Micro-Educational Reproduction

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ABSTRACT

This study analyzes the persistence of educational inequality in advanced industrialized societies with expanding and differentiated education systems. Using Denmark as a case, we investigate changes in immobility patterns for cohorts born 1960-1981 and develop a new micro-educational classification capturing both hierarchical and horizontal forms of educational differentiation. To investigate the association between parents' and children's educational status, we apply log linear models and control for four types of educational immobility: gradational (by returns to education), aggregated (5 macro-educational levels), horizontal (19 fields of study), and disaggregated (62 micro-educations). Our findings show that while macro-educational immobility has decreased across the period, micro-educational immobility at the university and university college levels remains high and stable, in particular for sons. We also find great variation in immobility for specific micro-educations within the university level. Studies of educational immobility would therefore benefit from paying attention to micro-educational classifications, because they capture patterns of multidimensional, disaggregated forms of reproduction. In addition, the micro-educational approach far better explains the immobility of sons than it explains that of daughters, revealing important gender differences in the immobility patterns for sons and daughters.

INTRODUCTION

The educational expansion following World War II has resulted in an overall increase in educational attainment in most Western countries (Breen and Jonsson 2005; Breen, Müller, and Pollak 2009; Shavit et al. 2007). Nevertheless, studies show that social advantages are still reproduced from parents to children through the education system. Not only are children from more advantaged backgrounds better positioned to take up the new educational opportunities that

expansion offers (Raftery and Hout 1993), but they are also more capable of securing for themselves qualitatively different types of education, with higher economic returns or social status at every educational level (Lucas 2001; Hällsten 2010; Thomsen 2015).

In this paper, we introduce a novel micro-educational approach, capturing both hierarchical and horizontal forms of educational differentiation (hereafter called "micro-educations"). We find three compelling theoretical and empirical reasons for introducing micro-education in educational (im)mobility studies. First, previous studies tend to employ a one-dimensional, hierarchical approach to measuring educational attainment, either by using aggregated educational levels (Breen 2004) or by applying gradational measures, such as years of schooling (Hertz et al. 2007). As more students obtain higher education, researchers now argue for a disaggregated and multidimensional approach, classifying education not only hierarchically by level of education but also horizontally by field of study (Ayalon and Yogev 2005; Davies and Guppy 1997; Jackson et al. 2008).

Our micro-educational classification allows us to disaggregate education even further, making possible the investigation of immobility patterns within specific fields of education, for example, between medical students and other health students. Compared to previous classifications, we argue that our micro-educational classification better accounts for educational immobility patterns in advanced industrialized societies with expanding and differentiated education systems. Lucas (2001) examines the social closure processes working through the education system and shows that privileged social groups try to maintain their privilege by seeking out advantages within educational levels, if advantages can no longer be kept just by reaching these levels. Inspired by studies showing evidence of what Lucas (2001) terms 'effectively maintained inequality' (Hällsten 2010; Thomsen 2015), we expect to find that, despite educational expansion, immobility persists in lucrative or prestigious micro-educations (such as architecture, engineering, and medicine programs).

Second, researchers of the multidimensional approach draw theoretically on well-established sociological insights to explain the persistence of educational inequality by referring to social processes in the family, the education system, and the labor market. Previous research highlights the individual's accumulation of personal traits and skills, as in human capital theory (Becker 2009 [1964]), or his or her calculations of risk in an attempt to avoid downward mobility (Goldthorpe 1996). In contrast, researchers applying the multidimensional approach use detailed classifications of parental occupation, highlighting the connection between the family and the educational system.

For example, when explaining the persistence of educational inequality, Van de Werfhorst and Luijkx (2010) draw on Grusky's "micro-class approach" to emphasize the role of parents' occupation. Grusky and Sørensen (1998) argue that the micro-class approach reveals occupation-specific parent-child socialization patterns lost in more aggregated class categorizations, and we apply this argument to the realm of education, suggesting that these occupation-specific patterns already reveal themselves in children's choice of education. Moreover, micro-class reproduction depends on families' relationship to the education system and the labor market (i.e., availability of study programs and job positions), whereas micro-educational reproduction depends primarily on families' relationship to the education system. While children will be influenced by job availability in their educational choices, job availability will not formally limit their educational choices (as when children of architects choose to pursue an architectural degree despite high unemployment rates). As a result, micro-educational reproduction has educational sorting as its primary focus. As an increasing percentage of the population pass through highly differentiated, specialized, and expanding education systems, the micro-educational approach is increasingly necessary.

Third, while much research find empirical evidence of gender segregation in the choice of field of study and in subsequent returns (Barone 2011; England 2010; Kim, Tamborini, and Sakamoto 2015), other studies report new gendered patterns in educational attainment, framing

these differences as the reversal of the gender gap in education (Buchman et al. 2008; DiPrete and Buchmann 2013; Shavit, Arum, and Gamoran 2007). Thus, whereas women today are more educationally mobile than men, gender segregation in choice of field of study and occupation persist. In addition, gender segregation patterns in the family mean that the dominant parent (most often the father) passes on his micro-class to the son, while passing on more generic class-wide skills to his daughter (Breen, Mood, and Jonsson 2016; Jonsson et al. 2009). Following these arguments, we expect our micro-educational approach to better explain immobility patterns for men than for women.

This paper examines whether a new classification of micro-educations better accounts for educational immobility patterns in advanced industrialized societies. We argue that such an approach is necessary if we want to fully understand educational inequality in highly differentiated education systems. We test our argument by examining immobility patterns in an expanding education system for Danish cohorts born between 1960 and 1981. Drawing on the richness of Danish administrative data, our analysis includes four ways of classifying education: gradational (returns to education), aggregated hierarchical, horizontal (fields of study), and disaggregated hierarchical and horizontal (micro-educations). While the inclusion of the first three layers is motivated by previous approaches to the study of educational immobility, the fourth is our new micro-educational classification, consisting of five hierarchical levels combined with 19 horizontal fields at the three upper levels.

As Denmark has witnessed a massive educational expansion, in which the number of people enrolled in higher education has multiplied enormously since the 1950s, it provides a valuable case for examining inequality in advanced education systems. We acknowledge that Denmark, as well as most other advanced industrialized countries, has witnessed high rates of upward mobility within the last 40-50 years. Whereas the significance of this educational expansion cannot be overstated,

we argue that it remains important to thoroughly investigate pockets of persistency of educational reproduction–in particular among educations with high social and economic prestige.

In addition, because the Danish welfare state—with its comprehensive social benefits and a tuition-free education system—reduces the effect of family background on educational attainment (Jæger 2007), any differences found in Denmark will arguably be more pronounced in countries without the same degree of state redistribution. Moreover, similar to the other Scandinavian countries, scholars view the Danish labor market as an example of big-class organization where industrial relations are negotiated between centralized trade unions and employer federations (Andrade 2015; Korpi 1983). Research suggests that the big-class labor market organization mirrors a mobility pattern in which Scandinavian children are more likely to reproduce their parents' big class than their occupation (Erikson et al. 2012; Jonsson 2009). If our analysis shows empirical evidence of high rates of intergenerational micro-educational immobility, we would argue that countries with less big-class organization could be even more affected by micro-educational reproduction.

We find support for our core hypothesis that micro-educations significantly contribute to the explanation of educational reproduction patterns. Most importantly, we find that micro-educational immobility has remained stable even though macro-educational immobility has decreased for cohorts born 1960-1981. In addition, we find that the micro-educational approach far better explains the immobility of sons than it explains that of daughters. As girls and boys display distinctively different (micro) immobility patterns, our findings thus contribute to the literature on educational inequality by shedding new light on the gender differences in educational reproduction.

EXPANDING EDUCATION SYSTEMS IN ADVANCED INDUSTRIALIZED COUNTRIES

Individuals' educational pathways are both shaped and constrained by the opportunities that different education systems provide. Most educational systems in advanced industrial societies are characterized by three major processes of change, although these changes may differ in magnitude due to country-specific institutional variations in education systems (Kerckhoff 1995): expansion in the number of educational institutions and programs, increased differentiation in higher education, and changes in the returns to education. Using Denmark as a case, in this section we briefly outline these processes of change, arguing that each adds credence to our call for a micro-educational approach to educational immobility studies.

Since the early 1960s, to enhance economic growth and advance educational opportunities, all advanced industrial countries have spent increasingly larger amounts of their GDP on education, (OECD 2014). Similar to other advanced industrial countries, Denmark has experienced a major increase in the educational level of its population since World War II, reflected in the massive influx of students to colleges and universities. By Trow's (1972) famous definition, Denmark not only has gone from an elite system of higher education to a mass one but is also on the verge of entering the "universal state," i.e., when more than 60 percent of a youth cohort enrolls in higher education.[1] The first big wave of expansion in Denmark was in the mid-1960s.

The second wave, which began in the late 1980s, coincides roughly with the educational careers of the cohorts examined in this paper (born 1960 to 1981). The educational level of the 30-year-olds has increased across the period we investigate, particularly that of women (Thomsen 2015). The percentage of women who at age 30 were enrolled in a university or had obtained a university degree increased from 7.1 percent for cohorts born 1960-66 to 18.4 percent for cohorts born 1974-81, while the percentage of their male counterparts increased somewhat more modestly, from 8.9 percent to 17 percent in the same period. The percentage of women who completed only

compulsory school decreased from 25 percent for the 1960-66 cohorts to 11.9 percent for the 1974-81 cohorts, while the decrease for men has been less pronounced, from 24.8 percent to 17.2 percent (authors' calculations based on administrative data).

The large investments in education in advanced industrial societies have both resulted in a massive increase in the educational level of the population (Breen 2004) and produced a multitude of new types of education, particularly at the college and university levels (Shavit, Arum and Gamoran 2007). Figure 1 shows that this development also applies to Denmark: The educational expansion has led to an institutional diversification, illustrated by the rise in the number of applicable programs at the different educational levels.

Figure 1 about here

The real increase in the number of applicable programs is clearly at the highest educational level (university), with much more modest increases at the lower levels. We also see a massive diversification in types of programs offered at the university level (from about 150 in 1984 to 400 in 2010). We argue that an increasingly institutionally diverse education system, especially at the most expanding levels, warrants the inclusion of a micro-educational parameter in our immobility models.

Several studies find that educational expansion is followed by a growing polarization in returns to education between, for example, people with a college degree and those with no education beyond high school (Goldin and Katz 2009). However, this growing gap in returns to education is not limited to differences between hierarchical educational levels but is also evident within the hierarchical levels (Kim et al. 2015). A Nordic study (Prix 2013) finds that the average economic returns for college degrees have become more differentiated between 1985 and 2005.

U.S. studies point to social closure mechanisms in the labor market, finding increasing gaps in occupational returns within the same social classes (Weeden 2002, Weeden et al. 2007).[2]

We find similar patterns in Denmark: Figure A1 in the Appendix shows how increasingly heterogeneous returns to education go hand in hand with educational expansion. The rank in the income distribution follows the aggregated educational level: The higher the level of education, the higher the return. Figure A1 also reveal great variation within levels. In particular, the returns to disaggregated educations (measured by field of study) at the university level are increasingly diverse, even though some programs remain at a constantly high rank in the income distribution (e.g., the medicine program at the university level, ranking 98 out of 100 throughout the period [not depicted]). We argue that the increased differentiation in returns to education at the highest educational level further supports our call for a closer examination of the explanatory power of micro-educations in immobility tables. If returns to education are increasingly diverse, then arguing for an aggregated classification of education becomes harder for researchers interested in examining the intergenerational transmission of resources.

THREE APPROACHES TO EDUCATIONAL IMMOBILITY

In this section, we outline the three major approaches to studying educational inequality, the different ways in which they operationalize education, and the prevailing theoretical perspectives within each approach. Inspired by Weeden and Grusky's (2005) review of different ways of measuring (class) inequality, we argue that studies on educational inequality can be reduced to three dominant approaches: a gradational approach, an aggregated approach, and a disaggregated approach. While these approaches have often been presented as competing (e.g., Goldthorpe 2000), we argue that a thorough examination of educational mobility and immobility in contemporary Western education systems must assess the explanatory power of all approaches. At the end of the

section, we discuss the ways in which the disaggregated approach may show promise in addressing issues of educational mobility and immobility.

The gradational approach to educational origin-destination associations

In their search of gradational measures of educational origin-destination associations, some researchers either use years of education as a gradational measure or attempt to overcome the non-continuous nature of length of education by applying relative ranking techniques (e.g., Thomsen 2015). Even so, most followers of the gradational approach tend to use returns to education as a hierarchical principle of ordering education (Card 1999). Whether researchers order education by economic returns or by newer approaches targeting its inherent "lumpiness" (i.e., non-gradational nature), their aim has been to present a parsimonious, one-dimensional explanation of the origin-destination association.

Studies using the returns-to-education approach have traditionally been linked to Becker's (2009 [1964]) influential theory of human capital (Black, Devereux, and Salvanes 2005). Human capital theories propose that investments in education and job training of any kind constitute a positional good that leads to a higher amount of individual human capital. Individuals invest in education to obtain resources, in terms of skills and knowledge that are valuable in the labor market. In this way, education translates into a job, transforming human capital into economic returns. The dominant returns-to-education approach constitutes a major explanatory framework for analyzing origin-destination patterns. In our later log-linear models, we include a term that assumes a linear association between parents' and offspring's returns to education, in our case meaning that intergenerational returns to education should explain a substantial part of the origin-educational destination transition in our models.

The aggregated approach to educational origin-destination associations

The aggregated, hierarchical approach to classifying education is by far the most common in the sociological literature on educational mobility and immobility (Breen et al. 2009; Shavit, Arum and Gamoran 2007). The aggregated approach tends to use both country-specific and international categorizations of hierarchically ordered educational levels, such as the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) or the International Standard Classification of Education (ISCED) classifications.

On the one hand, the aggregated approach is necessary for working with a "lumpy" educational distribution. Education is highly unevenly distributed and inherently qualitative in nature. Therefore, as Blanden (2013: 44) notes, the impact of education is unlikely to be linear or monotonic. On the other hand, the use of hierarchical categories can have a theoretical underpinning similar to the logic in aggregated social classes, assigning qualitatively different traits (and thus sociological explanatory power) to different levels of education, for example, by distinguishing between college programs and non-academic vocational training programs. Much like the Erikson-Goldthorpe-Portocarero (EGP) class scheme, the popularity of this approach results from empirical studies showing that aggregated classifications of educational origin have proved to be a powerful proxy for family resources in the child's upbringing, affecting later educational transitions (Breen 2004).

The aggregated approach has often been associated with relative-risk-aversion theory, the assumption that a fundamental preference for avoiding downward mobility drives individuals' educational and occupational aspirations and choices (Breen and Goldthorpe 1997). Drawing on Boudon's (1974) pioneering work, researchers argue that educational choices involve rational assessments of cost and benefits of specific educational pathways. Depending on their social background, individuals will have different views of whether the cost of continuing education (e.g.,

the risk of failure) will be higher than the utility they gain from further education (Jæger and Holm 2012). Within this approach, researchers believe that the use of a few ordered educational levels gives educational origin-destination transitions the most parsimonious explanation. In our later models, we test the explanatory power of this predominant approach.

The disaggregated approach to educational origin-destination associations

Since the late 1990s, the disaggregated approach has been on the rise in research on educational mobility and immobility. As a result, researchers have begun to supplement a vertical dimension (educational level) with a horizontal dimension (fields of study), often arguing that a more detailed classification (especially within higher education) is needed for properly understanding both educational pathways and selection and allocation mechanisms in the labor market. Most of this new line of studies reports differential effects of disaggregating education, whether by field of study, by separating the applied-oriented from the less applied-oriented or the prestigious programs from the non-prestigious (Davies and Guppy, 1997; Goyette and Mullen 2006; Jackson et al. 2008; Thomsen 2015). Other studies find that the parents' occupation guides children's social selection into fields of study or particular professions (Aina and Nicoletti 2014; Sørensen 2007; Van de Werfhorst and Luijkx 2010).

Although the disaggregated approach covers diverse theoretical perspectives, the majority of studies may reasonably be categorized as belonging to a cultural capital or social closure theory tradition (Bourdieu 1984; Parkin 1971). These traditions view choice of education as resulting from both socialization traits and the ability of privileged social groups to maintain their relative advantage by monopolizing particular educational pathways (Alon 2009).

In this paper, we pay particular attention to the disaggregated approach by applying the logic of the micro-class theory in our educational classification. The micro-class theory combines a

Durkheimian notion of occupational communities with a Weberian emphasis on how privileged social groups guard access to certain types and levels of education through closure strategies, monopolizing certain credentials and cultivating their children in certain ways (Grusky and Sørensen 1998).

Weeden and Grusky (2005) argue that occupational socialization processes are a crucial part of explaining why children develop preferences for specific pathways. Another crucial part is the educational institutions themselves, which give preferential treatment to students from particular types of families, for example, by using definitions of "merit" that favor the privileged classes in the admission process (Karabel 2005; see Thomsen 2012, 2016, and Thomsen et al. 2013 for a treatment of how such processes work in Denmark). Educational credentials such as skills, degrees, and licenses guaranteed by specific educational programs are intimately linked to the social logics of occupational reproduction (Weeden 2002). This connection between family resources and social institutions means that micro-educational and micro-class categories will share common traits (occupation-specific cultures, norms, and values). While occupational reproduction will also overwhelmingly be micro-educational reproduction, we offer four important arguments for the micro-educational approach.[3]

First, as the primary source of social mobility in contemporary society (Breen and Jonsson 2005), the importance of education cannot be overstated. As education has expanded, new forms of specialization, differentiation, and closure processes in the education systems have emerged (Alon 2009). As more and more people participate in higher education, stratification is no longer only a matter of level of skills but also a matter of qualitatively different types of education within the same level (Jackson et al. 2008). Our micro-educational approach enables us to research immobility in a highly disaggregated way that reflects the structure of highly expanded and complex education systems.

Second, Grusky and colleagues stress that the micro-class approach reveals occupation-specific parent-child socialization patterns lost in more aggregated categorizations of the socio-economic status of the family (Grusky and Sørensen 1998; Weeden and Grusky 2005). We extend this argument to the site of education, suggesting that these occupational socialization patterns (which may also include influences from community, institutions, and social networks) are also manifest in the choice of education, a choice that precedes entry into a specific type of occupation.

Third, despite prevalent barriers to choosing education, young generations today have more freedom in choosing their education than in choosing their occupation. While the allocation of positions in the labor market is largely structurally conditioned by the demand for qualified candidates—what Sørensen (1983) calls "vacancy competition"—the allocation of educational qualifications is largely supply-driven. Moreover, because more freedom in choice of education does not necessarily coincide with more freedom in choosing a job, we argue that the persistence of intergenerational inequality in social positions is more openly revealed in the children's choice of education than in their choice of occupation as adults. Because students choose their field of study from the start in university and university college programs, the Danish education system is a particularly good example.[4]

Fourth, our micro-educational classification accounts for both hierarchical and horizontal differences in a systematic way. Because we apply the same fields of study across educational levels, we can answer more specific questions about changes in immobility patterns, for example, whether children within particular fields are more field-immobile than others or whether particular field affinities pertain to relative similarities in socialization patterns between same-field families at different educational levels. We may reasonably expect that affinity can cause immobility. Our disaggregated classifications—the micro-educations and the field of study—allow us to analyze when social closure mechanisms remain in effect for micro-educations characterized by a strong

social organizational and professional identity, and when children are more likely to be mobile if they choose a micro-education within the same field as their parents.

The major differences in the gradational, the aggregated, and the disaggregated approaches to educational immobility can be summarized as two factors: first, in researchers' attitudes toward preferences for explaining educational pathways through the actions of individuals vis-a-vis social groups and, second, in researchers' attitudes to the trade-off between parsimonious explanations and the loss of sociologically relevant information.[5] Regardless of theoretical stance, proponents of the disaggregated approach argue that key sociological insights into patterns of social reproduction are lost if educations pertaining to occupations with distinctively different strategies and patterns of socialization are collapsed into big aggregated educational categories.

Thus, the overall advances made by studies using aggregated educational categorizations of origin-destination associations notwithstanding, we argue that the expansion and differentiation of the education system in advanced industrialized societies increasingly warrant a multidimensional approach. This approach disaggregates education into smaller units, allowing researchers to determine possibly heterogeneous immobility patterns within specific types of education, patterns that are hidden within more aggregated, hierarchical categorizations of educational levels.

DATA AND VARIABLES

We use administrative data from Statistics Denmark, including all 30-year-olds born between 1960 and 1981, totaling 1,239,727 individuals, of whom 49.1 percent are women (data quality does not allow us to go further back than the 1960 birth cohort).[6] We collapse our 22 cohorts into three birth groups: born 1960-66, 1967-73, and 1974-81. To operationalize the three different approaches to educational classifications, we use detailed information on both children and parents. For the *gradational approach*, we use expected returns to education for the child, measured by the average

return for each micro-education of the parents (constructed as an inflation-adjusted average of three years when the 30-year-old "child" was between 23 and 25 years old).[7]

For the categorical approaches, we apply three versions of the educational status of the children (highest completed or ongoing education at age 30) and parents (highest completed education when the 30-year-old turned 25). We operationalize the *aggregated educational approach* by classifying educations into five hierarchal groups on the basis of the ISCED levels: compulsory school (level 1), high school (level 2), vocational education and training (VET) (level 3), university college (level 4), and university (level 5).

The disaggregated educational approach is represented *horizontally* by the ISCED classification of field of study (19 specific fields in this paper), and by our *micro-educations,* combining levels and fields of study, resulting in 62 micro-educations for parents and children. By combining educational levels and fields, we are able to capture educational groupings (i.e., micro-educations) that mirror key distinctions on the labor market, such as the distinctions between blue-collar manual jobs (most often occupied by individuals with compulsory school-level skills only) and craft jobs (most often requiring a VET-level education).

For the parents, we define the dominant aggregated educational level as the highest among them, and the dominant micro-education as the education held by the parent with the highest rank in the income distribution, i.e., the parent with the type of education that ranks highest in terms of returns to education (the "dominant" parent).

Table 1 shows the formal relationship among the five educational levels, the different fields (ISCED fields), and the micro-educations (both levels and fields). As the first column shows, the Danish educational system consists of five levels. The basic educational level is the elementary school for ages 6 to 15 (level 1). Young people can then choose a three-year college-preparatory high school (level 2) or a VET course, preparing people for skilled work in a specific trade (level 3).

Those who opt for a college preparatory high school can later choose to either attend business academy or university college (level 4) − which comprises mainly business programs and applied programs such as nursing and compulsory school teaching − or enroll in a university (level 5), with a wide range of traditional liberal arts and science programs. A level 4 degree consists either of a short program of two years (business academies) or a longer program of three or four (university colleges). In contrast, university programs (level 5) are often five-year programs (three years for a bachelor's degree plus two years for a master's degree, with an additional three years for a doctoral degree). Almost all university and university college programs are subject-specific, that is, choice of field of study takes place at the very beginning of the young people's academic career.[8]

Table 1 about here*

The second column displays the logic in the classification of the micro-educations. Apart from the first two levels, where differentiating by field of study is impossible, the three upper levels are divided into identical fields of study.[9] This identical subdivision allows us to analyze field immobility, net of educational level, in our later models. We are particularly interested in programs that constitute exclusive pathways to professional or semi-professional occupations requiring a license, such as doctors, architects, lawyers, nurses, and teachers (Abbott 1988). Therefore, in our micro-educational classification, we single out major professional (medicine, law, engineering, and architecture) and semi-professional programs (nursing, compulsory school teaching, and early care and education programs). For example, we divide "G Health" at level 5 (university) into "5 G Medicine" and "5 G Health".

METHOD

Because we are interested in assessing different explanations of immobility patterns in origin-destination tables, we use log-linear models (Jonsson et al. 2009). These models allow us to retrieve odds ratios for each cell in our mobility tables and to determine what kind of immobility parameter best explains the patterns of association. Drawing on previous explanations of educational immobility, the models analyzed in this paper include four types of educational immobility explained by (1) returns to education, (2) hierarchical, aggregated educational classifications (5-level), (3) 21 fields of study, and (4) our 62 disaggregated micro-educations. The model can be written as follows:

$$\log(m_{ijk}) = \alpha + \beta_i + \gamma_j + \tau_k + \beta_i \times \tau_k + \gamma_j \times \tau_k + \varphi + \delta_{ij}^{A} + \delta_{ij}^{B} + \delta_{ij}^{C} \qquad (1),$$

where *i* indexes micro-educational origin (i.e., the education of the parent with the highest income), *j* indexes micro-educational destination, *k* indexes cohorts, m_{ijk} refers to the logarithm of the expected frequency in the ijkth cell, α is the main effect, β_i and γ_j refer to row and column marginal effects, τ_k refer to the three cohorts, and φ refers to the expected returns to education. δ_{ij}^{A}, δ_{ij}^{B}, and δ_{ij}^{C} refer to the aggregated, hierarchical levels, the horizontal (field of education), and the disaggregated (micro-education) immobility effects, respectively. Because the parameters are layered on one another, they capture net effects, i.e., any effect of the micro-educational parameter (micro-educational inheritance) will be effects that persist above and beyond the effects of the other parameters. We run models separately for sons and daughters.

In addition to the first gradational layer of our four types of educational immobility, returns to education, Figure 2 shows how the layers we use to analyze the categorical immobility patterns are modeled in the mobility table.

Figure 2 about here

The large diagonal squares in (I) illustrate the aggregated, categorical approach; the small diagonal squares in (II) illustrate field immobility, i.e., when a son reproduces his father's field by obtaining an education within the same field but at a higher (or lower) educational level; and the small diagonal squares in (III) illustrate the disaggregated, micro-educational approach.[10]

Our layers take into account the expansion and diversification of the education system. The field layer captures intergenerational field immobility regardless of whether any field, for example, holds 10 specific educational programs in the earliest period and 30 programs in the latest. For example, the field layer measures the likelihood of the enrollment of electricians' sons in any electrical engineering program, regardless of the number of new engineering programs. In addition, the micro-educational layer captures the intergenerational reproduction of specific educations, regardless of whether, for example, the micro-educational grouping of social science held one program in the earliest time period and four in the latest.

ANALYSIS

In the section on expanding education systems, we outlined how the educational level of 30-year-olds has risen for the cohorts born 1960-81. The rising educational level is evidence of a changed mobility pattern, resulting in more immobility at the highest educational level (as the cohorts increasingly finish their schooling at this level). Figure 3 depicts the trend in absolute immobility for sons and daughters. On one hand, we can see an overall decline in immobility when we use the aggregated educational classification. This overall decline covers different trends at different levels: more immobility at the university level but also much less immobility at the lowest level (as a result of the rising educational level). On the other hand, however, we see a slight increase in field-of-

study immobility (including micro-educational immobility) and when we look at micro-educations only, immobility is constant for men and slightly increasing for women.

Figure 3 about here

To provide a detailed overview of the amount of immobility within each micro-education, we present immobility rates for each micro-education in Table 2. At the university level, the professional programs show the highest level of reproduction, in particular Medicine, where app. 1 in 5 has parents where at least one parent holds a medical degree. At the university college level, school teachers have high levels of reproduction, and at the vocational level, Business and administration, Architecture and building, and Engineering stands out.

Table 2 about here

We now investigate whether the patterns depicted in figure 3 and table 2 persist when we include other immobility parameters. To assess the explanatory power of the different immobility patterns in our origin-destination tables for men and women, respectively, we estimate log linear models. We examine how well the three approaches capture intergenerational educational immobility pattern for cohorts born between 1960 and 1981. The earlier section on expanding education systems has outlined the increasing educational levels in the Danish population, showing that expansion is followed by increased differentiation in university programs and returns to higher education. These processes of change raise the question of whether aggregated macro-hierarchical categories cover up qualitatively different and substantial micro-educational patterns of immobility as well as patterns of immobility that persist despite educational expansion.

We therefore examine the three major approaches to educational immobility: the gradational, the hierarchical aggregated, and the disaggregated micro-educational approach. In addition, the classification of the micro-educations allows us to analyze how we can use the field of study as an explanation of propensities for reproducing specific domains, net of educational level. To study these explanations of immobility, we follow the traditional procedure in (im)mobility table studies by using log-linear models (Breen 2004; Jonsson et al. 2009). Our log-linear models include layers that capture the four different patterns of immobility. All models are estimated both with and without controlling for changes in these layers across cohorts. An overview of the models' fit appears in Table 3.

Table 3 about here

After estimating the baseline model, we investigate how models with time-invariant immobility layers fit (A), after which we test the fit of time-varying models (B). In each case, we compare a full model to models in which we exclude layers explaining a particular immobility association in the origin-destination table. We report several fit measures. The index of dissimilarity (Δ) reports the percentage of cases needed for changing cells to make the fitted distribution identical to the actual distribution. The lower the percentage reported, the better the model fit. The deviance measure (G^2) provides information on the discrepancy between the observed and fitted values, and smaller values indicate a better model fit. Finally, we report the Bayesian Information Criterion (BIC) value, taking the number of parameters into account, where lower values also indicate a better model fit. We pay particular attention to the deviance measure (G^2) and the BIC value, which accounts for the use of degrees of freedom in the models. We also include a column that reports the difference in

deviance between the different models (ΔG^2), giving us a clear overview of how much we are penalized for excluding particular layers.

The time-varying models (B1-5) generally provide a better fit than the time-invariant models (A1-5), meaning that the immobility patterns of association change across cohorts. The layer coefficients show that the severity of excluding a layer differs substantially. We may reasonably expect the bulk of immobility to be explained by the parameters capturing educational levels, and we can also see that the exclusion of field of study (affinity net of educational levels) results in only modest deteriorations in the model fit both for men and (in particular) for women (model A3). Nevertheless, even after we account for other types of immobility, the field of study parameter captures a significant amount of field immobility.

For men, excluding our micro-educational inheritance layer is more costly than excluding the layers capturing immobility by returns to education and aggregated educational levels: excluding the micro-educational layer results in the worst model fit by all measures (model A5). In other words, this layer is particularly valuable in explaining the immobility patterns in our educational origin-destination table. For women, the picture is very different. The gradational layer of returns to education proves the most costly to exclude (model A2), followed by the aggregated (macro-) and micro-educational layers, respectively.

These findings suggest that the disaggregated explanations of immobility—primarily the micro-educational layer but also the field-of-study layer—are more important in explaining male educational immobility. In contrast, female immobility is best captured by the gradational parameter, no matter what fit measure we use.[11] The macro-educational layer is not superior for either men or women. We will return to these findings in our discussion.

In countries with elite universities, such as the U.S. or the UK, educational immobility may be linked to elite educational institutions (e.g., Harvard and Oxford) rather than to particular

educational programs. However, Nordic countries are comparatively small, with no genuinely elite universities. As a result, Danish children from socially privileged backgrounds will seek out particular programs more than particular institutions (Thomsen 2016; see Ford and Thompson 2016 for a U.S. example). For the latest period (earlier periods suffer from too many missing values for institutional affiliation), we have run a model adding a layer capturing institutional educational immobility. Adding a layer accounting for the likelihood of having attended the same educational institution as the dominant parent only marginally improves the model. This finding confirms that in Denmark, a small country without elite institutions, program-specific immobility is much more important than institutional immobility.[12]

Even though the penalties for excluding different parameters in the time-invariant models vary, they all contribute significantly to improving the model fit. However, when we let the parameters interact with a time-varying parameter, we find that model B4 (using the BIC value penalizing the use of degrees of freedom), in which the micro-educational parameter is constant over time, provides the best fit. We therefore proceed with model B4 for both men and women in our examination of the parameter estimates.

Table 4 presents the exponentiated immobility net effect estimates (odds ratios) from the model with the best fit by the BIC value (B4). In this model, the micro-educational immobility parameter is time-invariant, meaning that micro-educational immobility stays constant across the period investigated. A look at immobility between aggregated macro-educational levels, clearly reveals that when we account for changes in the educational distribution, the upwardly mobile trend over cohorts outlined earlier does not translate into increased immobility at the highest educational levels. While, in the oldest cohort, sons of parents at the university level were 4.1 times as likely to reproduce their parents' macro- education as to move elsewhere on the educational ladder, this figure drops to 2.8 for men in the youngest cohort. For daughters, there is no decline; immobility

remains stable at 2.7. We also see a stable level of modest field reproduction across the period for both sons and daughters (i.e., propensities to move within the same educational field as the dominant parent).

Table 4 about here

As for the amount of micro-educational immobility within each of the three upper macro-education levels, we find substantial micro-educational immobility, especially at the university level.[13] Sons have 3.4 times the odds of reproducing their parents' micro-education at the university level, and daughters have 2.7 times the odds. Propensities for micro-educational reproduction are generally more pronounced for men than for women. In short, Table 4 shows that even though macro-educational immobility at the university and university college level is decreasing (in particular for sons), micro-educational immobility at these levels remains constant.[14] Thus, had we focused only on the macro-level, decreases in macro-educational immobility would have covered up stable micro-educational immobility patterns at the university and university college levels.

Because the figures in Table 4 represent the average micro-educational immobility within each macro-educational level, they may cover up substantial differences in the odds of reproducing particular micro-educations. Figure 4 depicts immobility coefficients for micro-educations at the vocational, university college, and university levels, respectively.

. ***Figure 4 about here***

At level 3, the vocational education and training programs, the agricultural programs and the creative arts programs (mainly graphic design programs) stand out as passing on the same micro-

education from parents to offspring. At the university college level (level 4), sons and daughters are particularly likely to reproduce their parents' micro-education within the field of journalism and creative arts (including mainly skilled designers and actors at this level). Apart from these programs, the immobility ratios of the other micro-educations do not deviate much from the average micro-educational immobility ratios in each level (red dotted line, taken from table 4).

The picture is very different when we look at the micro-educations at the university level (level 5), where we see great variation in the odds of being immobile. Traditional professional programs such as architecture, health (mainly dentists), medicine, law, and the creative arts (which include the fine, applied, and performing arts) display high odds of immobility for sons. Daughters display particularly high immobility odds ratios (OR) in the architecture and creative arts programs. Net of the other immobility layers, women are more than seven times as likely to reproduce their parent's micro-education within architecture (OR≈7.3), whereas men are eight times as likely to reproduce architecture (OR≈7.9), six times as likely to reproduce medicine (OR≈5.7) and five times as likely to reproduce law (OR≈4.6). Immobility within the professional university engineering programs is lower for men than expected—lower than the social sciences and not much higher than within the business and administration programs.

In sum, Figure 4 shows variation in micro-educational immobility, especially at the university level. The figure reveals how an overall decline in macro-educational immobility at the university level for men (as shown in table 4) covers up high and persistent micro-educational immobility. The figure shows that micro-educational immobility is particularly strong in some of the highly profession-oriented programs, where we find families characterized by a strong professional identity (doctors, architects and creative arts professionals at the university level, along with journalists and designers at the university college level). Closure mechanisms will be particularly

present in these families, which will try to maintain their advantage in access to professional programs.

While the micro-educational parameter in Table 4 and Figure 4 captures micro-educational affinity, we also look at field-affinity. As stated earlier, one particular advantage of our classification is that it allows us to also examine propensities for being field-immobile across educational levels. For example, a field affinity may make it more likely for the son of an electrician to choose engineering over a different type of university college or university program. Another look at the field-parameter in Table 4 shows the odds of choosing an education within the same field—but on another educational level—as the dominant parent. If the child ends up at another (most often higher) educational level than the dominant parent, we find only modest propensities for choosing an education within the same field as the dominant parent.[15] Across the periods, both 30-year-old women and men are about 1.5 times as likely to reproduce their parents' field as to move to another field of study.

Although we have not depicted field immobility for each field, teaching, agriculture and the creative arts are some of the fields in which sons and daughters have the highest odds of reproducing their parents' field (odds ratios of 2 to 4), well above the modest average of 1.5 in Table 4. This field reproduction suggests that the values and socialization processes associated with the parents' education rub off on the offspring's propensity for choosing not only the same education but also the same field when the children move between levels. Examples include children of lower-skilled agricultural workers studying agriculture or veterinary science at a college or university, or children of school teachers pursuing a master's degree in teaching.

DISCUSSION AND CONCLUSION

In this paper we have argued that the expansion and differentiation of the education system in advanced industrialized societies warrants an investigation into the explanatory power of micro-

educations for researchers investigating patterns of intergenerational educational immobility. In our log-linear models of Danish sons' and daughters' educational careers across 22 years, we have included four types of educational immobility patterns: gradational (by returns to education), categorical (5-level), horizontal (19 fields of study), and disaggregated (62 micro-educations). Each of the educational immobility patterns captures net effects of different types of selection and closure mechanisms in the educational system. Our analysis shows that although macro-educational immobility has decreased across the period, micro-educational immobility at the university and university college levels remains high and stable, particularly for sons.

We find high odds of being micro-educationally immobile at the university level for men and women, even when we control for the effects of other immobility patterns. In addition, we find that professional programs, such as architecture, creative arts, law and medicine, show a particularly high reproduction. As adding the field immobility parameter only marginally improves the models and as we find only modest propensities for sons and daughters to be field immobile, we conclude that field-of-study reproduction is overwhelmingly micro-educational reproduction. In sum, our study highlights the importance of taking the site of production of occupational values, norms, and identities into account, that is, explaining micro-educational immobility patterns by familial, communitarian, and institutional processes of socialization.

The value of using a micro-education approach reveals itself in the patterns of inequality it uncovers in two important ways: First, the approach highlights the persistence of social closure processes in society. Despite initial and substantial macro-educational immobility at the university and university college level, this type of immobility is decreasing across the period, while micro-educational immobility at these levels remains constant. Our micro-educational classification allows us to uncover high and persistent immobility rates in some of the most lucrative and prestigious university programs. Second, our approach reveals that sons are more likely than daughters to be

micro-educationally immobile. As we will detail below, these gender-specific immobility patterns have implications for our understanding of educational and occupational gender segregation.

Some may argue that because we are modeling the diagonal in immobility tables, disaggregated micro-educational classifications will automatically be superior to more aggregated classifications (see Eriksen Goldthorpe, and Hällsten's 2012 critique of micro-class studies). While we acknowledge the validity of this argument, we argue that the micro-educational approach is superior in explaining only the immobility of sons, while the immobility of daughters is better explained by more aggregated and gradational layers. These gender differences suggest that our findings are not simply a product of the level of disaggregation. They are genuine identifications of different immobility patterns between men and women. We suggest that the micro-educational layer can be used in studies as a benchmark for comparing the level of heterogeneity in immobility found in more aggregated educational classifications and for investigating changes in these immobility patterns over time.[16]

Nevertheless, the importance of including micro-educations hold true more for men than for women: Even though all four immobility layers are important for explaining the persistence of educational inequality, the micro-educational and field layer parameters provide better explanations of immobility patterns for sons than for daughters. Indeed, the educational pathways of daughters are better explained by the gradational parameter (returns to education) than by aggregated and disaggregated categorical educational classifications. This finding suggests a clear gender difference in how children reproduce their parents' educational level.

Although differences in educational immobility between sons and daughters at more detailed educational classifications is a highly under-researched subject, our findings are in line with Dryler (1998), who finds that having parents working or educated within a specific sector increase the probability of the child's making a similar educational choice. Same-sector effects are found to be

stronger for fathers and sons, while no effects are found for mothers and daughters. Moreover, Jonsson et al. (2009) find that micro-class reproduction is more prominent for men than for women (see also Erikson et al. 2012). Despite their having data only on fathers, they suggest that "for women, the classical professions are operating like an authentic big class with generic class-wide reproduction" (Jonsson et al. 2009: 1016). Because of gender segregation, they argue, the father passes on his specific micro-class to the son, while passing on generic class-wide (big-class) skills to the daughter (see also Breen, Mood, and Jonsson 2016; Charles and Grusky 2004).

One might ask whether the reason we find that micro-education is superior only for sons is that we are actually modeling son-father and daughter-father relationships (because the dominant parent in our models is most often the father). To answer this question, we estimated additional models, run separately by gender for children and parents, measuring four types of intergenerational educational immobility patterns: father-to-son, father-to-daughter, mother-to-son, and mother-to-daughter. The results, shown in Appendix Table A1, are similar to Dryler's: Sons are far more likely to reproduce their fathers' specific type of education than are daughters. Moreover, as daughters are not very likely to reproduce their mothers' specific type of education, we conclude that field affinities and propensities for reproducing family micro-educations are far more pronounced for sons.

One explanation for this difference in educational immobility within families is that occupational reproduction historically has been passed from fathers to sons, an institutionalized, social, and cultural pattern that still prevails (DiPrete and Buchmann 2013). In our case, on the one hand, advantaged sons are more likely to reproduce their parents' (most often fathers') education and profession; on the other hand, disadvantaged sons are less likely than daughters to take advantage of the educational opportunities offered to them. In other words, micro-educational immobility is also immobility for the disadvantaged (see also DiPrete and Buchmann 2006). In

contrast, since the 1960s women have been much more mobile and have consequently chosen different educational pathways than their parents (in part simply because women have had to branch beyond occupations traditionally considered female).

Nonetheless, sociocultural gender differences exist, with class-specific socialization patterns and cultural beliefs about gender leading to different expectations and educational pathways for men and women (Barone 2011; Correll 2001; Diprete and Buchmann 2013: 200ff).[17] As no studies have yet uncovered why daughters' educational pathways are more likely to be affected by parents' returns to education than by their specific type of education, our paper offers new insights into immobility research by suggesting that micro-educational immobility can be understood to a higher degree through occupational community and social closure theories for men than for women. Women may be endowed with more generic skills through family socialization, leading their educational pathways to be better explained by theories placing weight on the rational action of individuals. In addition, these gender-specific explanations may aid in our understanding of why some (mostly men) choose apparently "irrational" educational pathways, as when they reproduce micro-educational university programs with consistently high levels of unemployment. One example is when children of architects maintain their aspirations to become architects despite the field's high unemployment and low income relative to, say, that of engineering.

England (2010) offers important insights into these gendered choice patterns: While the gender wage gap has meant that women have had strong incentives to enter male-dominated jobs (and thus also male-dominated educations), men have had little incentives to enter female-dominated occupations. In short, women have been more upwardly mobile and moved into formerly male dominated fields, including the prestigious and lucrative university programs, whereas men have been more inclined to stay within these programs (avoiding female-dominated fields with lower returns). In addition, Shauman (2016) reports persistent negative associations between female

representation in majors and later labor market outcomes, and Levanon et al. (2009) find that traditionally male-dominated fields have seen wages drop as women have entered.

We have shown the importance of taking into account micro-educational immobility when examining educational reproduction, and we have uncovered very different micro-educational pathways for men and women. Future studies may show how universal these findings are, and whether the gender-specific immobility patterns are transitory or more stable. In addition, it could prove fruitful to examine whether the micro-educational immobility patterns treated in this paper are best captured by using parents' micro-education or parents' micro-class.

[1] According to the Danish Ministry of Education, as many as 62 percent of the 15-year-olds in 2012 are expected to eventually graduate from a university college or a university.

[2] However, country variations may exist: Bol and Weeden (2015) find differences in occupational closure across countries with differing institutional contexts.

[3] While the association between micro-education and micro-class may differ between countries, this association will be particularly strong in countries with highly expanded education systems.

[4] As we do not wish to downplay the many demand-side constraints on choice of occupation (the importance of skills signaling, social networks, family business inheritance, etc.), we maintain that choice of education is a strong proxy for the intergenerational transmission of resources and preferences.

[5] While these approaches are often presented as competing (Goldthorpe 2000), a few studies have begun to view them as complementary. For example, Glaesser and Cooper (2013) show that the weighing of risks in educational decision-making is sensitive to more disaggregated social groups than that normally applied. Therefore, the relative risk aversion theory may also be potentially adaptable in a research framework that uses a more detailed categorization of social groups, such as the micro-class theory. However, investigating this possibility is beyond the scope of this paper.

[6] While the micro-educational approach will benefit from large sample sizes (as found in the Nordic countries), disaggregated approaches may work with smaller samples (as shown by Jonsson et al. 2009 in their micro-class approach). In addition, if theoretical assumptions are not violated, the researcher may aggregate some micro-educations to account for smaller sample sizes.

[7] We are not able to measure parental educational level when the child is younger, e.g., at age 15. However, almost all parents have reached their final educational destination by the time the child is 15, leading to no bias in measuring the status when the child is 23-25.

[8] The Danish educational system has no tuition fees. In addition, a universal government grants system entitles all students above age 18 to monthly grants for their stipulated time of study. Whereas the college

preparatory high school diploma will formally grant them access to further education, some highly sought-after programs (found almost exclusively found at the university level), will admit only those with the highest high school GPA. The vast majority of bachelor students (more than 80 percent) will eventually pursue master studies.

[9] Some micro-educations may comprise very few or no individuals, thereby explaining why the actual number of micro-education groupings used in later models will be smaller than the number of formal classifications.

[10] As most of the major occupations in Denmark have required the same educational level for both parents and their offspring, propensities for reproducing the field will reflect genuine field affinities (e.g., when the parent is an electrician and the son an engineer) and will not be driven by increasing educational demands for specific occupations (e.g., if the educational requirements for being an electrician were at level 3 for the father but at level 4 for the son).

[11] One may expect a substantial amount of the gender difference to be attributable to public/private sector gender segregation (e.g., Esping-Andersen 2015). We have tested the need for including a public/private sector layer by multiplying the log values of the percentage of people in each micro-educational origin category occupied in the public sector by the expected percentage of public sector employment in each micro-educational destination category. Adding a public/private-sector layer only marginally improves the model ($\Delta G^2 = 4{,}256.7$ for men, 3,055.8 for women) and does not alter the overall pattern of the layer effect sizes.

[12] Removing the institutional layer from a full model leads only to a 1% reduction in model fit (BIC) for both sons and daughters. As a comparison, removing the micro-educational layer leads to a 16% reduction for sons and a 9% reduction for daughters.

[13] We have only genuine micro-educations in the three upper levels, because the two lowest levels comprise only primary school and two types of college preparatory high school.

[14] We ran the full model (B1), confirming that the micro-educational immobility parameter does not change across the periods under investigation.

[15] As previously discussed, intergenerational mobility will most often be upward.

[16] Indeed, if we continued disaggregating our micro-educations, we might find an even better model fit for sons. However, we argue that the detailed level of the internationally well-known ISCED classification is a reasonable trade-off between too much and too little disaggregation.

[17] Other studies have also found that differences in educational mobility pattern between men and women are attributable to socialization patterns. Goyette (2008) explains such gender differences by arguing that female students aspire to careers that require more education than do male students, and Okamoto and England (1999) show that "mother-friendly" features in future jobs play a significant role for women who are about to choose their educational careers.

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Table 1 The micro-educational classification

Educational level	Micro-educational classification (levels combined with ISCED fields)	
Level1: Compulsory school (ISCED level 1+2)	Compulsory school	
Level 2: High school (ISCED level 3)	High school (applied) High school (general)	
Level 3: Vocational education and training (VET) (ISCED level 4)	ISCED narrow fields:	
	A	Agriculture, forestry and fishery
	B	Architecture and building (architecture singled out at level 5)
	C	Business and administration
	D	Computing
	E	Creative arts
	F	Engineering and engineering trades
	G	Health (nursing singled out at level 4 and medicine singled out at level 5)
Level 4: University college (ISCED level 5+6)	H	Humanities
	I	Journalism and information
	J	Law
	K	Life science
	L	Manufacturing and processing
	M	Mathematics and statistics
	N	Personal services
Level 5: University (ISCED level 7+8)	O	Physical science
	P	Security services (police officer training at level 4)
	Q	Social science/social services (social work and early care at level 4)
	R	Teacher training and education science (compulsory school teaching at level 4)
	S	Transport services

Note: Table 1 depicts the principle in classifying micro-educations. Each of the three upper educational levels consists of 19 fields. Each field has been assigned a letter for identification. Some micro-educations may not exist in reality or may have very small cell counts (for example, there are no law programs at level 4 in Denmark).

Historically, the Danish higher education system has been a binary system, separating university institutions (ISCED levels 7+8) from university college institutions (ISCED levels 5+6). Level 5 mainly comprises business academies and level 6 mainly comprises semi-professional bachelor's programs (school teacher, nurse, social worker, child care worker, etc.). The business academies at level 5 only constitute a very small part of the higher education system, and are therefore coded together with level 6. Whereas about 5 percent of a youth cohort achieves a business academy degree (level 5), 19 percent achieves a professional bachelor's degree (level 6), and 19 percent a masters and doctoral degree (level 7 and 8). The reason for coding ISCED levels 7 and 8 together is mainly that the share of 30-year olds holding a doctoral degree is very small—less than 1 percent—and even smaller among parents: here, virtually no one has obtained a doctoral degree.

Table 2 Immobility rates for each micro-education. 30 year-olds born 1974-81. Share of parents within each micro-education where at least one parent has the same micro-education as the child.

Level 5: University	%	**Level 4: University college**	%	**Level 3: Vocational education and training (VET)**	%
5G Medicine	18	4R Elementary School Teaching	19	3C Business and Administration	37
5L Law	8	4Q Social Work and Early Care	13	3F Engineering	27
5B Architecture	8	4F Engineering	10	3B Architecture and Building	21
5H Humanities	7	4B Architecture and Building	8	3G Health	13
5Q Social science	7	4G Nursing	8	3A Agriculture, Forestry and Fishery	12
5F Engineering	7	4G Health	7	3E Creative Arts	11
5G Health	7	4S Transport Services	6	3L Manufacturing	8
5A Agriculture	4	4P Police Officer Training	6	3N Personal Services	6
5C Business and adm.	3	4E Creative Arts	5	3D Computing	1
5M Mathematics	3	4I Journalism and Information	4		
5A Veterinary	3	4H Humanities	3	**Level 2: High school**	
5E Creative Arts	2	4C Business and Administration	3	2B High school, broad	6
5K Life Science	2	4N Personal Services	3	2B High school, applied	2
5O Physical Science	2	4A Agric., Forestry and Fishery	1		
5L Manufacturing	1			**Level 1: Compulsory school**	
5Q Security services	1			1A Elementary education	72

Notes: Only the latest time period shown for brevity (cohorts born 1974-81).

Table 3 Goodness of fit of log linear models for men and women

		MEN (n = 630,623)				WOMEN (n = 608,682)			
Model	*df*	G^2	ΔG^2	Δ	BIC	G^2	ΔG^2	Δ	BIC
Baseline									
0a. Baseline model O+D+C+A	7,099	150,471.5		17.6	87,416.4	141,217.9		17.6	78,162.7
0b. Add field of study O+D+C+A+F	7,085	145,864.0	+4,607.5	17.3	82,933.2	139,036.3	+2,181.6	17.5	76,105.5
0c. Add returns to education O+D+C+A+F+R	7,084	127,346.8	+23,124.7	16.3	64,424.9	116,961.8	+24,256.1	16.1	53,994.9
0d. Add micro-education O+D+C+A+F+R+B	7036	106,104.8	+44,366.7	14.6	43,609.3	110,104.7	+31,113.2	15.7	47,609.2
A. Time invariance									
1. Full model (common social fluidity) O+D+C+A+F+R+B	7036	106,104.8		14.6	43,609.3	110,104.7		15.7	47,609.2
2. Exclude returns to education O+D+C+A+F+B	7,037	122,693.5	-16,588.7	15.5	60,189.1	130,786.5	-20,681.8	17.0	68,282.1
3. Exclude field of study O+D+C+R+A+B	7,050	110,977.9	-4,873.1	15.0	48,358.0	112,593.2	-2,488.5	15.8	49,973.3
4. Exclude educational level O+D+C+R+F+B	7,040	116,993.6	-10,888.8	15.3	54,462.6	117,705.2	-7,600.5	16.1	55,174.1
5. Exclude micro-education O+D+C+R+A+F	7,084	127,346.8	-21,242.0	16.3	64,424.9	116,961.8	-6,857.1	16.1	53,994.9
B. Time variability									
1. Complete variability O×C+D×C+R×C+A×C+F×C+B×C	6,709	58,311.4		9.7	-1,279.6	44,271.1		8.6	-15,328.8
2. Field constant over time O×C+D×C+R×C+A×C+F+B×C	6,737	58,435.0	-123.6	9.7	-1,404.7	44,381.9	-110.8	8.6	-15,466.7
3. Educational level constant over time O×C+D×C+R×C+A+F×C+B×C	6,717	59,110.1	-798.7	9.8	-552.0	44,522.8	-251.7	8.7	-15,148.2
4. Micro-education constant over time O×C+D×C+R×C+A×C+F×C+B	6,804	58,650.0	-338.6	9.9	-1,793.9	44,435.0	-163.9	8.7	-16,008.7
5. Returns constant over time O×C+D×C+R+A×C+F×C+B	6,711	58,543.9	-232.5	9.7	-1,064.9	44,297.3	-26.2	8.6	-15,320.3

Note: O = micro-educational origin; D = micro-educational destination; C = cohort; A = Macro education layer; B = Micro education layer; F = field of study; R = Returns to education. ΔG^2 = Deterioration in model fit.

Table 4 Immobility coefficients (odds ratios)

Layer	MEN			WOMEN		
	1960-1966	1967-1973	1974-1981	1960-1966	1967-1973	1974-1981
Macro-educational immobility						
Compulsory school	1.8	1.6	1.3	1.6	1.6	1.5
High school	2.3	1.8	1.5	1.5	1.2	1.2
Vocational education and training	0.9	*1.0*	1.2	1.0	1.2	1.3
University college	1.5	1.3	1.0	1.4	1.3	1.1
University	4.1	3.7	2.8	2.7	2.7	2.7
Field immobility	1.5	1.6	1.6	1.5	1.6	1.5
Micro-educational immobility within the three upper macro-educational levels						
Vocational education and training		2.0			1.2	
University college		2.5			2.0	
University		3.4			2.7	

Note: For the purpose of presentation, the table is based on a modified version of the full model (B1), with fields aggregated into a dummy variable of reproducing field or not, and micro-educational immobility is aggregated into a dummy within each macro-educational level (being micro-educational immobile or not). Coefficients in italics are insignificant at the 5 percent level (two-tailed tests).

Figure 1 Increased educational differentiation. Illustrated by the increase in applicable programs at different educational levels for each year 1984-2010

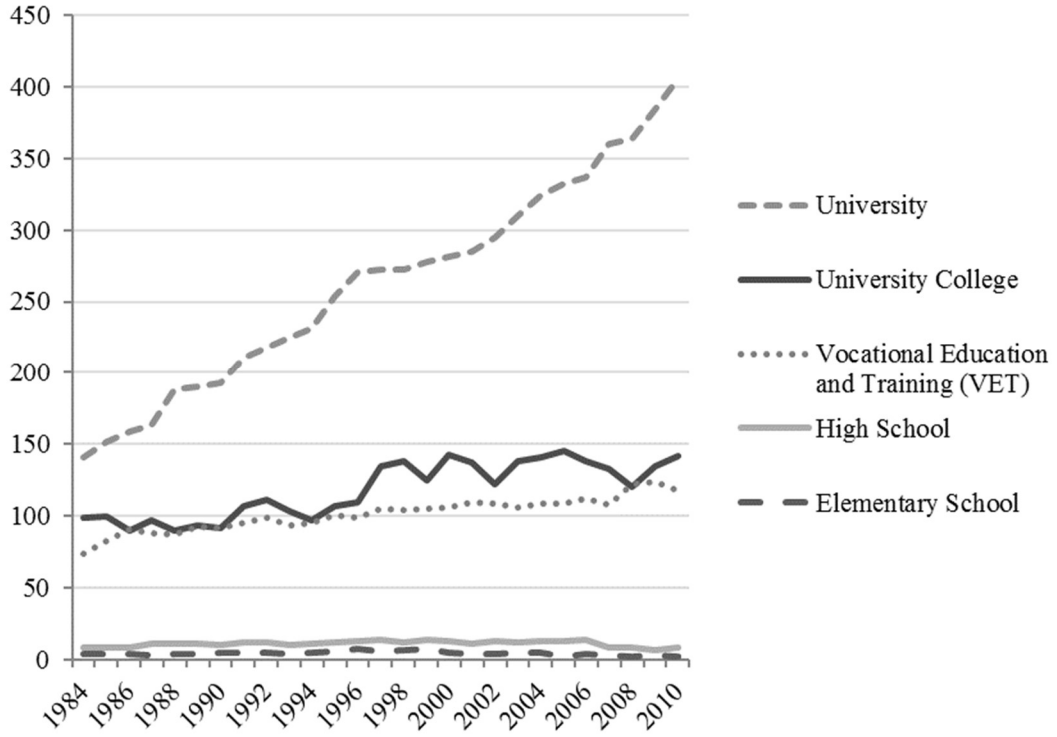
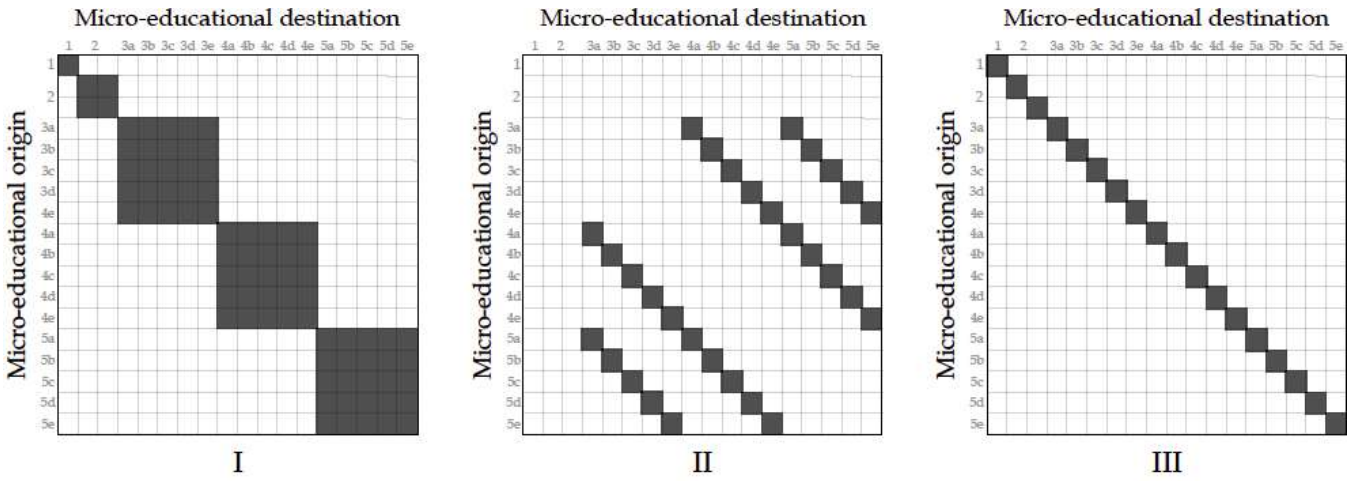
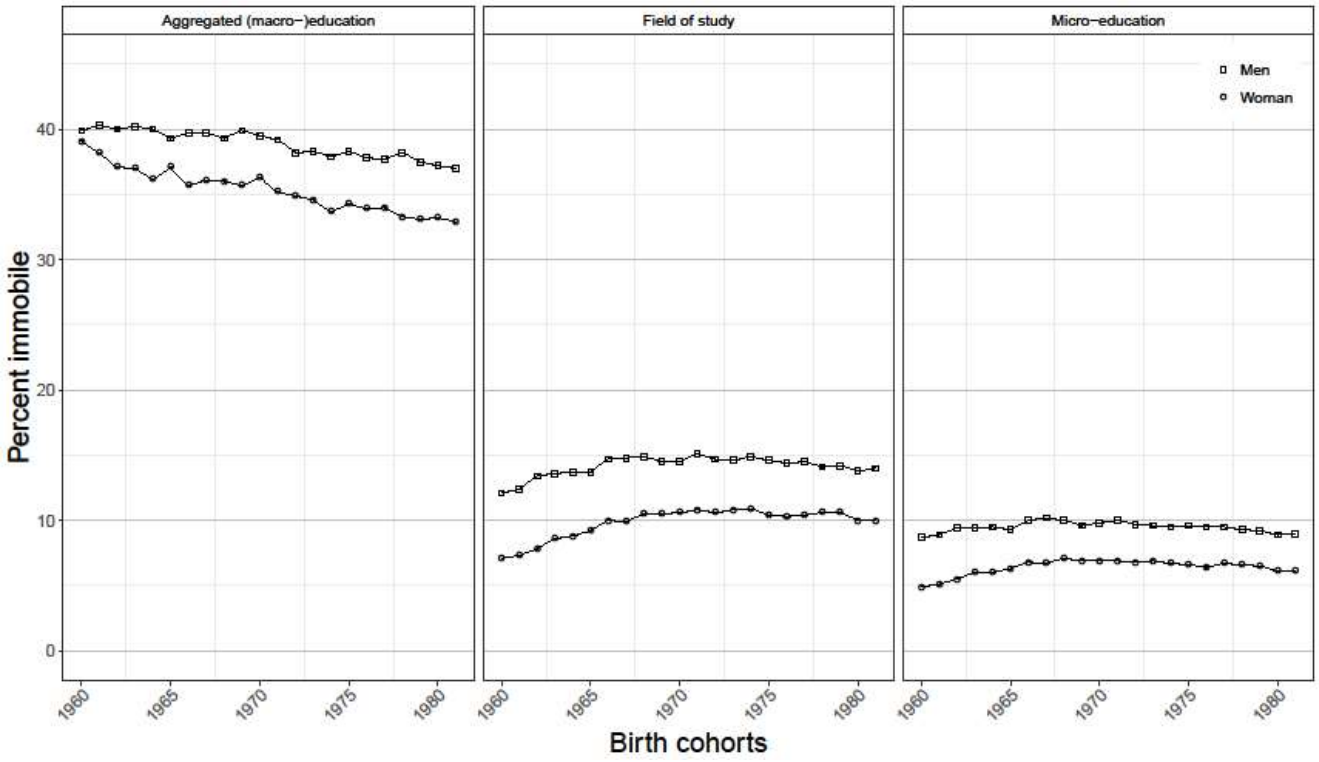


Figure 2 The three categorical immobility layers



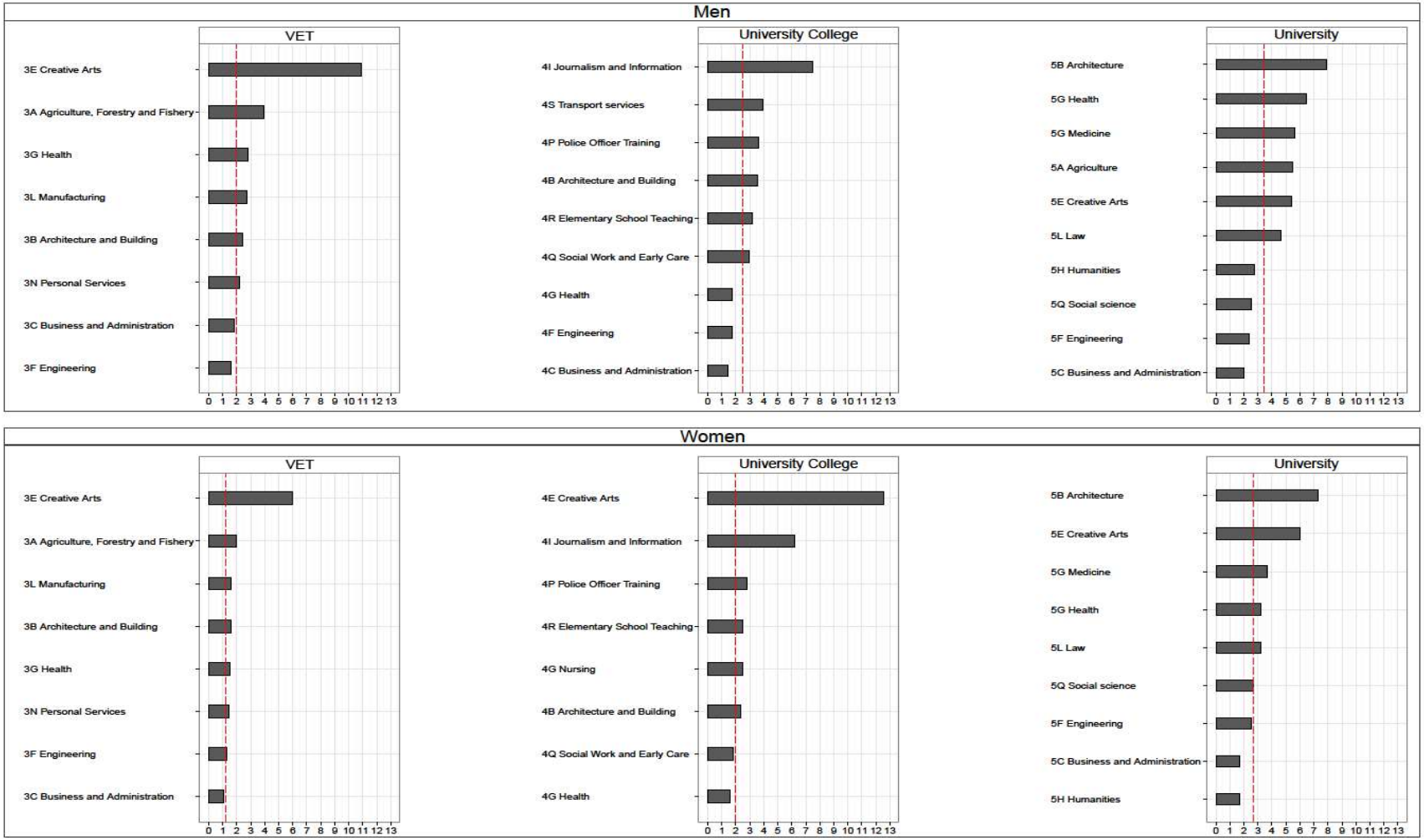
Note: (I) Aggregated immobility (squares denoting the five hierarchical levels); (II) Field immobility (squares denote field immobility net of micro-educational immobility); (III) Micro-educational immobility (diagonal squares). For ease of interpretation, we show the principle in classification by fields (a-e) not the actual number of fields (19) used in our analysis.

Figure 3 Percentage immobile across educational levels, fields and micro-educations (child cohorts 1960-1981)



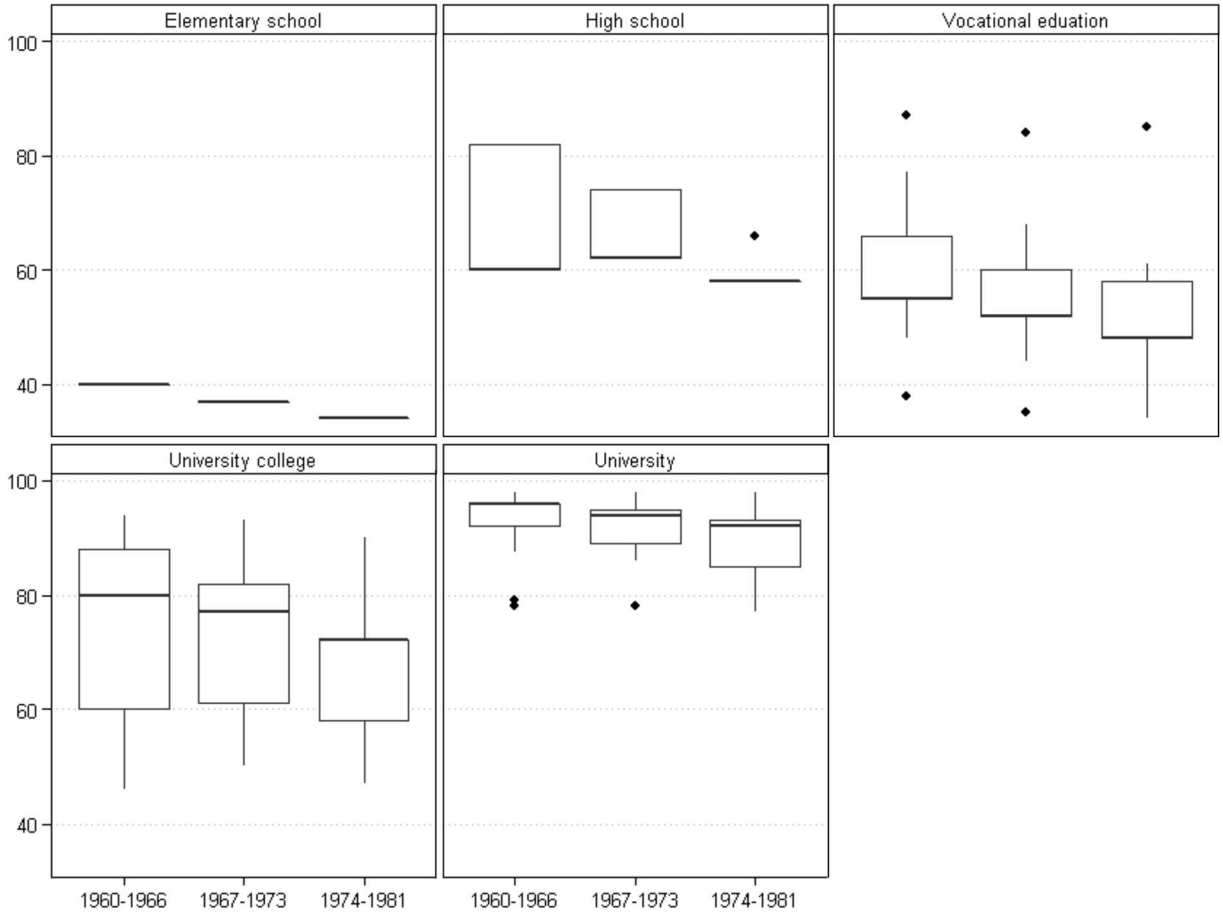
Note: Field of study and micro immobility only covers the three upper educational levels where the micro-educations are found.

Figure 4 Micro-educational immobility for selected micro-educations (odds ratios)



Note: Numbers 3-5 denote educational level (3=vocational education and training; 4=university college; 5=university). Exponentiated coefficients are taken from model B4. We only report significant estimates at the 5 percent level (two-tailed test) and cells with more than 50 observations. Letters refer to the fields listed in Table 1.

Appendix Figure A1 Box plots of variation in returns to micro-educations for parents within aggregated educational levels, over child cohorts 1960-1981



Note: Figure A1 depicts box plots of the economic returns to detailed fields of study for the parents of three cohort groups within each of the five aggregated education levels (inflation-adjusted average net returns for parents when the 30-year-old "child" was between 23 and 25 years old). In the box plots we have calculated, for each field of study within the five levels, the relative rank of the economic returns to that particular education for the parents of the 30-year-olds. By calculating the relative rank across the period, we obtain a measure of what place in the income distribution that particular type of education grants access to, and we obtain a measure of the changes in the income status of the different types of education across the period.

Appendix Table A1 Goodness of fit of log linear models separately for mothers and fathers

	Type of intergenerational educational mobility							
	Fathers to Sons		Fathers to Daughters		Mothers to Daughters		Mothers to Sons	
Model	G^2	ΔG^2	G^2	ΔG^2	G^2	ΔG^2	G^2	ΔG^2
A. Time invariance								
1. Common social fluidity O+D+C+R+A+B+F	107,684.1		110,991.2		120,908.2		119,527.1	
2. Exclude returns to education O+D+C+A+B+F	119,287.4	-11,603.3	123,778.4	-12,787.2	141,773.0	-20,864.8	128,119.8	-8,592.7
3. Exclude field of study O+D+C+R+A+B	113,447.1	-5,763.0	113,086.6	-2,095.4	123,578.3	-2,670.1	121,789.8	-2,262.7
4. Exclude educational level O+D+C+R+B+F	121,124.3	-13,440.2	122,328.4	-11,337.2	128,038.0	-7,129.8	130,026.9	-10,499.8
5. Exclude micro-education O+D+C+R+B+F	134,834.7	-27,150.6	117,467.7	-6,476.5	126,229.7	-5,321.5	123,496.1	-3,969.0

Note: O = micro-educational origin; D = micro-educational destination; C = cohort; A = Macro education layer; B = Micro education layer; F = educational field; R = Returns to education. ΔG^2 = Deterioration in model fit.