to the intervention, we conducted focus groups in eight of the targeted schools with the aim of understanding the students' perspective about going into higher education and delving into the role of entrance exams. The transcript of the conversations identified important factors surrounding the process. One of the most salient is the fear and anxiety that students feel about the exam. Students specifically mentioned the time constraints. Students also suggested that they felt additional anxiety since they had limited exposure to both practice and general exam information. We also were able to confirm that resource constraints limited students' access to supplementary services outside of school. During our visits to schools, we learned that teachers had limited information about admissions processes.

In the design phase of the intervention, we also had conversations with school administrators. None of the schools in our sample had enough computers within any class to allow computer administration; and internet access was even more restricted. As such, we administered the intervention by paper and pen.

The intervention took place from December 2022 to May 2023. It consisted of a total of eight short lessons (guided practice), practice worksheets (independent practice), and practice exams. We administered these short lessons over five sessions. The short lessons focused on basic numerical and logical reasoning.

We rely on four sources of data: a baseline exam, a baseline survey, a final exam, and an endline survey. Once we entered a school, the entire intervention took about three weeks. The surveys included demographic, socioeconomic and academic information. The exams, and the worksheets, consisted of question items selected from a library developed by the E-Learning Lab of the University of Cuenca

in 2022 and were based on the two Transformar practice worksheets available to the public on the official webpage. We created no new resources beyond those which were already publicly available. The practice exams included only the math section of the Transformar

Twenty-four university students from the School of Pedagogy of Experimental Sciences of the University of Cuenca had the role of "instructor" and delivered the intervention. This activity counted as part of the internship workload that the students must register as a requirement for graduation. The students received a six-hour training session in the procedures of the intervention.

The intervention consisted of working sessions lasting 80 minutes each, i.e., the equivalent to two class periods. The instructors started each session by registering attendance and providing instructions to the students. Students were informed about the timing of each activity and asked to silently wait if they finished the practice worksheets early.

In the first session, the baseline exam and initial survey were administered. At each subsequent session they started by solving the scheduled practice worksheet, followed by the short lesson that aimed at providing feedback. In the fifth session, the instructor presented the final material, administered a follow up survey, and conducted the final exam. We defined this order of activities since the contents of the tests have already been learned; therefore, our intervention is aimed at reactivating the students' prior knowledge while familiarizing them with the test structure by exposing them to the item's formats and time constraints. In the short lessons, the instructors were told to emphasize the comprehension and reasoning skills required.

The control group was not exposed to the short lessons nor practice worksheets. While the treatment group was working in the scheduled activities, the control group was having the regular scheduled class. During the first and last sessions, control group students completed the exams and surveys. The consent form had the same format for treatment and control conditions.

### 4.3.2. Balance of randomization

The internal validity of our results depends on two factors. First, our randomization should create a balanced sample across treatment and control groups. Second, attrition from our sample should not vary by treatment status. We examine both of these in turn.

Randomization resulted in 40 out of 75 classes in the treatment condition. The full sample consists of 1,955 students, 999 participating in the treatment and

956 in the control group. There are two reasons why the number of treatment classes is higher. First, when schools had an odd number of school classes, we assigned the "extra" class to the treatment (for example, if there were five classes, three were assigned to treatment and two to control). Second, there were schools where there was a single class. This represents a group of three schools that corresponds to 2.3 percent of the students in the sample. These single class schools were directly assigned to the treatment group. While this group was not randomized, they may give additional statistical power. We report our main results with the complete sample but our results do not change when we exclude these single-class schools.

Given that randomization happened within schools and across classrooms, we included school level fixed effects and clustered the standard errors are the classroom level. We show the balance of our sample in Table 4.1. Our covariates are indeed balanced across the different groups and do not predict treatment status. Only a few characteristics appear to show some difference. There were some small differences in the income distribution and also in the distribution of educational aspiration. All other differences are not statistically significant. We also test the joint significance of all covariates in predicting treatment status (see the p-value of Chi-test) and find no evidence of imbalance across the treatment and control groups.

Table 4.2 shows attrition reporting the likelihood that students participated in our data collection activities. On any given day, about 10 percent of students are absent. In the first session, absenteeism was about 10 percent, with no significant difference between the treatment and control groups. When we held our last session, the fifth session, absenteeism was up from 10 percent to 13.2 percent in a balanced way across the treatment and control groups. We also look at absenteeism in both sessions, which shows that 18 percent of the sample missed either the first or the last session. Again, this does not seem to suggest any imbalance.

Another way to examine attrition is to examine whether students are missing data in any of our data collection tools. Our key outcomes and baseline covariates come through four sources of data: two exams and two surveys. We examine attrition on these data sources in Table 4.3. We create an indicator for whether the student participated in a source of our data collection. We then regressed this indicator against a treatment indicator with school fixed effects and standard errors clustered at the classroom level. The results suggest balanced attrition across all of our data instruments. There is no significant difference in the likelihood that students participated in initial and final exams, the student survey, or a short survey.

Table 4.1. Balance analysis

| | Control Mean (1) | Regression Adjusted Difference (2) | Sample Size (3) |
|---|---|---|---|
| Female | 0.532 | -0.002 | 1787 |
| | (0.499) | (0.022) | |
| Income | | | 1734 |
| $0 - $186 | 0.096 | -0.011 | |
| | (0.295) | (0.009) | |
| $187 - $292 | 0.158 | -0.033** | |
| | (0.365) | (0.013) | |
| $293 - $412 | 0.227 | 0.006 | |
| | (0.419) | (0.017) | |
| $413 - $560 | 0.293 | 0.016 | |
| | (0.455) | (0.015) | |
| $561 - $1830 | 0.211 | 0.010 | |
| | (0.408) | (0.019) | |
| > $1830 | 0.015 | 0.013** | |
| | (0.123) | (0.006) | |
| Educational Aspiration | | | 1800 |
| High School | 0.022 | 0.016** | |
| | (0.146) | (0.008) | |
| CTE | 0.045 | 0.002 | |
| | (0.207) | (0.010) | |
| University | 0.370 | 0.034 | |
| | (0.483) | (0.023) | |
| Post-graduate | 0.563 | -0.052* | |
| | (0.496) | (0.027) | |
| P-value of Chi test for joint significance | | 0.133 | |

Notes: Column 1 presents the average variable levels for the control group. Column 2 presents coefficients on treatment of regression of covariate on Treatment dummy with school fixed effects. Colum 3 the total sample size. Clustered standard errors are in parentheses in Column 2. * p<0.1, ** p<0.05, *** p<0.01

Table 4.2. Attrition over time

| | All Students | Treatment | Control |
|---|---|---|---|
| Students Complete S1 | 89.9% | 90.7% | 89.1% |
| Students Complete S5 | 86.8% | 86.9% | 86.7% |
| Students Complete S1 & S5 | 81.8% | 82.1% | 81.6% |

Notes: In the first session (S1) there were 101 students who did not complete one of the collection instruments. In the last session (S5) there were 166 students who did not complete one of the collection instruments.

We derive our covariates based on the data instruments, and we use standard missing value techniques for students for whom we have a final exam but lack some set of the relevant covariates. Appendix Table A. 4.1 shows the extent of missingness for individual covariates in our sample.

Table 4.3. Differential attrition across data instruments

| | Initial Exam | Final Exam | Student Survey | Short Survey |
|---|---|---|---|---|
| Treatment | -0.004 | 0.002 | -0.021 | -0.005 |
| | (0.017) | (0.015) | (0.015) | (0.015) |
| Observations | 1955 | 1955 | 1955 | 1955 |
| School Fixed Effects | Yes | Yes | Yes | Yes |

Notes: ***p-value < 0.01 **p-value < 0.05 *p-value < 0.1; standard errors in brackets

## 4.4. Empirical strategy

We randomized across classrooms within schools. As such, simple treatment-control comparisons that control for the school structure should identify the treatment effect. Specifically, we estimate the following equation:

$$y_{ijk} = a_k + b * T_{jk} + c * X_{ijk} + e_{ijk} \quad (4.1)$$

where $i$ denotes the student; $j$ represents the classroom and $k$ the school. $y_{ijk}$ is the after-treatment score achieved, out of 40, by student $i$ in class $j$ and school $k$, $T$ is an indicator variable for treated classes; $X_{ijk}$ is a vector of individual-level student characteristics derived from the surveys such as: baseline performance on the exam, sex, household income and educational aspirations. Household income is an open question that we break up into quintiles. Educational aspiration is a categorical variable that captures the maximum level of education that the student wants to achieve among high school, career and technical education (CTE), university or a postgraduate degree. Given our randomization strategy, we cluster our standard errors at the classroom level for the main analyses and include school fixed effects.

While Equation 4.1 can help us understand the efficacy of the intervention, it does not help distinguish between the mechanisms for improvement. As we mentioned above, there are three reasons that test scores can improve (Messick 1982). First, students' content knowledge can improve. Second, students can learn more about the specific test format and pacing across the exam. Students can learn the rewards or penalties that are available for guessing. Third, students can learn test taking strategies (e.g. strategic guessing) that may improve students' overall performances.

To explore these hypotheses, we analyze treatment effects on each question item from the exam. To this end, we use the following equation:

$$y_{qijk} = a_k + b * T_{jk} + e_{qijk} \quad (4.2)$$

where $y_{qijk}$ is the question $q$ outcome variable for student $i$ in class $j$ and school $k$, which can be either of the following outcomes: if the question was attempted, if the question was correctly answered or if the question was correctly answered given that it was attempted. $T$ is an indicator variable for treated classes.

## 4.5. Results

### 4.5.1. Baseline results

Our primary outcome variable is students' performance on a post-experiment test. Table 4.4 reports estimates of the impact based on Equation 4.1. At endline, the control students were able to correctly solve 11 questions on average. We estimate that the impact of the program is 2.4 additional test points representing a 0.37 of a standard deviation impact.

This effect can be taken as large considering the benchmarks proposed by Kraft (2020), who compares it to the average improvement in student achievement that is found at approximately 0.40 SD or less over the course of an academic year. The effect is not influenced by changes in the model's specification. As observed in Columns 2 to 4, it is robust to the addition of covariates for prior test performance, student gender, family income, and students' educational aspirations. As robustness check, we estimated the impact of the program excluding the schools with single classes. These results are reported in Table A. 4.2 in the Appendix.

In terms of pre-registry, the main impact on test scores was the only confirmatory hypothesis. The subsequent analysis is exploratory and designed to help us understand why the impact may have occurred[6].

[6] We did not pre-register the experiment in any registry database. However, we submitted a grant application before the intervention which detailed our design and key outcome. A copy of the grant is available upon request.

Table 4.4. Treatment effects on test score points

| | Basic | Prior | Prior+dem | All |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treatment | 2.358** | 2.494*** | 2.415*** | 2.436*** |
| | (0.957) | (0.924) | (0.907) | (0.913) |
| Prior Test Scores | | 0.487*** | 0.436*** | 0.431*** |
| | | (0.054) | (0.051) | (0.052) |
| Female | | | -1.500*** | -1.627*** |
| | | | (0.373) | (0.407) |
| Income | | | | |
| $187 - $292 | | | 0.335 | 0.344 |
| | | | (0.491) | (0.485) |
| $293 - $412 | | | 0.496 | 0.471 |
| | | | (0.411) | (0.417) |
| $413 - $560 | | | 1.145*** | 1.1084*** |
| | | | (0.411) | (0.405) |
| $561 - $1830 | | | 1.470*** | 1.371*** |
| | | | (0.465) | (0.470) |
| > $1830 | | | 0.128 | 0.009 |
| | | | (1.053) | (1.027) |
| Educational Aspiration | | | | |
| CTE | | | | -0.287 |
| | | | | (0.846) |
| University | | | | -0.06 |
| | | | | (0.639) |
| Post-graduate | | | | 0.478 |
| | | | | (0.806) |
| School Fixed Effects | X | X | X | X |
| Control Mean (st dev) | | | 11.170 (5.595) | |
| Observations | 1751 | 1751 | 1751 | 1751 |
| R2 | 0.181 | 0.244 | 0.268 | 0.270 |

Notes: The table presents linear regression results of the treatment effect on an outcome variable measuring the post-experiment test final scores. All estimations are performed with clustered standard errors at the classroom level and school fixed effects. Column 1 includes only treatment. Column 2 presents the effect of treatment including prior exam performance. Column 3 adds socioeconomic information, i.e., sex and income. Column 4 adds academic information, i.e., educational aspirations. Significance is denoted by ***p-value < 0.01 **p-value < 0.05 *p-value < 0.1; standard errors in brackets.

### 4.5.2. The anatomy of test score gains

In Table 4.5, we start to unpack our main result. As mentioned, our goal is to identify whether the impacts occur because of changes to content knowledge, procedural test knowledge and/or test taking strategies. To start, we examine effort. We use Equation 4.1 but replace the outcome variable by two variables that have been studied as proxy measures of effort by Gneezy et al. (2019) and Zamarro et al. (2019): i) the response rate, measured by the total number of questions answered/attempted by the student and ii) the share of correct responses, measured as the ratio of the number of correct answers over the number of attempted questions by the student.

We first examine the impact of the treatment on the number of questions that students attempted (Columns 1 and 2). Since incorrect answers are not penalized (i.e. students receive negative points for incorrect responses as in the SAT), this increase can be seen as an increase in the effort they expend in the test as a way of maximizing their scores, which can be driven by a concern for their performance (Gneezy et al., 2019). It also represents test knowledge about the lack of penalties for attempting and the importance of timing so that students can attempt all questions. We find that treated students try five additional questions. This is a significant improvement in students' underlying effort.

Table 4.5. Treatment effects on effort variables

| | Attempts (1) | Attempts (2) | Share of Correct (3) | Share of Correct (4) |
|---|---|---|---|---|
| Treatment | 5.005*** | 5.033*** | -0.003 | -0.001 |
| | (1.266) | (1.115) | (0.017) | (0.017) |
| Constant | 21.907*** | 24.323*** | 0.545*** | 0.425*** |
| | (0.811) | (1.691) | (0.008) | (0.029) |
| Observations | 1751 | 1751 | 1751 | 1751 |
| Covariates | | X | | X |
| R2 | 0.167 | 0.266 | 0.071 | 0.087 |

Notes: The table presents linear regression results of the treatment effect on effort variables. In columns 1 and 2 the outcome variable is the total number of answered/attempted questions by students. In columns 3 and 4, the outcome variable is the share of correct responses over attempts by students. All estimations are performed with clustered standard errors at the classroom level and school fixed effects. Significance is denoted by ***p-value < 0.01 **p-value < 0.05 *p-value < 0.1; standard errors in brackets.

In Columns 3 and 4, we examine the effect of the treatment on the share of correct answers. If students are less likely to have correct answers, then the

treatment would have only increased random guessing. On the other hand, they could be exercising more effort in each new attempt and more likely to have more correct answers (Jacob, 2005). In our case, the results display a non-significant effect suggesting no differences in the probabilities that students' answered questions correctly conditional on attempting. This seems to point less to new content knowledge and more to a change in students' approach to the exam.

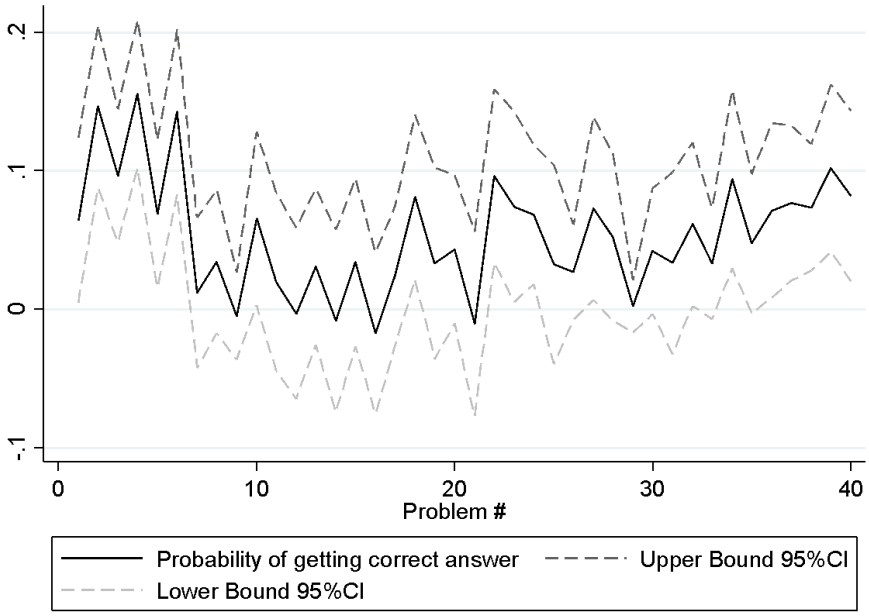
Gneezy et al. (2019) and Zamarro et al. (2019) have proposed that the rate of attempts is an important indicator of effort as a student who cares about performing well will attempt to answer every question. Since not answering is always an alternative, and there is no incentive for finishing the test, these results suggest that students may be taking the opportunity to try and maximize their results. They have no incentive to do so apart from more practice on test taking. Therefore, taken together, the results in Table 4.5 suggest that the treatment helped students feel more comfortable trying and exerting effort. Moreover, such compromise to task may be a unique form of human capital more related to the soft skills that have recent attention for its impact on later-life outcomes such as educational attainment and earnings (Hitt et al., 2016; Anghel & Balart, 2017).

We make one important caveat to these results. Columns 3 and 4, and much of our subsequent analysis relies on conditional results, i.e.,conditional on students attempting to answer the question. The problem with conditional results is that the treatment induced students to answer more questions. So the conditionality could be endogenous. However, we believe that the conditional results, if anything, understate any treatment effect. The marginal student induced to answer an additional question likely has a lower probability of getting the correct answer than the average control student. As such the treatment effect estimate should understate the true probability of answering correctly. Hence our conditional estimates in Table 4.5 should be a lower bound on the treatment effect.

To understand more about the students' experience and the treatment effects, now we turn our results to the conditional responses question per question. In short, we find little treatment effect once we control for the probability of guessing and find only marginal evidence that performance improves at the item level as a result of the treatment.

Figure 4.1 shows the results of estimating Equation 4.2 using as outcome variable an indicator variable of whether the item is answered correctly. A wrong answer or a failure to attempt to answer the question (non-response) would lead to an incorrect answer. Treated students are about 10 per cent more likely to answer questions 1 to 6 correctly. Then, the probabilities of correct answers are not significantly different from zero until the last five questions, and the observed point estimate of the treatment effect is increasing after question 30.

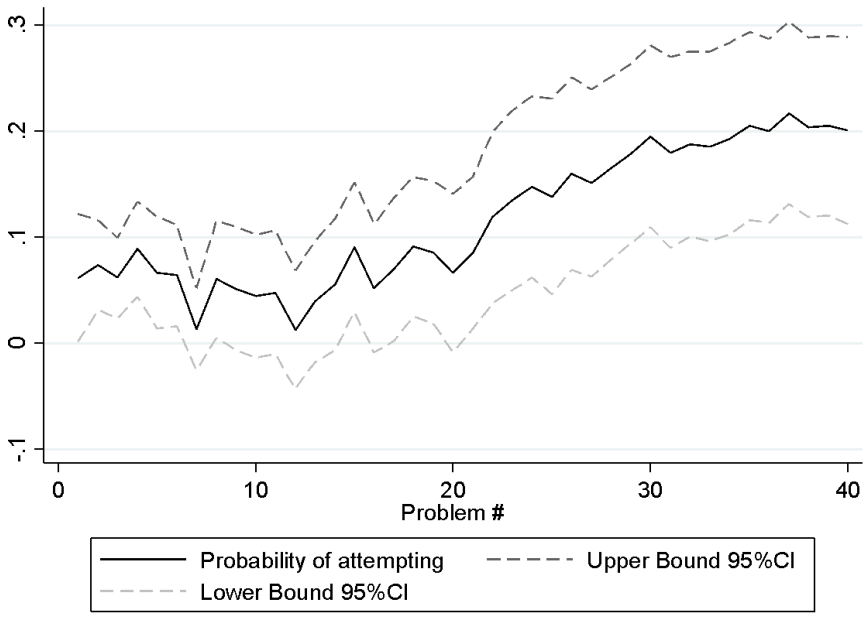
Figure 4.1. Probability of answering each question correctly




Notes: The figure presents the results of treatment effects by question item. The outcome variable is a binary indicator of a correct response on the item. The solid line represents the point estimate obtained from a linear probability model. Dashed lines denote the 95% confidence interval. All estimations are performed with clustered standard errors at the student's level.

Given that not attempting a question can lead to the observed impacts in Figure 4.1, we explore the probability of attempting a question in Figure 4.2. As in Table 4.5, we find that treated students attempt more questions; however, here we find that students' increased attempts are really driven by the back half of the exam. This may sound unpredictable in view of evidence where test taking behavior points to a decrease in students' effort and motivation as the test progresses (Borgonovi & Biecek, 2016). Since we observe an increase in the probability of answering throughout the test, this could indicate that treated students are willing to answer more questions through different levels of difficulty and fatigue.

Figure 4.2. Probability of attempting each question

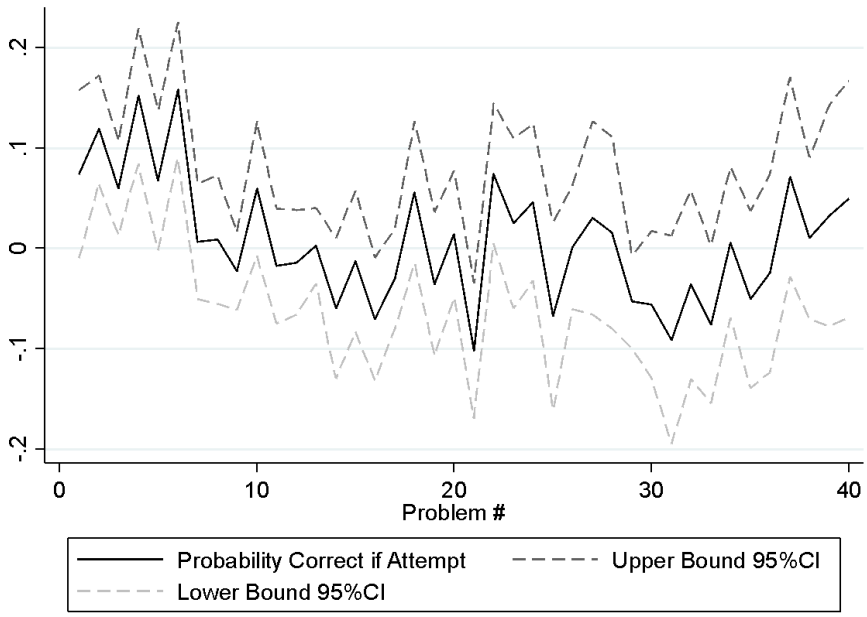



Notes: The figure presents the results of treatment effects by question item. The outcome variable is a binary indicator of a response/attempt on the item. The solid line represents the point estimate obtained from a linear probability model. Dashed lines denote the 95% confidence interval. All estimations are performed with clustered standard errors at the student's level.

Notwithstanding this increased interest in completing the test, the probability that these attempts are correct is not greatly improved and we observe a treatment effect only in questions one to six. This is presented in Figure 4.3, which focuses on correctness, conditional on attempting. The results reinforce those from Figure 4.1. An increase in knowledge content may explain the results in questions one to six but not beyond that. After that, it is about test taking knowledge or strategies.

Taken together, these results suggest that about 20 to 25 percent of our treatment effect would be due to an improvement in students' content knowledge to solve the problems (driven by problems 1-6). This likely comes from the guided practice that focused on reviewing the key concepts involved and breaking down the processes needed to solve the problems. The remaining of the treatment effect we could argue to come from the adoption of non-cognitive skills related to test-taking. For instance, Gneezy et al. (2019) found that students of all cognitive ability levels attempt solving more questions when motivation is leveraged. Furthermore, Hitt et al. (2016) and Zamarro et al. (2019), show that in surveys and tests, the number of attempts can be associated to individuals' traits such as consciousness, diligence and perseverance. These traits may come from a better understating of the structure of the questions, which is likely to be the result of exposure to the test and independent practice.

Figure 4.3. Probability of getting the answer correct conditional on trying




Notes: The figure presents the results of treatment effects by question item. The outcome variable is a binary indicator of a correct response on the item conditioned on attempting. The solid line represents the point estimate obtained from a linear probability model. Dashed lines denote the 95% confidence interval. All estimations are performed with clustered standard errors at the student's level.

While we have demonstrated that effort seems to be driving students' increased attempts, we have not demonstrated whether students have learned test-taking strategies that might improve their performance over just guessing. We demonstrate this in two ways. First, in Figure A. 4.1 where we plot the probability of getting a correct answer, conditioned on attempting, by treatment and control, compared to a guessing strategy. We do see evidence across the board that students' answers are better than a guessing strategy; however, outside the first five questions, we do not see a difference in the probabilities by control and treatment groups.

To demonstrate this statistically, we estimate out the following regression in Table 4.6:

$$y_{ijk} = a_k + b * T_{jk} + c * Guess_{ijk} + d * Guess_{ijk}T_{jk} + e_{qijk} \qquad (4.3)$$

We compute the total score $(y)$ for student $i$ in classroom $j$ in school $k$ for a set of questions (e.g. Questions 1-5). We compute this only for the questions a student attempted. Therefore, if we were doing this for the first five questions and they only attempted one question, then it would show the score for that one question. The variable $Guess$ is the expected score if students solely guessed randomly on each question that they answered. For example, if a student only attempted one question out of the first five and there were four possible answers, then the value

would be 0.25 for the Guess variable for that student. If the student attempted all five questions and each was multiple choice based on four options, then $y$ would denote the total correct while the Guess variable would take on a value of 1.25 (5 questions * 0.25). If a student's score was completely based on guessing, then the estimated coefficient on Guess should equal one ($\hat{c} = 1$). The interaction term tests whether students guessing patterns were better for treated students. The main treatment effect should pick up the improvement in test scores based on content knowledge while the interaction tests whether guessing patterns are better. If the test preparation workshops taught students how to be more savvy in their guessing, then this coefficient would likely be positive. For ease, we report one-sided t-tests for the probability of guessing with the null hypothesis that the coefficient is less than one.

The results are suggestive that students, both control and treatment, are good at guessing when they do so. Either they have good content information and are able to get questions right or they are able to make "educated" attempts that are better than blind guesses. For almost every interval, students performed above guessing level.

We find no treatment effect for students test scores in this exercise. The interaction terms do not suggest that treated students perform better than control students at guessing. The treatment variable is never statistically significant and the overall score is largely driven by improved (but not significantly different) in the aggregated, conditional-on-responding score in the first five questions. This seems to provide more support that the score is largely based on students' increased effort to at least make an attempt on all questions.

The interaction term also helps us reevaluate the results in Table 4.5 that were conditional on responding. All of the results in Table 4.6 were conditional on responding. If indeed, marginal-treatment-induced-item-finishers among the treatment group had a lower probability of answering a question correct then we should see a reduction in the interactive term when the probability of answering is higher. Consider, for example, comparing columns 3 and 5 of Table 4.6. In questions 6-10, there was no difference in response rates across treatment and control groups. There was no significant improvement for the control group in students score above guessing ($c$=1.093, p=value on null hypothesis that $b$<1 = 0.196). The point estimate on the interaction is positive but not significant. The positive point estimate suggests that, for these questions that treated students were just as likely to answer, the performance above guessing is better but not significantly so. By contrast, column 5 focuses on the questions where treated students were more likely to answer. All control students perform better than guessing (p-value that $c$=1.269>1 = .004), indicating that they likely used partial knowledge or test strategies beyond chance.

However, among treated students, the interaction term turns negative, suggesting that they gained less from these strategies than the control. If indeed the extra treatment students were weaker students who were less likely to be successful at adopting strategies, then the average performance for treated students relative to control should have fallen which is exactly what the point estimate suggests. We lack power on the interactions to make definitive conclusions on the potential bias, but the lack of significance fits a pattern that the change in performance is almost entirely based on students attempting questions that were previously not answered as a result of the treatment.

Table 4.6.Treatment effects conditional on attempting compared to guessing strategies

| | Entire Test | Questions 1-5 | Questions 6-10 | Questions 11-20 | Questions 21-40 |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Probability of Guessing | 1.143*** | 1.262*** | 1.093*** | 1.353*** | 1.269*** |
| | (0.072) | (0.149) | (0.108) | (0.041) | (0.098) |
| Treatment | 0.618 | 0.484 | 0.012 | 0.046 | 0.116 |
| | (0.819) | (0.296) | (0.188) | (0.208) | (0.259) |
| Probability of Guessing*Treatment | 0.019 | -0.022 | 0.149 | -0.048 | -0.031 |
| | (0.154) | (0.310) | (0.185) | (0.078) | (0.151) |
| Observations | 1751 | 1751 | 1751 | 1751 | 1751 |
| P-value on whether Coeff on Probability of Guessing < 1 | 0.024 | 0.042 | 0.196 | 0.000 | 0.004 |

Notes: The table presents linear regression results of the treatment effect on an outcome variable measuring the number of correct answers, conditional on attempting. In Column 1, the outcome variable is measured for the entire test. Columns 2 to 5, measure the outcome variable is measured for sections of the test (divided into questions 1-5, 6-10, 11-20 and 21-40). The probability of guessing is defined as the predicted aggregated score for the questions listed conditional on attempting the questions. The regressions also include a "main" effect for Treatment. The reported interaction term tests whether there was a differential pattern of guessing for treatment groups. Significance is denoted by ***p-value < 0.01 **p-value < 0.05 *p-value < 0.1; standard errors in brackets.

### 4.5.3. Translating the impact into changes in college attendance

In this section, we use administrative records from the University of Cuenca, a regional public university in the city of Cuenca to simulate how the improvement in performance in the underprivileged students could translate into enrollment. The University of Cuenca data do not include college admission test data for all students.

The dataset contains the test scores of the students who registered, took the entrance test and enrolled at the University of Cuenca. We do know that a majority of students, particularly the high-achieving students, can enroll. For reference, 75 percent of students who scored above the 90th percentile from our treated schools attended University of Cuenca in prior years.

To simulate the impact of our intervention on college test scores, we carried out the following procedures. First, we converted our estimated impact from Table 4.4 into standard deviations. We then estimated the standard deviation for the treatment school students' test scores among those who applied to University of Cuenca. We then added the treatment effect to the test scores of prior year applicants to University of Cuenca. Next, we estimated the probability of admission by decile using prior year's cohorts' test scores.

With the new "treated" distribution of test scores, we then examined how the treated test scores changed the population at each decile. Using the old probabilities by decile, we then used the new population per decile to estimate the expected increase in the number of students attending Cuenca. Naturally, we are assuming that there are no capacity constraints and that other high schools whose students attend University of Cuenca do not change their behavior. Using this method, we estimate that there could be a 40-50 percent increase in the number of students attending University of Cuenca from our treated high schools. For reference, 564 of the 2,854 entering students at University of Cuenca came from our treated high schools. We estimate that this could increase to almost 800 in our simulation. That is an increase of approximately 40 percent of students coming from disadvantaged backgrounds.

This analysis is specific to the University of Cuenca and could not be extrapolated to the rest of the country. It should also be noted that the data corresponds to schools and a university in the third most important city of Ecuador, where being disadvantage is not as pronounced as in other cities.

### 4.5.4. Cost-effectiveness

Our training intervention can be seen within the broad category of programs aimed at tutoring disadvantaged students. We compare our results with the reference program for tutoring, the "Balsakhi" and a recent program in a neighboring country, Colombia (Alvarez-Martinelli et al., 2021). The authors find score gains of 0.27 of a standard deviation with an implementation cost of 2.25 USD per student and 0.27 of a standard deviation with an average implementation cost of 89 USD, respectively. In our case, the score gains are 0.36 of a standard deviation with an implementation cost of 1.25 USD per student.

For ease of comparison, we report our results into the percentage of forgone consumption per capita. In the program in India, the cost translates into 0.5 percent, in the Colombian case it is a 1.5 percent, and in our case, it amounts to a 0.18 percent of forgone consumption. Following Alvarez-Marinelli et al. (2021), another indicator of cost-effectiveness is the comparison of the intervention's costs and learning gains with those of the school system. To this end, we use data of the Ministry of Education (MINEDUC, 2023) to estimate the school hours that an average student spends in mathematics classes and the approximate corresponding public spending as reported by World Bank data. We estimate that students in high school in their third year in the public school system, i.e., the control group, increased learning by 5 standard deviations per 100 dollars spent while the increase in the treatment group was 22 standard deviations per 100 dollars. The study by Alvarez-Marinelli et al. (2021) finds 0.18 and 0.30 standard deviations per 100 dollars spent, respectively.

The largest cost in this type of program is the instructors' wages; however, in our case they are university students doing their compulsory internship workload. With that, the largest cost is for printing services as we delivered the intervention in paper and pen. Implicitly, the university, by mandating internships, shifts the cost benefit analysis in our favor. A scaled up version without the "subsidized" workforce may not have the same cost effectiveness.

## 4.6. Conclusions

Our results suggest that the impact of the intervention is due to meaningful changes in how students engaged with the college entrance exam rather than large changes in cognitive skills. Treated students attempted significantly more questions, especially in the second half of the test, suggesting greater perseverance and willingness to face difficult or fatiguing parts of the exam. However, their accuracy on attempted questions did not increase significantly, and most of the observed gains in performance can be attributed to greater effort and test engagement, primarily by attempting more questions. Small improvements at the beginning of the test may reflect some content acquisition, yet the overall pattern points to enhanced test-taking behavior as the main mechanism. Importantly, we find that both control and treated students perform above random guessing when they do choose to respond, implying that students—regardless of treatment—either possess partial content knowledge or have learned to make informed, strategic guesses. This reinforces the view that performance gaps may not reflect differences in ability alone, but also differences in approach and confidence in engaging with the test.

Furthermore, the study offers some empirical evidence on how a short-term and simple test preparation intervention can contribute to improve performance using

Messick's (1982) three mechanisms framework. Since we observe some gains in the earliest test questions, there is modest support of mechanism one: improvement in cognitive knowledge. However, the rest of the effect appears to operate through mechanisms two (test familiarization or procedural knowledge) and not three (strategic guessing). Treated students showed greater familiarity with how the test works than the treatment group. Students were also more willing to guess, but their strategic attempts (i.e. "educated" guesses) were no better than the control group. These behavioral changes are consistent with insights gathered from focus groups during the intervention design phase, where students expressed that their greatest source of insecurity stemmed not from gaps in academic knowledge, but from unfamiliarity with the test procedures and structure. In addition, this reinforces the idea that performance on high-stakes exams is shaped not just by what students know, but also by how confident and prepared they feel to navigate the test format itself.

The policy implications are substantial. In Ecuador, high-scoring students are disproportionately those with access to private tutoring, paid preparation courses, or the opportunity to retake the exam multiple times. Our findings suggest that low-cost, school-based interventions that focus on test familiarization and strategic test-taking can serve as effective paths to more equitable outcomes while broader structural reforms are under consideration. We propose that such interventions be viewed not as substitutes for broader reforms, but as mitigating strategies that help level the playing field in the short term.

These insights are relevant to other contexts beyond Ecuador. Since entrance exams in general involve both cognitive and procedural demands, the distinction between what students know and how they approach the test applies broadly. As debates about the fairness and validity of entrance exams persist worldwide, our study highlights a complementary solution: so long as such exams remain in place, providing all students, regardless of background, with the tools to navigate them effectively is essential for fostering a more equitable system of access to higher education.

# 4.7. Appendix

Table A. 4.1. Attrition by variable

| Variable | Complete | Incomplete | Imputed | Total |
|---|---|---|---|---|
| Control group | | | | |
| Female | 866 | 90 | 90 | 956 |
| Income | 843 | 113 | 113 | 956 |
| Educational Aspiration | 872 | 84 | 84 | 956 |
| Treatment group | | | | |
| Female | 921 | 78 | 78 | 999 |
| Income | 891 | 108 | 108 | 999 |
| Educational Aspiration | 928 | 71 | 71 | 999 |
| Overall | | | | |
| Female | 1787 | 168 | 168 | 1955 |
| Income | 1734 | 221 | 221 | 1955 |
| Educational Aspiration | 1800 | 155 | 155 | 1955 |

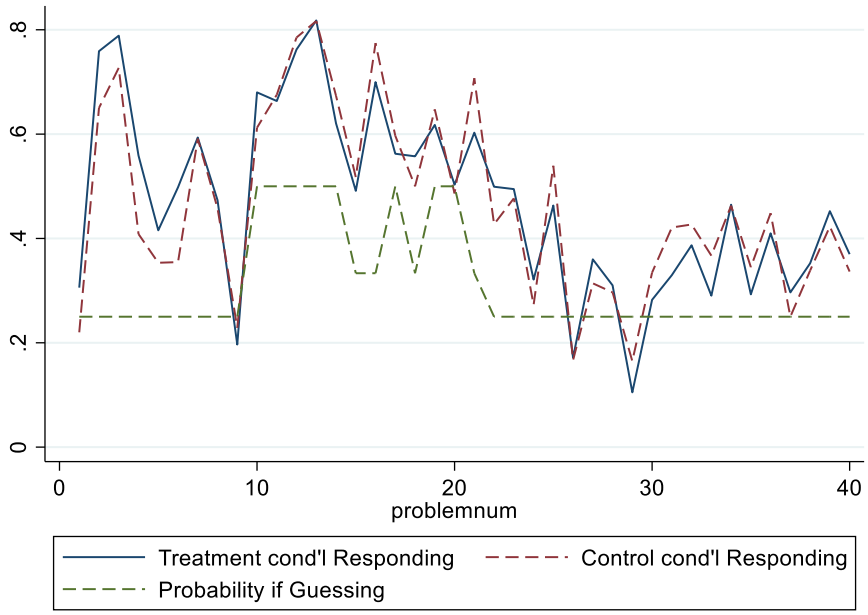
Notes: the table presents the number of collection instruments with complete responses compared to the collection instrument with nonresponse, i.e., not completed, by selected variables and for the overall sample, treatment and control groups.

Table A. 4.2. Main treatment effects excluding schools with single classes

| | Basic | Prior | Prior+dem | All |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treatment | 2.358** | 2.494*** | 2.412*** | 2.437*** |
| | (0.957) | (0.923) | (0.907) | (0.912) |
| Prior Test Scores | | 0.483*** | 0.432*** | 0.427*** |
| | | (0.055) | (0.051) | (0.052) |
| Female | | | -1.542*** | -1.666*** |
| | | | (0.382) | (0.417) |
| Income | | | | |
| $187 - $292 | | | 0.234 | 0.245 |
| | | | (0.501) | (0.495) |
| $293 - $412 | | | 0.461 | 0.435 |
| | | | (0.427) | (0.433) |
| $413 - $560 | | | 1.087** | 1.017** |
| | | | (0.424) | (0.417) |
| $561 - $1830 | | | 1.416*** | 1.311*** |
| | | | (0.479) | (0.482) |
| > $1830 | | | 0.163 | 0.026 |
| | | | (1.092) | (1.063) |
| Educational Aspiration | | | | |
| CTE | | | | 0.102 |
| | | | | (0.843) |
| University | | | | 0.2 |
| | | | | (0.627) |
| Post-graduate | | | | 0.744 |
| | | | | (0.815) |
| School Fixed Effects | x | x | x | x |
| Observations | 1708 | 1708 | 1708 | 1708 |
| R2 | 0.179 | 0.242 | 0.267 | 0.269 |

Notes: The table presents linear regression results of the treatment effect on an outcome variable measuring the post-experiment test final scores. All estimations are performed with clustered standard errors at the classroom level and school fixed effects. Column 1 includes only treatment. Column 2 presents the effect of treatment including prior exam performance. Column 3 adds socioeconomic information, i.e., sex and income. Column 4 adds academic information, i.e., educational aspirations. Significance is denoted by ***p-value < 0.01 **p-value < 0.05 *p-value < 0.1; standard errors in brackets

Figure A. 4.1..Probability of correct answer by treatment and control compared to guessing strategy




Notes: The figure presents the binary indicator of a correct response conditioned on attempting, averaged over the treatment and control groups. It also presents the probability of guessing, measured as the predicted score for the question conditional on attempting.

# 5.Concluding Remarks

## 5.1. Main findings

This thesis investigated intergenerational educational mobility from multiple angles, combining descriptive, comparative, and experimental approaches to deepen our understanding of the persistence of inequality across generations. Shifting the focus from an in-depth country analysis to cross-country comparisons, the research addressed ongoing debates about intergenerational mobility spanning regional and gender disparities, and the design of strategies connected to longer-term mobility prospects.

Through the three studies, the thesis responded to its overarching objective, advancing the ongoing debates on intergenerational mobility and specifically showing that it is spatially interconnected and driven by contextual factors embedded in the demographic, human capital and labor market structure of the territories. At the individual level, we showed that proficiency in cognitive and noncognitive skills has an impact on the gender differences in intergenerational outcomes, in ways that are skill and country specific. Finally, it also showed that specific skills can be built in relatively short periods of time to support students from disadvantaged backgrounds. Across the different settings and debates that the thesis explored, the three studies highlighted the role of human capital development not only in advancing individual prospects, but also in generating broader opportunity structures.

Chapter 2 focused on the spatial dimension of intergenerational educational mobility within Ecuador. Using a variety of mobility concepts, it uncovered considerable subnational heterogeneity. Importantly, the study showed that the type of mobility metric used can lead to different conclusions about which areas provide greater opportunities for children to surpass their parents' education. While average educational attainment was highest in many capital cantons, these same areas often exhibited stronger intergenerational persistence. The findings further demonstrated that mobility is spatially correlated, suggesting that contextual elements including migration, ethnicity, schooling level and its distribution, and the composition of employment in one territory affect outcomes in neighboring regions through spillover effects. The study contributes to a broad international literature on regional intergenerational mobility where spatial correlations have been previously discussed yet not tested (Chetty et al., 2014; Acciari et al., 2022).

Chapter 3 shifted the focus to the gender dimension of intergenerational mobility, using cross-country data to examine how cognitive and noncognitive skills shape gendered pathways of educational attainment. The study found a consistent

female advantage in educational mobility relative to male. Although daughters' educational outcomes are more closely tied to their parents' levels of schooling, they are also more likely to surpass their most educated parent. This apparent paradox is resolved when considering that parental transmission may reflect the inheritance of higher parental education rather than social reproduction in contexts where women increasingly attain high levels of schooling. The chapter further explored the role of skills, revealing a significant influence of cognitive skills and noncognitive skills, through numeracy, Conscientiousness and Open-mindedness, respectively, with significant cross-country variation and differentiated effects for women and men. The main takeout from this chapter is the strong case for educational systems influencing intergenerational mobility through skill development. This should consider that cognitive abilities are more strongly influenced by early childhood conditions and heredity, while noncognitive skills are more malleable, especially during adolescence.

Chapter 4 turned to the question of whether a short-term, skill-focused intervention could improve performance in numerical and logical reasoning, a crucial gateway to higher education. It presented the design and implementation of a randomized controlled trial to train low-income high school students. The study found that the intervention significantly increased students' performance, measured by their final score. A breakdown of this suggested that the program built noncognitive skills relevant for test-taking captured by effort proxies, which have been associated with more perseverance, engagement and confidence. Cognitive knowledge was built to a lesser extent. The contribution of this chapter is twofold. First, low-cost school-based interventions can partially compensate for unequal access to private preparatory resources, thus supporting a more level playing field in the short term. Second, these results speak to broader international debates around the fairness and effectiveness of entrance exams.

## 5.2. Collective insights and policy

Together, the three studies can be understood through the lens of Chapter 2, which although focused on a particular country, offers broader implications in terms of the mechanisms through which intergenerational mobility occurs within a country and sheds light on the most effective policy pathways.

By underscoring the relevance of regional disparities and their interconnected nature, Chapter 2 highlights that uniform national strategies may fall short in addressing deeply rooted, territorial inequalities and calls for place-based approaches. Furthermore, the study identifies distinct clusters characterized by intergenerational persistence of low education attainment. Often, these territories also experience

poor outcomes in economic growth, health, basic services, and educational access; therefore, targeting these areas is crucial to prevent them from falling further behind with respect to the rest of the country.

As for the potential mechanisms underlying spatial dependencies, migration emerged as a key positive driver of intergenerational mobility. There is growing importance of internal migration as it exceeds international migration in scale and is expected to continue rising with ongoing urbanization (IOM, 2024). This underscores the role of migration for its widely known benefits, e.g. improved employment prospects and access to services, but also as a tool to promote longer-term societal gains and regional convergence in intergenerational mobility.

Policy design is therefore key and should include efforts that focus on improving internal migrants' access to education, housing and social services in destination areas, thereby maximizing the positive effects of migration and promoting equality across generations. Comparative studies of intergenerational mobility among immigrants and native-born individuals reveal that the former tend to experience higher mobility and that human capital, either through the child's education or the parents', is the pivotal driver (Oberdabernig & Schneebaum, 2017; Zorlu & van Gent, 2023). Hence, the critical importance of education policies is emphasized, where access to quality education and skills training are key to migrants' integration.

Regarding the role of education, in fact, the thesis offers further insights. Across the three chapters, it reveals a shared underlying mechanism through which education systems influence intergenerational mobility: the development and distribution of skills. Chapter 2 shows that regions with higher levels of average schooling tend to exhibit greater mobility. Therefore, increasing schooling opportunities may allow for better outcomes. However, the results also point out that the unequal distribution of schooling undermines the equalizing potential of education, a result echoing Duong (2024).

One potential way in which this manifests in Ecuador is through the unequal access to preparation for university entrance examinations. This indicates that positively intentioned policies such as free university access may have limited impact on educational mobility if students from the lowest socioeconomic backgrounds are, in practice, less likely than their economically advantaged peers to have the skills required to succeed Through a short-term, cost-efficient program aimed at supporting these students, this thesis offers an actionable strategy to support the constitutional promise of equal opportunity. However, there is a need for structural policies to address not only students' access to higher education but completion, and, hence, achieving intergenerational mobility.

Considering that schooling is a pathway to the development of cognitive and noncognitive skills, which our evidence suggests are also fundamental to gender disparities in mobility, these results reinforce the role of the education system as a potential opportunity equalizer.

Building on this evidence, structural education policies could focus on targeted skill building programs, particularly at the secondary level as skills are more malleable at this stage, exhibit the greatest gender disparities, and influence access to higher education. Additionally, policies should address resource allocation across schools and regions from an equity perspective, prioritizing underperforming schools and low attainment regions. One final implication for education policy is the integration of gender-responsive approaches. Given that skills have a gendered impact on intergenerational mobility, a more diverse skill development should be supported among girls and boys.

## 5.3. Future research

Ultimately, improving intergenerational educational mobility requires both a clear understanding of where opportunities are constrained and a commitment to designing interventions that are responsive to those constraints. Drawing on the findings across all chapters, the thesis raises important considerations for future research, which are described next.

From Chapter 2 emerges the need to further explore the mechanisms linking place, migration, and intergenerational progress. While capital cantons tend to have higher average schooling levels and attract more internal migrants, both aspects connected to spatial spillovers of mobility, capitals do not necessarily exhibit higher intergenerational mobility. This apparent disconnect puts forward the need for more evidence unveiling how internal migration interacts with key aspects such as urban inequalities, school quality, and labor market conditions to shape the mobility prospects of migrants and natives in capital cities.

The chapter also highlights the relevance of identifying clusters of intergenerational advantage and disadvantage. This can be informative to the mechanisms underlying the low mobility trap in Latin America. One question that surges is to whether other Latin American countries are also characterized by clusters of high persistence, and whether high-income economies show a combination of these with clusters where high mobility can also be experienced or even a dominance of the latter, and what drives this. Exploring these questions can be a step towards understanding the differences in overall levels of inequality in developing countries compared to developed countries.

The findings in chapters 2 and 3 speak of the relevance of measurement of intergenerational mobility. Using multiple measures of intergenerational mobility proves to offer a better, yet sometimes conflicting, view of the phenomenon. This aligns with recent surveys that highlight that despite some measures are correlated, they should be selected depending on the research question (Deutscher & Mazumbder, 2023). It also points to the need of developing richer measures of mobility, incorporating multidimensional indexes for instance, and for better integrating theory and empirics (Cholli & Durlauf, 2022).

Chapter 3 also points to the need for deeper analyses to unveil the mechanisms behind the influence of skills on gender disparities in intergenerational mobility. For example, recent developments show that more agreeable individuals, usually women, are less likely to negotiate entry-level wages and promotions, and this is a mechanism behind the earnings gender gap (Flinn et al. 2025). This finding prompts a compelling question: how do the characteristics of agreeable, conscientious, open-minded individuals translate into the intergenerational gains or losses presented in this study? Addressing this question would require more granularity in the data.

Moreover, a significant portion of the gender disparity in mobility remains unexplained. This gap that can be filled by building upon research on earlier life stages, which points to other forces behind the gender differences in educational outcomes, including students and parents' aspirations and expectations. Hence, another avenue for future research is the exploration of the link between adult outcomes in intergenerational mobility and these forces. Such research can be grounded in the existing work by Borgonovi et al. (2021) and Gustafsson (2016), who link young and adult educational outcomes.

The studies in chapters 3 and 4 showed that skills are relevant to outcomes related to intergenerational prospects, i.e. entrance to university tests (Chapter 4), and to intergenerational mobility measures indeed (Chapter 3). What remains unexplained is whether the take up of programs designed to build skills differs between boys and girls. According to Delaney and Devereux, (2021), evidence on the gender differences in program response is limited and weak, but points to a higher response by girls. This implies that, while reducing skills gaps between economically advantaged and disadvantaged students, a program like ours can increase gender gaps. Rigorous research is needed to understand if this can become a consolidated finding, and to identify the underlying mechanisms. The research gap here is furthermore funding-intensive as fieldwork through randomized controlled trials is likely the most appropriate way of getting these deeper answers.

Taken together, all the chapters also point to more complex questions regarding the intersectionality of them. Across the 23 countries analyzed, there were different levels of gender gaps in mobility, do different regions within a country mirror this?

i.e. do some regions show larger gender differences in mobility? This is more likely to be the case than not, could this regional variation reflect differences in access to skill-building opportunities? How do school quality, social phenomena and cultural norms around gender and education relate to this? Research argues that boys are more sensitive to economic disadvantages and to certain gender social norms in the education system (Delaney & Devereux, 2021). This calls for further use of intersectional analyses that can disentangle the compound effects of region, gender and skills in mobility outcomes.

All in all, while answering key questions in the debates surrounding intergenerational mobility, the thesis also raises multiple avenues for future research. The findings point to the complex and multifaced nature of the phenomenon and underscore the need for targeted policy design to foster intergenerational mobility. Although this poses challenging demands, it is critically necessary to more equitable societies.

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