Three Essays on the Role of Higher Education in Inequality



Jung In
University of Oxford
Nuffield College

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Abstract

Educational expansion has raised questions of whether higher education alleviates, maintains, or exacerbates inequality. This thesis discusses the role of higher education in socioeconomic inequality in contemporary societies, focusing on two types of inequality associated with higher education: first, intergenerational inequality among college graduates, and second, inter-household inequality originating from educational assortative mating among men and women with higher education. The first two chapters, which concern the first type, aim to identify potential locations and mechanisms of social origin gaps in socioeconomic outcomes among individuals with higher education in the UK. Results from the first chapter confirm substantial social origin gaps among college graduates but with extensive heterogeneity by educational attainment, labour market sector, socioeconomic outcome of interest, and gender. The second chapter reveals differentiated pathways through higher education associated with unequal access to top occupations among individuals with a postgraduate degree. The third chapter addresses the second type of inequality using the most recent US data. Although there have been changes in factors determining inter-household economic inequality over the past two decades, results suggest that changes in educational assortative mating have not contributed to inter-household earnings inequality. Results of the thesis shed light on promising lines of future research that are relevant to higher education and inequality: the role of family formation in intergenerational inequality and heterogeneity among individuals or households of the same educational attainments.

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Chapter 1

Introduction

1.1 Background

1.1.1 Higher Education and Inequality

In Economics and Sociology, the relationship between higher education and inequality has centred around two main arguments. On the one hand, observing the growing gap in earnings or incomes between college graduates and people with less education, scholars have suggested that the wage premium attached to college education has been a primary source of the increase in economic inequality (Autor 2014; Goldin and Katz 2009). On the other hand, however, relatively small or null intergenerational associations in earnings or occupation among those with a college degree has been taken as evidence of the equalising role of higher education in society (Breen 2010; Breen and Jonsson 2007; Breen and Luijkx 2007; Hauser and Logan 1992; Hout 1984, 1988; Karlson 2019; Pfeffer and Hertel 2015; Thompson 2019; Torche 2011; Vallet 2004; Zhou 2019). Both arguments have often coincided in their implications for educational expansion's potential role in reducing inequality.

1.1.2 Higher Education and Intergenerational Inequality

Apart from those studies directly addressing the relationship between educational expansion and inequality, it is notable that two lines of research that have provided support for higher education's role in inequality have also been questioned. First and

foremost, studies, both in qualitative and quantitative approaches, have claimed that there are substantial gaps in socioeconomic outcomes or premiums associated with college attendance among college graduates from different socioeconomic origins (Bartik and Hershbein 2018; Britton et al. 2016; Witteveen and Attewell 2017). Studies on the high intergenerational income persistence at the top of the adult children's income distribution (Björklund, Roine, and Waldenström 2012; Crawford et al. 2016; Gregg, Macmillan, and Vittori 2019; Palomino, Marrero, and Rodríguez 2018; Schnitzlein 2016) also indirectly suggest the presence of such social origin gaps among the highly educated.

What is still inconclusive is where the gap comes from and what it implies for discussions about the association between higher education and intergenerational inequality. Previous studies have found such heterogeneity in the origin gaps among college graduates, for example, by institutional selectivity of colleges (Chetty et al. 2017; Giani 2016; Thompson 2019) or job characteristics (Hällsten 2013; Hansen 1996; Manzoni and Streib 2018; Mastekaasa 2004, 2011; Rivera 2016) but these results are still inconclusive. These studies often focus only on specific cohorts or only on men and they mostly examine only one outcome measure. These limitations are, in many cases, inevitable because most of the available data for the analysis of college graduates are subsamples of nationally representative data. This approach very often leads to a small sample size problem (exceptions are studies that used large-sized administrative data, such as Chetty et al. (2017) or Hällsten (2013)).

For the same reason, there are far fewer studies of postgraduate degree holders than of college graduates. Although increasing attention has been paid to inequality associated with postgraduate education, for example, in access, persistence, or outcomes (for a systematic review, see Posselt and Grodsky (2017)), this area is still less often studied than undergraduate education. Given the limited number of datasets that include information about postgraduate education for a sufficient number of respondents, progress has been particularly slow in discussing inequality among this small but growing population at the top of the educational distribution.

However, previous findings of a substantial intergenerational socioeconomic association among this education group (Falcon and Bataille 2018; Oh and Kim 2019; Torche 2011, 2018; Wakeling and Laurison 2017) and stratified selection into postgraduate education (Mullen, Goyette, and Soares 2003; Oh and Kim 2020) raise the need for a separate framework to understand inequality among them.

1.1.3 Higher Education and Inequality between Households

As mentioned above, higher education has been claimed as a potential equaliser, on the one hand, but a source of growing inequality, on the other. In line with the latter point, some sociologists have further expanded their interest from individual-level economic disparities between college graduates and non-graduates to how changes in the distributions of education and of the economic returns to education have affected household-level economic inequality through demographic processes, such as marriage, cohabitation, or fertility (for a systematic review, see Schwartz 2013). Because both intra- and intergenerational inequalities are deeply rooted in household-level resources and dynamics, this has become a significant research field in which inequalities in individual-level returns from higher education play a major role.

The primary concern raised in this field is whether the increase in economic inequality between college graduates and non-graduates has led to greater household-level inequality through college graduates' higher propensity for marriage and through sorting on educational attainment. Suppose college graduates, whose income grows much faster than the less educated, are more likely to marry than remain single and more likely to marry another college graduate and pool their incomes. This would be expected to increase the gap between those highly educated households and others, so contributing to growth in inequality. However, empirical studies have suggested that this has not been the case, at least in the US during the late-twentieth century, where both educational expansion and a rapid growth of income inequality were observed (Breen and Salazar 2011; Western, Bloome, and Percheski 2008). Also, from the cross-sectional perspectives, inequality between household

types defined by man's and woman's education only explains a quarter of the entire inequality (Breen and Salazar 2011), with most of the variance in income being between households of the same type.

Despite these findings, there are two reasons why we cannot exclude the possibility of a significant role of educational expansion, especially in recent decades, in the increase in economic inequality between households. First, changes in education, labour market, and inequality patterns in the twentieth-first century have been different from the previous decades in several points. Educational expansion in the past two decades has been substantially more concentrated at the top of educational distribution (bachelor's and postgraduate degrees) and among women, leading to a reversal of the gender gap in higher education. Also, the growth of inequality in this period has been more modest than in previous decades. Second, previous studies left the possibility that their educational classification and analysis could not capture variance between households sufficiently, mostly due to the data limitation.

1.2 Research Questions and Approaches

With this background, this dissertation addresses three specific questions relevant to current debates around higher education and inequality. The first and second questions are about individual-level inequalities associated with socioeconomic origins in socioeconomic outcomes, especially among college graduates. The third is about household-level inequalities associated with differences between college graduates and the less educated in their educational choices, returns to education, and demographic processes.

The first research question aims to provide a more comprehensive and precise description of the origin gap in socioeconomic outcomes by identifying and addressing limitations in previous studies. It addresses the challenge of taking multiple heterogeneities into account coming from differences in adult children's educational attainment, occupational destination, and gender, as well as which socioeconomic outcome is examined. I constructed an analytic framework to address this chal-

lenge, borrowing two concepts that describe gender or race inequality mechanisms in the labour market (allocative inequality and within-occupation rewards inequality) (England 1992; Petersen and Morgan 1995; Petersen and Saporta 2004; Treiman and Hartmann 1981). Furthermore, I estimated the social origin gaps in occupational access and economic returns separately for men and women. In doing so, the most critical element of occupational heterogeneity identified was the extent to which an occupation is credentialised. By intersecting such occupational credentialisation with individuals' educational attainment I was able to provide a more nuanced description of the relationship between higher education and inequality in outcomes between people from different social origins.

The second question asks how the class gap in socioeconomic outcome is generated at the top of the educational distribution. Despite the growth in the proportion of postgraduate degree holders, together with increasing economic returns, but also increasing variation, among people with postgraduate qualifications, studies of this group has been limited in number. This has mostly been due to a lack of data that would provide measures of entire educational pathways through higher education as well as of socioeconomic origins and outcomes for a sufficient number of postgraduate degree holders. As a result, most previous studies have focused only on parts of the transitions (e.g., the transition from postgraduate education to occupational destination) or particular dimensions of stratifications (e.g., postgraduate-level institutional selectivity) between origins and outcomes. Moreover, many studies have focused on the US case where a distinct postgraduate educational system exists. Therefore, the second research question asks about the mechanisms of the social origin gap in access to elite occupations among postgraduate degree holders taking account of multiple transitions and educational stratifications between social origins and occupational destinations.

Lastly, while the first two questions are about inequalities associated with socioeconomic origins with a particular focus on college graduates, the third research question is about economic inequality associated with different educational attain-

ments. However, instead of focusing on inequalities between individuals it asks whether changes in the pattern of family formation, along with changes in individuals' distribution across educational attainments and in the economic returns to each qualification, have contributed to an increase in economic inequality between households. More specifically, it first asks whether highly educated people increasingly match with a person of the same education level, either because of increased opportunities to meet each other or because of increased propensities to seek such a partner with a better economic status or prospects. Next, it asks whether this type of educational assortative mating has been a source of increased economic inequalities between households. Because previous studies on this question may have mostly captured changes in the late twentieth century, recent decades in the twenty-first century are still understudied. Therefore, this research examines the role of changes in educational assortative mating in the rise in economic inequality between households in the past two decades using recent data and addressing some limitations of previous studies.

1.3 Data

For the first two chapters, the UK Labour Force Survey (LFS) was used. The LFS is a nationally representative cross-sectional survey, similar to the US Current Population Survey (CPS). The LFS asks about respondents' qualifications and labour market activities. This data provides a unique analytical opportunity because, since 2011, it has captured characteristics of both undergraduate and postgraduate education, such as degree-awarding institution, subject of degree, academic performance (for undergraduate education only), and type of postgraduate degree. These measures are included only in the secure access data, which requires a special permit to access. From 2014, the LFS also began to ask mobility-related questions in every July-September quarter survey. My study used the question about the main earner's occupation when respondents were age 14 to construct a social origin variable.

For the third chapter, I used the Annual Social and Economic Supplement

(ASEC) of the Current Population Survey (CPS) that is available from the Integrated Public Use Microdata Series (IPUMS). Two main variables of interest in the data are education and household income. The education question of the CPS was changed in 1992 from asking about grades to asking about qualifications attained. This change allows researchers to make precise educational classifications and distinguish degree types among graduate degree holders.

1.4 Chapter Astract

The first chapter seeks to provide a more precise and inclusive description of class gap in adult children's socioeconomic outcomes by addressing limitations in previous approaches to heterogeneous mobility research. The results from analyses of the UK Labour Force Survey data reveal substantial heterogeneity in the size and patterns of the social origin gap in occupational access and economic returns by offspring's educational attainment and occupational status. The findings of heterogeneous social origin gaps also suggest more precisely where the gap is relatively small among college graduates: in access to elite occupations not requiring a degree for all college graduates and in earnings for terminal BA holders (men) or advanced degree holders (women). Although whether it was because of the equalising role of higher education cannot be tested in the chapter, these findings point to where precisely the equalising potential of higher education is present. The results demonstrate that the interplay between class-reproductive and meritocratic forces in the labour market can only be captured when the sequential relations between education, occupational destination, and economic returns are considered.

The second chapter explores the mediating role of undergraduate- and postgraduate-level stratification in intergenerational occupational association among postgraduate degree holders in the UK. Results show that much of the association is indeed explained by undergraduate-level stratification even where postgraduate-level stratification might seem to account for it. Unequal distributions of undergraduate-level education, a strong path dependency between undergraduate- and postgraduate-

level stratification, and unequal sorting into postgraduate education jointly give rise to the unequal occupational outcome by social origin among postgraduate degree holders. Women from lower origins experience a double disadvantage from gender-specific patterns of class inequality. This study confirms that the source of social origin inequality among postgraduate degree holders goes beyond postgraduate education and reveals inequality-generating mechanisms in the transition from undergraduate to postgraduate education.

The last chapter examines effects of educational assortative mating on the growth in inequality in the US during the first two decades of the twenty-first century. The results suggest that the continuous educational expansion, gender reversal in higher education, and female college graduates' growth in the labour market in this period have not affected the mating pattern in a way that increases household income inequality. Rather, counterfactual analyses showed that distributional changes in household types, defined in terms of a husband's and wife's education, have mitigated increases in inequality. The result holds under two alternative settings to address potential reasons for a null effect, as suggested in previous studies: (1) with a new educational classification that better reflected educational differentiation in higher education; (2) when counterfactual inequalities were computed separately for different income groups.

Chapter 2

Heterogeneous Social Origin Gap in the UK: Education, Occupation, and Earnings

2.1 Introduction

The association between family background and offspring's socioeconomic outcomes is heterogeneous depending on their position on educational or economic distribution. This heterogeneity has been of persistent interest to stratification scholars, not least because it reveals mechanisms that can counter the effect of family background on offspring's socioeconomic outcomes. For example, a considerably weaker intergenerational occupational association among college graduates than among non-graduates has been suggested as evidence of higher education's equalising power (Hout 1984, 1988).

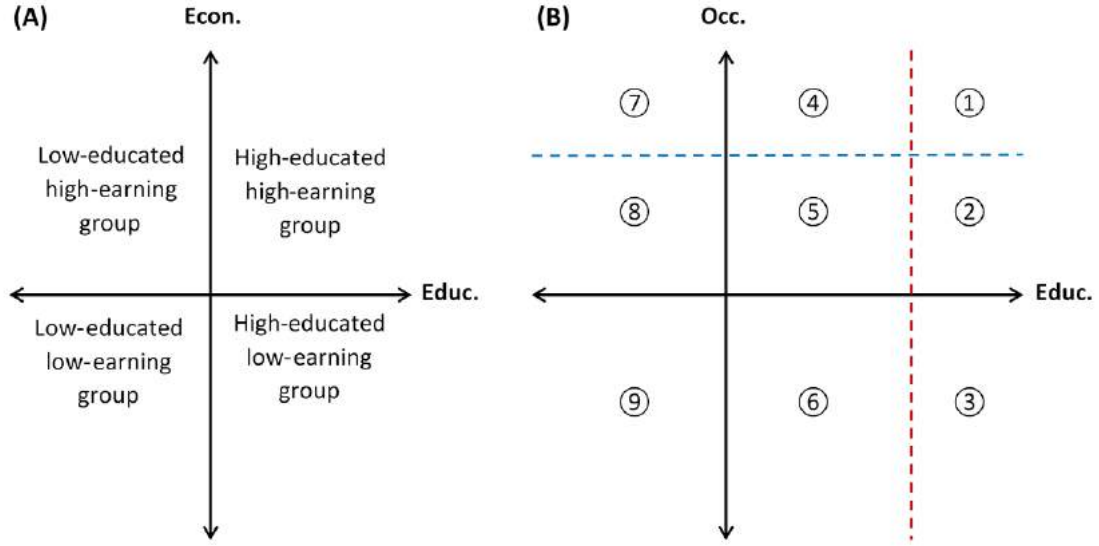
In this regard, recent findings of strong intergenerational economic persistence at the top of the offspring's economic distribution (Björklund, Roine, and Waldenström 2012; Crawford et al. 2016; Gregg, Macmillan, and Vittori 2019; Palomino, Marrero, and Rodríguez 2018; Schnitzlein 2016) could be puzzling. If one believes economically successful children are also highly likely to fall into a high-educated group which has been characterized by the weak intergenerational association (Breen 2010; Breen and Jonsson 2007; Breen and Luijkx 2007; Hauser and Logan 1992; Hout 1984, 1988; Pfeffer and Hertel 2015; Torche 2011; Vallet 2004), two strands of findings seem to contradict each other.

We should note, however, that the contradiction manifests only to the extent that two conditions are met: first, offspring's educational attainment strongly shapes their economic success; and second, the two most frequently used outcome measures – occupational and economic success – are highly exchangeable. While no studies have yet examined these two conditions systematically, a small group of scholars has challenged the second condition to account for the puzzling findings (Bernardi and Ballarino 2016; Bernardi and Gil-Hernández 2020). They noted that strong intergenerational association among high-earning children is found mostly on income or earnings, whereas weak intergenerational association among high-educated children is mostly observed in occupational status. Assuming that these two outcome measures are distinct, they argued that the puzzling results could be attributed to different forms of parental engagement by offspring's educational attainment. That is, parental help is pronounced both for low-educated and high-educated children but takes different forms by children's educational attainment. Parents' goal is to secure a decent occupation when their children are educationally unsuccessful (compensatory advantage), whereas when their children are educationally successful and thus reach an elite occupation, it is to elevate them to a top-earning stratum within this elite occupation (boosting effect).

What they did not challenge was the first condition mentioned above, on the basis of which they assume that individuals' educational attainment can be highly precisely inferred from their economic or occupational success. In reality, however, the relationship between educational attainment and economic success could be closer to what is shown in Figure 2.1A. People with similar economic success consist of heterogeneous subgroups of different educational attainment, and people with the same educational attainment do not necessarily achieve the same economic success (Bol et al. 2019). More importantly, the theoretical background for the present study, which will be laid out later in the article, indicates that even greater heterogeneity may be present as regards intergenerational association in the labour market, especially within a high-educated or high-earning occupation group (as shown in Figure

2.1B).

Figure 2.1: Analytic Approach



Notes: In Figure (A), the vertical axis denotes economic gradation, whereas the horizontal axis denotes educational gradation. In Figure (B), the vertical axis is occupational gradation. The additional vertical (dashed) line separates high-educated people into advanced-degree holders and terminal-BA holders, whereas the additional horizontal (dashed) line separates elite group into merit and non-merit subgroups. Following this approach, my analysis compares family background gaps across nine mutually exclusive groups as below. Merit subgroup of elite group consists of members of the NS-SEC 1 occupations that most incumbents (85% or more) have at least a BA degree. Non-merit subgroup of elite group consists of member of the other NS-SEC 1 occupations and non-elite group consists of members of NS-SEC 2 to 8 occupations: ① Advanced-degree-holding merit subgroup of elite group ② Advanced-degree-holding non-merit subgroup of elite group ③ Advanced-degree-holding non-elite group ④ Terminal-BA-holding merit subgroup of elite group ⑤ Terminal-BA-holding non-merit subgroup of elite group ⑥ Terminal-BA-holding non-elite group ⑦ Non-degree-holding merit subgroup of elite group ⑧ Non-degree-holding non-merit subgroup of elite group ⑨ Non-degree-holding non-elite group.

My study thus builds on the analytic approach presented in Figure 2.1B and asks three inter-related questions. First, how heterogeneous is the elite occupation group in terms of members' educational attainment? Second, is the association between social origin and offspring's occupational access pronounced among the low-educated? Third, is the association between social origin and offspring's earnings pronounced among the high-educated? By answering these questions, I aim to test the hypothetical mechanisms of the puzzle suggested earlier and to provide an accurate description of the social origin gaps in the UK labour market. Finally, without attributing causality and mindful that it is likely influenced by selection into higher education, I evaluate the potential role of higher education as an equaliser

both in occupational access and economic returns.

This study contributes to the literature on heterogeneous intergenerational economic persistence by addressing three limitations in the previous approaches. First, the literature has not paid much attention to the distinct mechanisms behind high intergenerational persistence at the top. My study focuses on the sequence of education to earnings through occupational allocation underlying the social origin gap, allowing for a distinction to be drawn between the gap in occupational access and the gap in economic returns. Second, previous studies have tended to control for all available educational measures to estimate residual social origin effects. However, they are often based on ambiguous definitions of meritocracy, leading to an over-control of the direct effect of social origin on offspring's economic success. In this study, I propose an alternative conditioning strategy based on a clearer definition of meritocracy. Lastly, studies in this line have often taken a pessimistic view of the equalising role of higher education only with partial evidence. This study reconsiders such a view based on a richer empirical basis.

This study also contributes to the current debate on the class gap in the UK. A recent study (Sullivan et al. 2018) suggested that all class gaps in access to elite occupations can be explained by sufficiently detailed measures of abilities and educational pathways, arguing against previous results showing substantial residual class gaps (Breen and Goldthorpe 2001; Bukodi and Goldthorpe 2011; Crawford et al. 2016; Devine and Li 2013; Gregg et al. 2019; Laurison and Friedman 2016; Macmillan 2009; Macmillan, Tyler, and Vignoles 2015). Meanwhile, it has been noted that non-negligible class earnings gaps exist even among high achievers, such as college graduates (Crawford and Vignoles 2014) or high-level managers or professionals (Laurison and Friedman 2016). Does this mean that individuals with similar abilities can access equally elite occupations regardless of their origin, but people from different class backgrounds reap unequal economic returns once there? No studies, however, have yet examined the class gap in occupational access and earnings comprehensively. Additionally, my study examines men and women separately,

departing from previous studies focusing exclusively on men (Gregg et al. 2019) or not attending to gender differences (Friedman, Laurison, and Miles 2015; Sullivan et al. 2018). It should be noted that cautious interpretation is required in the case of women because the complexities in their economic activities are not considered in this study. Nevertheless, the results will be useful for suggesting directions for future research on women's intergenerational mobility. Lastly, this study considers not only heterogeneity among offspring's elite occupation group, but also that among the elite social origin to assess whether specific resources are more or less effective in different labour markets.

The UK provides a good case study for the above-mentioned puzzle because previous studies set in the UK have shown weak intergenerational occupational association among college graduates (Breen 2010; Breen and Luijkx 2007; Vandecasteele 2016) and high intergenerational economic persistence at the top of the offspring's economic distribution (Crawford et al. 2016; Gregg et al. 2019). In the following pages, I will elabourate on the limitations in recent studies of heterogeneous intergenerational economic persistence. Then I will introduce strategies to address those limitations and to examine the heterogeneous social origin gaps in the labour market by reviewing relevant theoretical backgrounds and previous empirical findings.

2.2 Background and Research Strategy

2.2.1 Intergenerational Economic Persistence across Offspring's Economic Distribution

Despite extensive interest in intergenerational economic persistence, mostly measured by the intergenerational elasticity (IGE) in income or earnings, attempts to estimate differences in the IGE by the offspring's position on the economic distribution are relatively recent. Despite mixed results, recent findings point to a higher IGE at the upper tail of the offspring's economic distribution in several countries, such as the US, Germany, Sweden, and the UK (Björklund et al. 2012; Gregg et al.

2019; Palomino et al. 2018; Schnitzlein 2016). These studies employed the unconditional quantile regression method (Firpo, Fortin, and Lemieux 2009) and relatively large samples to overcome limitations in previous approaches.

However, they suffer not only from comparatively weak theoretical grounding but also from methodological ambiguities that make it challenging to draw meaningful inferences from the results. Of greatest significance, the high IGE at the top can result either from unequal access to high-earning occupations or unequal economic returns within those occupations. To illustrate, suppose that the IGE is high at the bottom and the top of the income distribution, as shown in the US (Palomino et al. 2018). While they are of similar extents, they could have resulted from different sources. For example, suppose the hypothetical mechanism presented earlier (Bernardi and Ballarino 2016) is accepted as valid. In that case, the high IGE at the bottom may have resulted from unequal access to better-earning occupations, whereas the high IGE at the top may have resulted from unequal economic returns within top-earning occupations. Nonetheless, no studies have yet paid adequate attention to this distinction.

Secondly, the way these studies estimate residual IGE may not be the best way to draw a solid conclusion on meritocracy. To separate out effects not explained by the offspring's abilities or effort from the IGE, most studies follow a strategy of controlling for all available measures of IQ, test scores, and differences in educational pathways (e.g., attending a private versus public school) at all available levels. This strategy is likewise taken by studies on the direct effect of social origin on the offspring's occupational access (e.g., Sullivan et al. 2018). However, most studies on high-educated people, including this one, are interested in the extent to which ascriptive characteristics of individuals affect their socioeconomic outcomes over and beyond their current abilities and effort, especially the formally acknowledged ones. In this case, controlling for all available measures at all available levels will lead to an over-control of the direct effect of social origin.

Lastly, studies in this line have articulated a pessimistic view of higher edu-

cation's meritocratic power based on substantial residual IGE after adjusting for degree characteristics, such as institutional selectivity, major, or academic performance (e.g., Gregg et al. 2019). However, this could be a hasty conclusion based only on partial evidence when the heterogeneity among higher earners is not taken into account. For example, let us suppose that a substantial number of high earners are actually low educated. Then controlling for degree characteristics will only have a limited impact on the initially high IGE among the high earners, even when degree characteristics account for most of the earnings difference among college graduates. Furthermore, even among college graduates, higher education may explain social origin gaps in earnings to different degrees depending on their highest qualifications or occupations.

In the following sections, I will introduce three alternative strategies to address these ambiguities and investigate mechanisms behind the high IGE at the upper end of the offspring's economic distribution. Based on these strategies, the rest of the article will seek to answer where and how, in the elite labour market in the UK, social origin gaps are present concerning occupational access and economic returns.

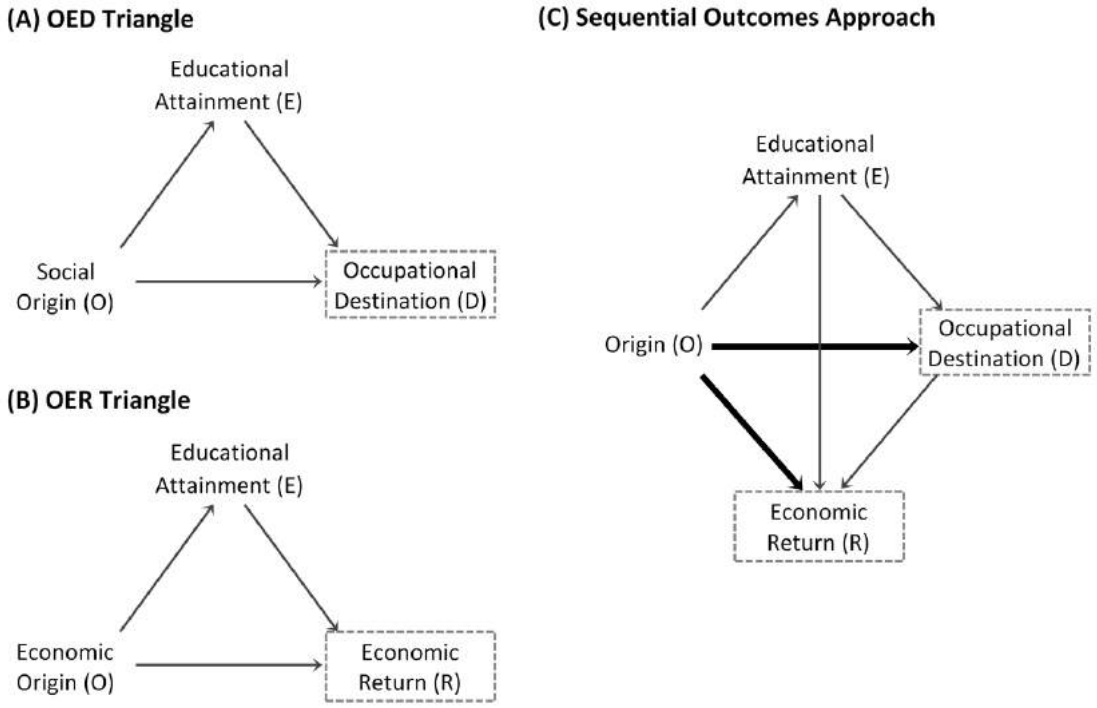
2.2.2 Strategy 1: Sequential Outcomes Approach

Previous research on the heterogeneous IGE can hardly tell whether the high IGE at the top is due to unequal access to or unequal economic returns within high-earning occupations. This ambiguity is closely associated with the separate development of two mobility research traditions: social mobility research that concerns occupational access and economic mobility research that examines income or earnings.

Nonetheless, an attempt was made to link these two research traditions to explore the mechanisms of labour market class inequality. Albeit descriptively, Torche (2011) explored the social origin gap in the labour market, borrowing the concept of two mechanisms operative in labour market gender or race inequality (allocative inequality and within-occupation rewards inequality) (England 1992; Petersen and Morgan 1995; Petersen and Saporta 2004; Treiman and Hartmann 1981). From this

perspective, the social origin gap emerges at two points in the labour market: first, in access to desirable occupations, and second, once access is obtained, in economic returns within the occupation obtained. Following this approach, I see occupational access and economic returns as sequentially-determined outcomes (Figure 2.2C), in contrast to previous studies on social (Figure 2.2A) or economic (Figure 2.2B) mobility that have treated those two outcomes as parallel measures of socioeconomic outcome.

Figure 2.2: Sequential Outcomes Approach



Notes: Figure (A) and (B) represent causal paths commonly used in social and economic mobility studies, respectively. Figure (C) represents our assumptions on the causal relationship between class origin, educational attainment, and socioeconomic status. Two bold solid lines with arrows in the Figure (C) present direct effect of class origin on occupational destination and economic returns conditional on educational attainment and occupational destination.

My study thus proceeds in two stages. In the first stage, the variable of interest is occupational groups that children enter. In the second stage, it is their earnings, and the comparison between social origins is made only among members of each occupational group. The social origin and occupational group are set to be identical for both stages for coherent interpretation. While access to elite occupations has

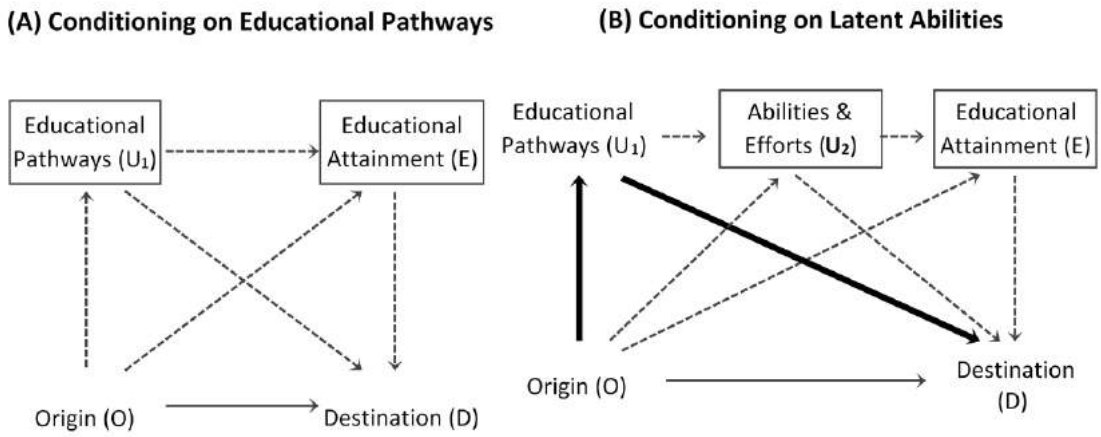
long been a central concern in social mobility research (Sullivan et al. 2018), the social origin gap in economic returns conditional on having an elite occupation has only recently started gaining attention (Friedman et al. 2015; Hällsten 2013; Hansen 1996, 2001a, 2001b; Laurison and Friedman 2016; Mastekaasa 2004). My study thus extends this research trend by addressing two more limitations as follows.

2.2.3 Strategy 2: Definition of Meritocracy and Conditioning Strategy

The second limitation in the heterogeneous IGE research is associated with its use of a conditioning strategy that may lead to an over-control of the direct effect of social origin. To illustrate, Figure 2.3A shows a conventional conditioning strategy in studies that aim to estimate the direct social origin effect on the offspring's socioeconomic outcomes. Here, to estimate the direct *O*-*D* path, a mediating variable *E* needs to be controlled. However, there could be unobserved confounders U_1 that affect both *E* and *D*. Typical examples of the U_1 can be IQ, test scores, and institutional differences. One problem here is that *E* is a collider (Elwert and Winship 2014), and conditioning on E opens a path of *O*-*E*-U_1-*D*, biasing the direct effect of social origin. Therefore, to avoid this bias, U_1 also needs to be controlled, and doing so represents a conventional strategy.

However, conditioning on U_1 may lead to over-control for differences in abilities and effort that affect one's socioeconomic outcomes over and beyond current abilities and effort. Suppose that we want to examine social origin gaps in socioeconomic outcomes among college graduates. In Figure 2.3B, an example of U_1 is attendance at a private secondary school and U_2 is abilities and effort that determine college pathways (e.g., institutional selectivity, major, and academic performance). In this case, if we follow the conventional strategy, we end up blocking a path *O*-U_1-*D*, as well as *O*-U_1-U_2-*E*-*D* and *O*-U_1-U_2-*D*. Substantively, the path *O*-U_1-*D* in our example captures additional advantages that higher-origin children enjoy by attending a private secondary school even compared to their lower-origin peers who graduate

Figure 2.3: Conditioning Strategy



Notes: Examples of the 'Educational Pathways (U_1)' could be IQ, test scores, and institutional differences at primary and secondary education, whereas 'Abilities & Efforts (U_2)' represents cognitive and non-cognitive abilities or efforts that are formed through educational pathways and directly determine a pathway in postsecondary-level education. Thus, this can be seen as a difference in abilities that is acknowledged by a formal qualification system.

from the same college with the same major and academic performance but who did not attend private secondary school. The path U_1-D has been found in the UK both on occupational access and income (Crawford and Vignoles 2014; Macmillan et al. 2015). The conventional strategy counts this advantage as a difference in innate abilities.

This criticism is not to argue for one definition of merit that should be followed in all cases. Rather, it underlines the fact that the definition of merit is far from clear and has encompassed a wide spectrum of meanings (Breen and Goldthorpe 1999; Sen 2000). When Michael Young first invented the term in 1958, merit originally meant a sum of intelligence and effort, regardless of whether it is expressed as a formal qualification. Since then, however, it has often been equated to an attained qualification (e.g., Bell 1972, 1973). Thus, when a society is described as meritocratic to the extent that the desirable social positions are distributed based on merit (Breen and Goldthorpe 1999), the meritocratic society as a social ideal can vary depending on the particular definition of merit on which it is based. Previous approaches could be problematic because they have taken available measures of intelligence, test scores, and educational pathways as a proxy of merit (Jackson 2007), potentially

confounding different implications from different definitions of merit.

It is especially important to distinguish the definitional difference in research on the high-educated group, given a long period of cumulative (dis)advantages and unbalanced selection into upper-level education by social origin. Although the debate is still underway as to the extent (see Karlson 2019 and Zhou 2019 for recent findings), college graduates from underprivileged origins are likely to be positively selected on attributes such as IQ, effort, or aspiration. This means that, when this selection is not taken into account, conditioning on degree characteristics is already likely to result in underestimating the direct effect of social origin. Therefore, further counting out the effect that is mediated by earlier development or education would leave only a very limited kind of direct social origin effect among this high-educated group. In this sense, the present study is interested in the social origin gap among similarly qualified people, rather than how much of the gap is left after counting out the differences in innate abilities. To pursue that aim, this study exploits the advantage of detailed measures of characteristics of higher education one received in the UK Labour Force Survey (LFS), such as degree type, institutional selectivity, degree subject, and academic performance. Taken together, these measures can be seen as a proxy for differences in abilities and effort that are acknowledged by a formal qualification system and that determine one's pathways in higher education. Therefore, as in Figure 2.3B, my models condition on U_2, instead of U_1, to estimate the residual social origin gap. By doing so, this study includes both paths of O-D (thin solid line with an arrow) and O-U_1-D (bold solid line with an arrow) and avoids bias resulting from the confounder U_2.

2.2.4 Strategy 3: Heterogeneous Subgroups among Elite Occupation Group

Educational heterogeneity in social origin gap

Lastly, previous heterogeneous IGE research has not paid proper attention to heterogeneity among high-earners or elite occupation members and its role in the high

IGE at the top. Social mobility researchers have found weak intergenerational associations among college graduates in the US and some European countries (Breen and Jonsson 2007; Breen and Luijkx 2007; Hauser and Logan 1992; Hout 1984, 1988; Torche 2011; Vallet 2004). These findings lead to an expectation that the social origin gap in the elite occupation group will be even larger for the non-graduates (⑦ and ⑧ in Figure 2.1) than for the college graduates (①, ②, ④, and ⑤).

Recent studies suggest a more nuanced view of heterogeneity at the top of the offspring's educational distribution. They show intergenerational association re-emerges among advanced degree holders in the US, the UK, and France (Falcon and Bataille 2018; Oh and Kim 2020; Posselt and Grodsky 2017; Torche 2011, 2016, 2018; Wakeling and Laurison 2017). For example, Torche (2011) found a U-shaped pattern of intergenerational association in a wide range of measures, such as class, occupational status, earnings, and family income. She claimed that the association is still weaker among college graduates than among non-graduates, yet it increases among advanced degree holders. These results suggest that the social origin gap would be more prominent for advanced degree holders (① and ②) than for terminal BA holders (④ and ⑤).

A growing number of studies have further reported a non-negligible presence of the social origin gap even within college graduates. Ethnographic studies show that economic, social, and cultural capital that is available only to children of privileged origins enables them to know the 'rules of the game' and to feel a 'sense of belonging,' both of which help them to adjust to college life with ease and accordingly to achieve more during college (Armstrong and Hamilton 2013; Hamilton 2013; Lareau 2015:6; Lee 2016; Ostrove and Long 2007; Yee 2014). Furthermore, such effects often reach beyond achievements in college. Coming from privileged origins often translates into direct advantages in the job market (Armstrong and Hamilton 2013; Rivera 2011, 2012, 2016).

A mounting body of recent scholarship based on representative samples also supports these claims. Although they showed that the association between family

background and college graduates' income is partly accounted for by degree characteristics (Bartik and Hershbein 2018; Britton et al. 2019; Emmons, Kent, and Ricketts 2018; Ford 2018; Giani 2016a; Manzoni and Streib 2018; Thompson 2019; Witteveen and Attewell 2017a, 2020), much of the association remains unexplained. These findings indicate that privileged origins become advantages in the labour market, partly through better choices or greater achievement during college and partly through more direct routes, such as via familial networks or cultural matching, in the transition to or in progress within the labour market after graduation. Therefore, it remains debatable whether there exists a substantial social origin gap in socioeconomic outcomes among those with only a bachelor's degree and where, if there is one.

Occupational heterogeneity in social origin gap

Compared to the educational gradient, the occupational gradient has been understudied as to the social origin gap in the graduate labour market. In this regard, a few studies that reveal a heterogeneous social origin gap by the level of college selectivity are illuminating (Britton et al. 2019; Giani 2016b; Thompson 2019; Witteveen and Attewell 2017b). Despite their mixed results on the location of the pronounced social origin gap, heterogeneity by college selectivity itself signals the significance of the labour market segment that college graduates enter, given that college selectivity is one of the key factors that shape graduates' post-college career (Brewer, Eide, and Ehrenberg 1999; Loury and Garman 1995; Thomas 2003; Thomas and Zhang 2005; Broecke 2012; Monks 2000; Witteveen and Attewell 2017b).

A few studies have also suggested that occupational characteristics are closely associated with the extent and mechanism of familial influence in the labour market. For example, some scholars suggest a large class gap in access to lower service sector jobs where relatively lower educational qualifications are required while the social skills that are readily learned in upper-class families are highly valued (Erikson and Jonsson 1998; Goldthorpe 2000; Jackson, Goldthorpe, and Mills 2005). Meanwhile,

another study highlights the top-tier elite labour market where candidates from privileged origins enjoy comparative advantages in recruitment because of better matching in experiences or self-presentation between evaluators and these candidates than their peers from underprivileged origins (Rivera 2012).

A few more examinations of the social origin gap by occupational characteristics have been attempted. These studies suggest that the gap is marked in traditional professions, small-size firms, private sectors, soft fields, and the same sector in which their father's job is located (Hällsten 2013; Hansen 2001b; Laurison and Friedman 2016; Mastekaasa 2004, 2011). While illuminating, most of these studies do not provide systematic and comprehensive analyses and are not based on solid theoretical grounds. More importantly, heterogeneous social origin gaps by occupational credentialing have rarely been investigated. Given that my study focuses on the role of higher education in the social origin gap, particularly regarding the elite labour market, credentialing of occupational destinations is as important as one's educational attainment in the investigation of the heterogeneous social origin gap.

Credentialing in the elite labour market and social origin gap In sociology, occupational credentialing has long been studied as a factor of labour market dynamics, such as occupational closure or wage decisions (Collins 1979; Weeden 2002). In contrast, little is known about its role in intergenerational mobility. The paucity of research is especially apparent for heterogeneity within elite occupations because all of the members of such elite occupations are often implicitly considered as highly credentialed. However, Jackson (2007) revealed a 'non-merit' subgroup in the higher classes facing a relatively low credential barrier in access (⑧ in Figure 2.1 falls in this category) and suggested that low-educated people from high-class origins may be able to maintain their class positions by entering such non-merit subgroups of higher classes. However, her study was not based on a representative population sample, and her hypothesis on the relationship between occupational credentialing and class reproduction was not empirically tested.

Indeed, the sociological literature provides two competing hypotheses as to where

the intergenerational transmission of advantages is more pronounced between the merit and non-merit subgroups of elite occupations. Research on the role of education in social mobility suggests that the graduate labour market is likely to be highly meritocratic because higher qualifications are a strong signal that leaves little room for familial involvement (Breen and Jonsson 2007). Following the same logic but on the flip side, it is also suggested that the intergenerational occupational association would be stronger in the job market with lower qualification requirements (Erikson and Jonsson 1998; Goldthorpe 2000; Jackson et al. 2005). If this claim holds, the social origin gap would be larger for the non-merit subgroup of elite occupations (②, ⑤, and ⑧) than for the merit subgroup (①, ④, and ⑦).

By contrast, neo-Marxist theories on the role of credentials in class reproduction highlight dynamics around the merit subgroup of elite occupations. Credentials in modern capitalist societies, according to these theories, not only legitimize labour market inequalities (Bourdieu and Boltanski 1978) but also facilitate high-class families' attempts to secure their class position for their offspring. In this system, cultural capital that is monopolized by high-class families (Bourdieu 1984; Bourdieu and Passeron 1977) translates into an 'institutionalized' form of capital (academic qualification), which later becomes a legitimate and stable ground for offspring's entrance to high-class positions (Bourdieu 1991, 2008). High-class families can effectively protect their less able offspring from competitions with more able offspring of lower-class families to the extent that cultural capital, credentials, and class positions are tightly linked (Sørensen 2000). Even among people of similar qualifications, cultural capital provides the offspring of high-class families with extra advantages in accessing high-class positions (Bourdieu 1984). These theories lead to the prediction of a marked social origin gap for the merit subgroup of elite occupations.

Studies in the micro-class tradition also support this prediction. The core argument of the micro-class research is that occupation-specific cultures and resources are passed on to the offspring, promoting class reproduction at the detailed occupation level (Jonsson et al. 2009; Weeden and Grusky 2005). Such micro-level

class reproduction is most prevalent among regulated professional occupations, such as doctors or legal professions (Ruggera and Barone 2017; Strømme and Hansen 2017). Furthermore, these occupations are characterized by more granular within-occupation stratification than other occupations, whereby doctors or lawyers whose parents are also doctors or lawyers tend to have even more successful careers and higher job satisfaction than doctors or lawyers whose parents have other occupations (Dinovitzer 2011; Dinovitzer and Garth 2007). Again, these findings suggest that the social origin gap in access to and progress in the merit subgroup will be larger than in the non-merit subgroup of elite occupations.

Although both streams of scholarship suggest larger advantages of coming from privileged origins in the merit subgroup elite labour market than in the non-merit subgroup elite labour market, each strand of research emphasizes slightly different mechanisms. The micro-class tradition underlines gains resulting from the homogeneity between social origin and destination, whereas Neo-Marxist theories pay more attention to comprehensive advantages generated by higher social origins. To test this difference in mechanism empirically, my study divides the elite social origin into the merit and non-merit subgroup as for offspring's elite occupational destination. If, for example, only children from merit subgroup elite origins, not those from non-merit subgroup elite origins, gain advantages in the merit subsector elite labour market, this will support the mechanism suggested by micro-class reproduction theories.

2.3 Data, Measures, and Analytic Strategy

2.3.1 The UK Labour Force Survey

I used Secure Access data of the UK Labour Force Survey (LFS) compiled between 2013 to 2020. As a cross-sectional survey equivalent to the Current Population Survey (CPS) in the US, the LFS asks about the qualifications and employment of a representative sample of the UK population. In this study, along with educational

attainment, knowing the characteristics of a degree, such as type of degree, institutional selectivity, degree subject, and academic performance (degree class), is critical in estimating the residual social origin gap in the offspring's socioeconomic outcomes, especially in the upper-end labour market. The LFS started asking about names of degree-awarding institutions in 2011, as well as subject and academic performance for those who earned their degrees from the UK institutions. Furthermore, in 2014, the LFS introduced a social mobility section, which provides researchers with measures of social origin by asking about the main earner's occupation in households that respondents resided in when they were 14 years old.

The LFS uses a short rotating panel design such that respondents are surveyed for five consecutive quarters, with around two-fifths of the sample either joining or leaving each quarter. In this protocol, some key measures for my study are not asked about every quarter: the social mobility questions are asked only in the July-September quarter of each year, whereas earnings questions are asked only in the first and the last wave for each cohort of respondents. Therefore, an analytic sample is constructed by linking respondents who answered the social mobility questions in each July-September quarter to their earnings data from the first and the last wave.

In detail, I restricted the sample to men and women aged between 35 and 59 who earned their degrees, if they hold one, in the UK, which leaves 95,362 respondents. The sample was restricted to UK degree holders because characteristics of degrees are only asked of these respondents. The age restriction is introduced to exclude respondents who are assumed to be retired or still in school. Because the study includes advanced degree holders, the lower limit is set to the age where most people complete their higher education, whether they pursue advanced degrees or not. This age limit is also relatively safe from fluctuations in occupational status or earnings at an earlier or later stage of economic activity and better reflects lifetime economic status.

Two different samples were constructed to examine the social origin gap in access to elite occupations and the earnings gap conditional on educational attainment and

occupational status. For the analysis of occupational access, 78,553 respondents who were in employment at the point of the interview were kept because detailed occupations are collected only for those people. Furthermore, cases with missing values for key measures were omitted, leaving an analytic sample of 71,416 respondents. To examine the social origin gap in earnings, three additional omission rules were introduced: 10,839 respondents were omitted because they were in self-employment or unpaid family workers and thus not asked about earnings. Also, those whose gross weekly earnings were missing or above £3,500 were omitted following the Office for National Statistics (ONS), and this left 55,040 respondents in the analytic sample. Lastly, respondents were dropped if there were missing values in their responses to the questions about job characteristics. The final analytic sample for the earnings analysis consisted of 53,819 men and women respondents.

2.3.2 Key Measures

Social origin

As noted above, in the Secure Access LFS, social origin is indicated by way of the main earner's occupation when respondents were 14 years old. Given that my study focuses on disadvantages that adult children of non-elite parents experience compared to adult children of elite parents, I used a categorical class schema rather than continuous measures, such as occupational prestige scores. In particular, whether being a child of merit/non-merit subgroup elite parents is related to varying degrees of advantage in the merit/non-merit subsector of the elite labour market can only be examined with this type of measure. Finally, this choice of measure allows me to compare the results with previous findings on the same data (e.g., Laurison and Friedman 2016). By drawing on the given measure of the National Statistics Socio-economic Classification (NS-SEC), which is based on the Goldthorpe class schema (Goldthorpe and Erikson 1992), I grouped eight social origins into five broad categories as depicted in Table 2.1 for a parsimonious representation of the social origin gap. A principal focus of this study is on the gap between the highest and the lowest

social origins, but this schema still allows me to explore non-linear patterns of the social origin gap, if there are any.

Table 2.1: Class Schema

NS-SEC Class Schema	5 Class Origins in This Study
1.1 Large employers/higher managerial occupations	Higher service class (merit)
1.2 Higher professional occupations	Higher service class (non-merit)
2. Lower managerial/professional occupations	Lower service class
3. Intermediate occupations	Intermediate class
4. Small employers and own account workers	
5. Lower supervisory and technical occupations	
6. Semi-routine occupations	Working class
7. Routine occupations	
8. No wage earner in household at age 14	

Educational qualification

Respondents' educational qualification is determined by their answers to questions concerning the highest qualification they received. Since 2011, names of degree-awarding institutions have been asked about for people who earned their degrees from higher education institutions in the UK. I recoded them into four categories of selectivity following previous studies (Boliver 2013; Crawford et al. 2016; Sullivan et al. 2018; Sullivan and Brown 2015; Wakeling and Savage 2015); global top 20 universities, Russell Group universities, pre-1992 universities, and post-1992 or other universities [1] . Twenty majors were grouped into four categories, also following earlier studies (Sullivan et al. 2018; Walker and Zhu 2011): LEM (Law, Economics, and Management), STEM (Science, Technology, Engineering, and Mathematics), OSSAH (Other Social Sciences, Arts, and Humanities), and combined areas. Lastly,

[1]Global top 20 universities are taken from the Times Higher Education's World University Rankings 2014-2017 (https://www.timeshighereducation.com/world-university-rankings/). In the UK, four universities have been listed in the top 20 of the ranking: Oxford, Cambridge, Imperial College London, and University College London. Following those four institutions, which are often called 'Golden Triangle' universities, are 24 large research-intensive universities that enjoy excellent reputations. These are called 'Russell Group' universities. Beneath this upper rung of the echelon, are pre- and post-1992 universities whose rankings are ordered in accordance with that dating convention. Post-1992 universities are former polytechnics or other institutions that were granted university status through the Further and Higher Education Act 1992 or founded after 1992, whereas pre-1992 universities are institutions that had university status before 1992 but are not in the Russell Group.

academic performance at undergraduate level was grouped into four categories: first, upper second, lower second, and third/pass. For advanced degree holders, in addition to institutional selectivity and degree subject, type of degree is also used in the analysis: doctorate, masters, PGCE (Postgraduate Certificate in Education), and others.

Occupational destination

I followed Laurison and Friedman (2016) in creating 15 occupational groups out of 63 individual NS-SEC 1 occupational titles such that the occupational titles within each group are as similar as possible in training, skills, and work contexts (Hout 1984). I then examined educational compositions of these 15 NS-SEC 1 occupational groups, discovering that they exhibit a surprising diversity within the elite occupation group. For example, only over 50% of managers and directors in business have a degree, whereas the vast majority of doctors or lawyers are degree holders.

Table 2.2: Composition of Elite Occupation Group

Subgroups of Elite Group	Occupational Groups	Mean Weekly Earnings	% of Subgroup	% of Occupational Group	% of College Graduates
Merit subgroup	Other life science profs	£692.38	18.00	2.64	95.19
	Academics	£823.67		3.75	94.65
	Law	£1044.22		3.75	94.09
	Doctors	£1259.16		4.21	91.94
	Scientists	£740.20		3.65	84.99
Non-merit subgroup	Built environment profs	£817.54	82.00	2.42	77.10
	Other profs	£743.97		2.35	76.71
	Public sector mgrs & profs	£857.22		5.77	73.63
	Accountants	£917.03		5.08	58.96
	Information technology	£966.16		13.93	58.56
	Protective civil service	£947.57		1.51	54.27
	Finance	£993.54		6.21	51.81
	Mgrs and directors in business	£1053.74		18.49	51.43
	Business profs	£922.43		18.90	51.21
	Engineers	£898.15		7.34	50.42
Total		£943.20	100.00	100.00	62.56

As shown in Table 2.2, 15 occupational groups were divided into two subgroups, based on their educational composition: merit subgroup (80% or more of incumbents are degree holders) and non-merit subgroup (less than 80% of incumbents are degree

holders). It is notable that only 18 percent of elite occupations can be considered as degree-requiring occupations. One might suspect that elite occupations in the merit subgroup can be characterized by other properties, such as high income. However, Table 2.2 shows that not all merit subgroup elite occupations are at the top income tier within the elite group. Only doctors and lawyers earn more than the mean gross weekly earnings of all elite occupations (£943.20).

Economic returns

For the second step of the analysis, the social origin gap was examined on earnings within nine subgroups defined both by educational attainment (advanced degree holders/terminal BA holders/Non-degree holders) and occupational status (merit subgroup of elite occupation group / non-merit subgroup of elite occupation group / non-elite occupation group). In the LFS, gross weekly earnings are asked for all employees and those on a government scheme. Earnings are log-transformed to normalize their distribution. Scholars have agreed that the weight for the income (*PIWT18*) is inappropriate to use when specific waves of the LFS are selected and pooled across years (Laurison and Friedman 2016; Chiappori et al. 2020). I thus use the person weight (*PWT18*) provided in the July-September quarter data. As a robustness check, I compared results with those using the income weight and no weights, finding no significant difference.

Demographic or job-related controls

For both occupational access and earnings analyses, age, age squared, ethnic group (white versus non-white), marital status, and country of birth were used as control variables. In the analysis of the earnings gap, an array of job characteristics, such as hours of work, job training for the past three months, regions of work, industry, firm size, and firm's status as private or public, were added to examine whether the social origin gap in earnings is mediated by occupational allocation. Region of work and firm size were indeed found to mediate some of the social origin gaps in earnings

among members of elite occupations (Laurison and Friedman 2016).

2.3.3 Analytic Strategy

The main analyses in this study consist of three parts to answer three research questions. The first one is a descriptive analysis of the educational and occupational distribution of the UK population. Specifically, this step is to examine the extent to which the occupational destination is heterogeneous within people of the same educational attainment, and likewise, the extent to which homogenous occupational groups are composed of people with different qualifications. Through these practices, I will examine how similar the distributions of educational attainment and occupational status are to what is suggested in Figure 2.1. The results of this descriptive analysis will guide the analyses that follow on the social origin gaps in occupational access and earnings.

The second analysis is to answer the second research question of whether advantages associated with coming from high social origins in occupational access is pronounced among the low-educated. This question can be restated as whether the social origin gap in access to the elite occupation group differs by educational attainment or by the level of credential requirement of elite occupations. I fitted multinomial logistic regression models for each education group to compare the social origin gap in the likelihood of entering the merit subgroup with that of entering the non-merit subgroup of the elite occupation group. For all estimations, the non-elite occupation group is set as a reference category, and demographic controls are included. If there are social origin gaps of different sizes in the likelihood of entering each subgroup of elite occupations, the questions that follow are: how much of those gaps are explained by differences in qualifications, and do the roles of the qualification differ either by educational attainments or credential barriers of elite occupations. We should note here that comparing coefficients across nested non-linear probability models is problematic due to the rescaling issue (Winship and Mare 1984). Thus, I use the KHB decomposition method suggested by Karlson,

Holm, and Breen (2012) to compute the percentages of the social origin gaps that are accounted for by the gaps in the qualification.

Finally, the third analysis is to answer the third research question of whether advantages in earnings associated with coming from high social origins are pronounced among the high-educated elite occupation members. Again, this question translates into a question of where, in terms of educational attainment and occupational status, the social origin gap in earnings is pronounced and where it is less prominent. I begin with a comparison of mean gross weekly earnings by adult children's social origin and their own occupational destination. This step is to test whether the pattern of the social origin gap in earnings across adult children's occupational status is consistent with the pattern of intergenerational persistence of economic status. Given that earlier findings showed a larger income gap at the top of the adult children's income distribution than at the lower part (Crawford et al. 2016; Gregg et al. 2019), the replacement of this 'top-earning group' with the 'elite occupation group' will be justifiable only if a similar pattern is observed for the earnings gap across adult children's occupational distribution.

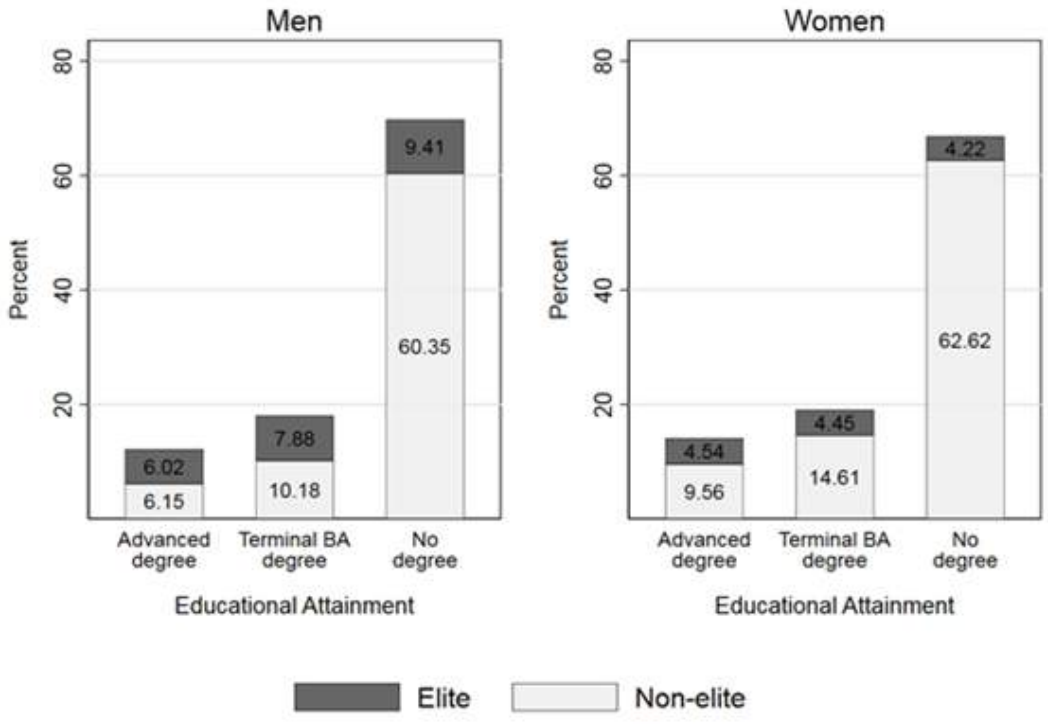
The following analysis breaks down the occupation group into three subgroups (merit and non-merit subgroups of elite group and non-elite group) and educational attainment into three levels (advanced degree holders, terminal BA holders, and non-degree holders), which leaves nine subgroups to be compared. Among these subgroups, the focus of this analysis is on the question of whether the social origin gap in earnings is the most pronounced among the highest educated members of the merit-subgroup elite occupations. Lastly, with stepwise additions of qualification and job characteristics, I examine how much of the social origin gaps in earnings is explained by differences in education or labour market progression and how much of these gaps remain unexplained.

2.4 Results

2.4.1 Heterogeneity in Educational Attainment and Occupational Status in the UK labour Market

The descriptive analysis reveals a high level of heterogeneity within the high-educated and the elite occupation group for both men and women, confirming the postulated intersecting distribution of education and occupation in the UK labour market (see Figure 2.1). In Figure 2.4, each figure on the bars represents the proportion of men and women whose educational attainment and occupational destination are the same. For example, 6.02% of men have an advanced degree and elite occupation. Although the proportion of elite members is much smaller for women than for men in all educational groups, both men and women similarly show two important features that can be seen as two sides of the same coin.

Figure 2.4: Educational and Occupational Composition of Men and Women



On the one hand, people with the same educational attainment do not necessarily

end up with the same-status occupations. Even for men with advanced degrees, only half of them have elite occupations at 35 to 59 years of age. This figure becomes even smaller for women. Just over 30% of women advanced degree holders reach elite occupations at those ages. On the flip side, the composition of elite occupations in terms of members' educational attainment is much more diverse than would have been thought. Around 40% and 32% of men and women elite occupation members, respectively, do not have a college degree. Therefore, it cannot be assumed that most highly educated people will have elite occupations or most elite occupation members are highly educated. This finding supports the analytic frame of this study presented in Figure 2.1, suggesting that the intersecting feature of educational attainment and occupational status must be taken into account when investigating social origin gaps in the labour market.

2.4.2 Social Origin Gap in Access to Elite Occupation Group

My next question is where precisely the social origin gap exists in access to the elite occupation group. Before conducting multinomial logistic regression analyses, Table 2.3 shows the predicted probability of having NS-SEC 1 occupations for children of different social origins for each educational group and odds ratios in the last row representing gaps between the highest and the lowest origins in the odds of reaching the elite occupation group. As has been suggested in previous studies, the gap is substantially larger among non-graduates than college graduates of both degree levels. Does this result provide corroborating evidence for the second research question confirming the substantially larger social origin gap in occupational access among the lower educated than among the higher educated?

Figure 2.5 shows results from the multinomial logistic regression models to answer this question. The right panels of each education column report average marginal effects (AME), showing the predicted probabilities of being in each type of occupational destination. As suggested by the AMEs, the chances of being in the elite occupation group are not very high even among college graduates and are

Table 2.3: Predictive Probability of being NS-SEC 1 Class and Odds Ratio of Probabilities

	Advanced degree	Terminal BA degree	No degree
Predicted Probability of being NS-SEC 1 Class			
NS-SEC 1 origins	0.450	0.374	0.162
NS-SEC 2 origins	0.398	0.338	0.135
NS-SEC 3 to 5 origins	0.371	0.320	0.097
NS-SEC 6 to 8 origins	0.366	0.279	0.071
Odds Ratio (highest vs. lowest origins)	1.416	1.540	2.523

Notes: Predicted probabilities are computed by regressing children's binary destination classes whereby 1 is NS-SEC 1 class and 0 is other class destinations on the interaction of children's social origin and their educational attainment.

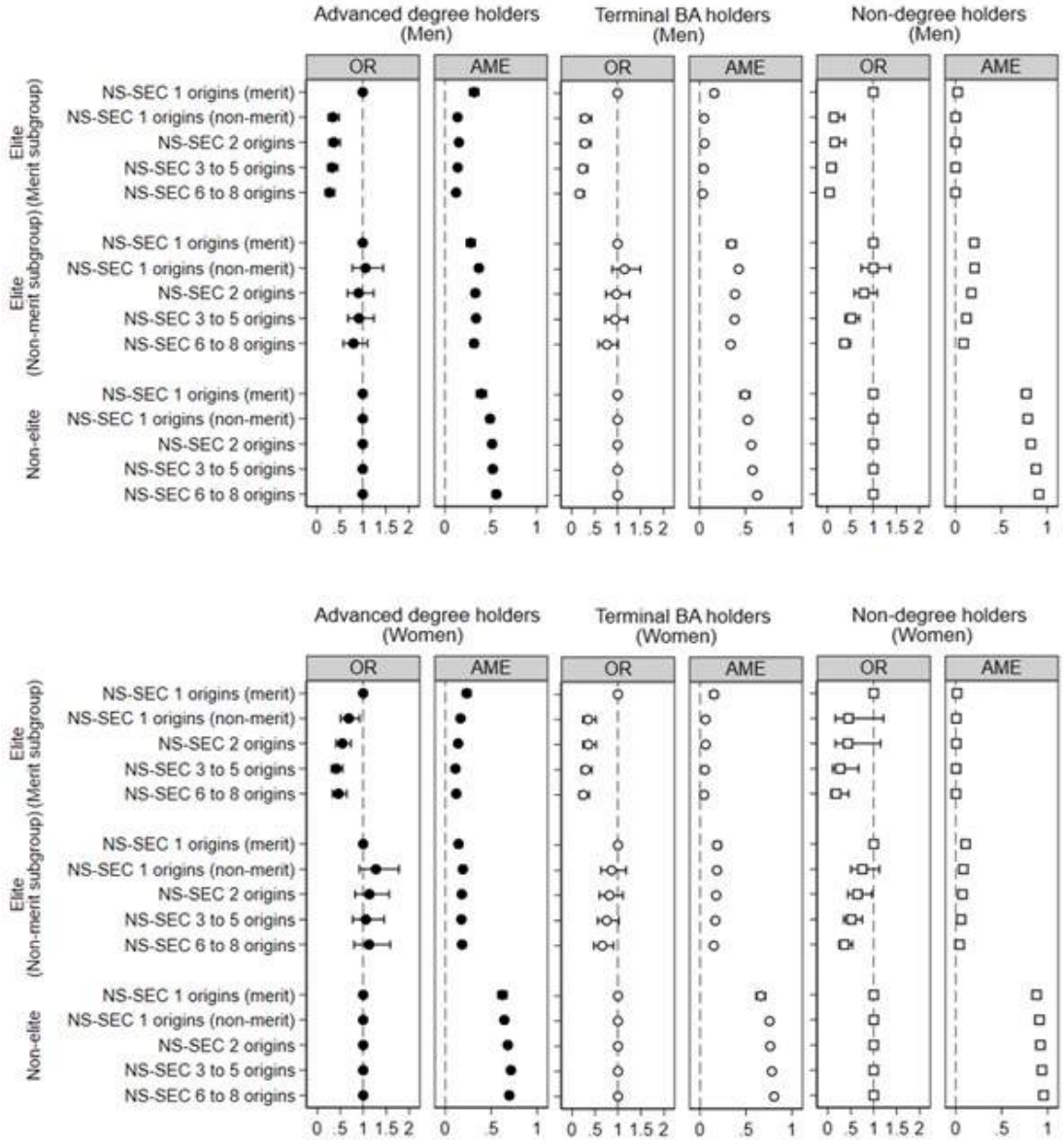
particularly slim for merit subgroup elite occupations (shown in the first row). This finding confirms again that occupational destination is heterogeneous within each education group, suggesting people with the same educational attainment could be affected differently by their social origin in occupational access due to the differences in their occupational destination.

The left panels of each column (OR) in Figure 2.5 show odds ratios of being in each subgroup of the elite occupation group rather than the non-elite occupation group for each social origin relative to the highest origin (NS-SEC 1 (merit) origin). Distances between the dot of the highest origin (on the dotted vertical line) and the dots of the other origins represent the social origin gap in occupational access.

Three findings on this gap in access to elite occupations are notable. First, as shown in Table 2.3, there is a substantial social origin gap among non-graduates in access to the non-merit subgroup of elite occupations (see the second row of the last column). Given that it is highly unlikely for non-graduates to have an elite occupation requiring a degree, this gap in access to elite occupations not requiring a degree may be the most prominent gap in occupational access among non-graduates. The first columns of each education group in Table 2.4 show the estimates from the same models but with the reference group changed from the highest to lowest origins. It shows that, among men without a degree, the odds of having a non-merit subgroup elite occupation for children from the highest origins is 2.86 times as large as the

odds for children from the lowest origins. This result implies that the non-merit subgroup elite occupations are the route through which educationally unsuccessful children from high social origins maintain high-class positions (Jackson 2007).

Figure 2.5: Odds Ratios and Average Marginal Effects from Multinomial Logistic Regression Models



The second and related finding is the contrasting patterns among college graduates in access to non-merit subgroup elite occupations. Figure 2.5 and Table 2.4 show that the social origin gap for this education group is much smaller than the gap among non-graduates. The odds of having a non-merit elite occupation are not

significantly different between children from the highest and lowest origins. The odds for children from non-merit elite origins are significantly larger than that for the lowest-origin children, but the size of the odds ratio is much smaller than among non-graduates (1.38 for advanced degree holders and 1.53 for terminal BA holders). This result implies that higher education, whether advanced or terminal BA degrees, does have a potentially equalising effect in access to some elite occupations for which barriers to entry are relatively low. Put differently, social origin does not translate into advantages in acquiring such elite occupations for college graduates as efficiently as for non-graduates.

Surprisingly, however, the social origin gap is substantial among college graduates if we turn our attention to the merit subgroup elite occupations. Figure 2.5 shows large gaps between the highest and the other origins, regardless of the level of degrees that children have (see the first row of the first two columns of Figure 2.5). In Table 2.4, the odds of having a merit subgroup elite occupation for men from the highest origins is 4.24 times as large as the odds for men from the lowest origins among advanced degree holders. The odds ratio is even larger for terminal BA holders (6.37). This finding refutes the suggested explanation that parents mostly engage in offspring's occupational upgrading when they are educationally unsuccessful. Indeed, their influence is present at all levels of children's educational attainment.

The difference by educational level lies in the type of elite occupation where parental influence is pronounced. When children are educationally unsuccessful and fail to earn a degree, they can gain advantages from family backgrounds in the non-merit subsector of the elite labour market. However, among college graduates, advantages stemming from family backgrounds are very effective in access to elite occupations requiring a degree, such as doctors, lawyers, and academics. More interestingly, patterns of social origin gaps also vary by children's education and the type of the elite labour market. In the chances for non-graduates to have a non-merit elite occupation, the effective social origin is a broader social class. In Figure

2.5, there is no difference between the NS-SEC 1 (merit) origins and the NS-SEC 1 (non-merit) origins in the size of the social origin gap. However, when social origin gives advantages to college graduates in access to merit subgroup elite occupations, only the merit subgroup elite origins are substantially effective. This represents a new finding that reveals specific mechanisms of the social origin gap that differ by children's education and labour market subsector. Also, it reveals a high level of class closure, showing that substantial micro-level class reproduction is present in the merit subsector of the elite labour market, where occupational closure (Weber 1978) is effectively established and maintained.

The overall pattern is very similar between men and women. The most notable difference is the substantially slimmer chances of having an elite occupation for women, as shown in the right panels of each column in Figure 2.5. The second difference is observed among advanced-degree-holding women. Compared to similarly high-educated men, the social origin gap in access to merit subgroup elite occupations is smaller among women. Furthermore, the odds of accessing the non-merit subgroup elite occupations is not significantly different for women from different social origins. This result is consistent with previous findings of weaker micro-class reproduction among women than men (Jonsson et al. 2009; Ruggera and Barone 2017) but is contrary to the finding of a stronger effect of parental ISEI on women's first job than on men's (Vandecasteele 2016). We can think of several hypotheses for this pattern. First, given the disparity by gender, in addition to that by social origin, in one's chances of obtaining an advanced degree, advanced degree holders from the lowest origins who are women could be more positively selected on abilities or aspiration as compared to advanced degree holders from similar origins who are men. If this is the case, the social origin gap will decrease due to the more unbalanced selection into the highly educated group across social origins among women. Second, due to gender inequality or gender segregation in the labour market for the highest educated, high-origin parents' ability to confer advantages to daughters may be more limited than it is for sons. Lastly, parental engagement could indeed

differ for daughters and sons, especially for the highest educated, in access to elite occupations without requiring a degree. Assessing these hypotheses is beyond the scope of this study, but they deserve further investigation in future research.

Table 2.4: Results from Nested Multinomial Logit Models Regressing Occupational Destination on Social Origin Using KHB Decomposition Method

	Advanced Degree			Terminal BA Degree			No Degree		
	M1	M2	% Exp.	M1	M2	% Exp.	M1	M2	% Exp.
				Men					
Outcome: Elite Group (Merit) vs. Non-elite Group									
Origin (vs. NS-SEC 6 to 8)									
NS-SEC 1 (M)	4.237***	3.082***	22.03	6.372***	4.173***	22.86	20.710***	17.030***	6.45
	(0.867)	(0.628)		(1.561)	(1.015)		(9.089)	(7.639)	
NS-SEC 1 (NM)	1.310	1.227	24.38	1.717*	1.421	34.93	2.879*	2.434*	15.88
	(0.226)	(0.212)		(0.395)	(0.327)		(1.200)	(1.036)	
NS-SEC 2	1.361	1.282	19.40	1.710*	1.596*	12.86	3.145**	2.723*	12.58
	(0.227)	(0.214)		(0.374)	(0.349)		(1.195)	(1.071)	
NS-SEC 3 to 5	1.229	1.167	25.16	1.425	1.377	9.51	1.784	1.686	9.74
	(0.200)	(0.190)		(0.304)	(0.294)		(0.574)	(0.543)	
Outcome: Elite Group (Non-merit) vs. Non-elite Group									
Origin (vs. NS-SEC 6 to 8 origins)									
NS-SEC 1 (M)	1.347	1.135	57.55	1.363*	1.210	38.54	2.860***	2.160***	26.73
	(0.233)	(0.195)		(0.191)	(0.170)		(0.452)	(0.343)	
NS-SEC 1 (NM)	1.375*	1.272	24.37	1.533***	1.460***	11.37	2.820***	2.212***	23.42
	(0.172)	(0.159)		(0.142)	(0.136)		(0.179)	(0.143)	
NS-SEC 2	1.168	1.147	11.95	1.286**	1.275**	3.54	2.224***	1.797***	26.71
	(0.142)	(0.140)		(0.116)	(0.115)		(0.136)	(0.111)	
NS-SEC 3 to 5	1.182	1.134	24.92	1.243*	1.234*	3.26	1.414***	1.277***	29.40
	(0.138)	(0.132)		(0.106)	(0.105)		(0.068)	(0.062)	
N		4,165			6,280			24,993	
				Women					
Outcome: Elite Group (Merit) vs. Non-elite Group									
Origin (vs. NS-SEC 6 to 8)									
NS-SEC 1 (M)	2.141***	1.341	61.49	4.452***	2.675***	34.11	5.586***	4.321**	14.93
	(0.395)	(0.249)		(1.031)	(0.615)		(2.656)	(2.074)	
NS-SEC 1 (NM)	1.460*	1.197	52.41	1.432	1.099	73.64	2.457**	2.204*	12.07
	(0.230)	(0.189)		(0.272)	(0.210)		(0.775)	(0.715)	
NS-SEC 2	1.116	0.969	128.68	1.462*	1.214	48.96	2.385**	2.150*	11.95
	(0.173)	(0.151)		(0.266)	(0.221)		(0.718)	(0.656)	
NS-SEC 3 to 5	0.822	0.752	-	1.200	1.091	52.06	1.481	1.431	8.69
	(0.126)	(0.116)		(0.212)	(0.193)		(0.368)	(0.356)	
Outcome: Elite Group (Non-merit) vs. Non-elite Group									
Origin (vs. NS-SEC 6 to 8)									
NS-SEC 1 (M)	0.945	0.758	-	1.588**	1.378	30.71	2.844***	2.301***	20.26
	(0.172)	(0.138)		(0.268)	(0.233)		(0.561)	(0.457)	
NS-SEC 1 (NM)	1.175	1.061	63.56	1.326*	1.193	37.49	2.125***	1.814***	21.02
	(0.159)	(0.144)		(0.148)	(0.133)		(0.205)	(0.177)	
NS-SEC 2	1.033	0.976	174.85	1.256*	1.180	27.34	1.834***	1.571***	25.57
	(0.136)	(0.129)		(0.139)	(0.131)		(0.161)	(0.140)	
NS-SEC 3 to 5	0.931	0.901	-	1.163	1.131	18.65	1.426***	1.327***	20.23
	(0.121)	(0.117)		(0.120)	(0.117)		(0.099)	(0.093)	
N		4,966			6,809			24,203	

Notes: Exponentiated coefficients; Standard errors in parentheses; For NS-SEC 1 origin, M stands for merit subgroup and NM for non-merit subgroup; Controls for Model 1 are age, age squared, ethnic group, marital status, and country of birth. Model 2 includes educational covariates that differ by education group. For advanced degree holders, postgraduate-level institutional selectivity, subject area, and degree type are controlled for. For terminal BA holders, undergraduate-level institutional selectivity, subject area, and academic performance are held constant. Lastly, for non-degree holders, detailed levels of the highest qualifications respondents received is controlled for.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 2.4 indicates that these social origin gaps do not disappear entirely even when comparing individuals of different origins with similar levels and types of qualifications. Education explains no more than 30% of the social origin gaps in occupational access among men, with only a few exceptions. The finding of statistically

significant and substantially large residual social origin gaps shown in estimates from Model 2 refutes non-significant residual gaps in access to elite occupations found in the recent study on the UK (Sullivan et al. 2018). In contrast, education explains more of the social origin gaps among women college graduates. Except for the gap in access to merit subgroup elite occupations among women advanced degree holders, the social origin gaps lose their significance once characteristics of qualifications are held constant. However, significant residual gaps among non-graduate women still support the argument of unequal occupational access.

In sum, this section's main finding is that there are substantial social origin gaps in occupational access both among college graduates and non-graduates, albeit with differences in form and location. This result first rebuts the hypothesis that the family background effect will be most marked in occupational access of the lowest educated group (Bernardi and Ballarino 2016; Bernardi and Gil-Hernández 2020). Also, the differences in the pattern of social origin gaps between the merit and non-merit subsectors confirm that it is necessary to take into account occupational heterogeneity within the elite labour market, as well as educational differences, in research examining social origin gaps. Lastly, although it implies a potentially equalising power of a college degree, the result of the smallest or non-significant social origin gaps for college graduates in access to elite occupations not requiring a degree paradoxically suggests that class equality in access to top occupations in the UK could be much more limited than has recently been claimed (e.g., Sullivan et al. 2018).

2.4.3 Social Origin Gap in Earnings Conditional on Educational Attainment and Occupational Destination

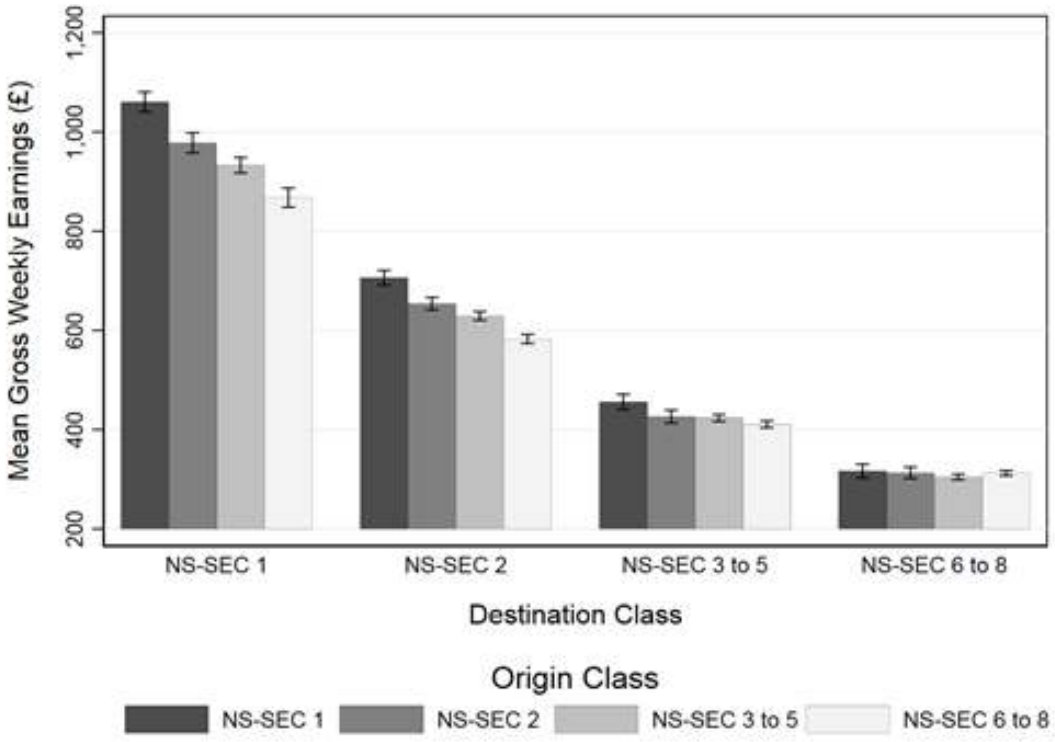
In this study, I have challenged conventional approaches in mobility research that choose either occupational access or economic returns as an outcome measure or that use both measures in parallel. The sequential outcomes approach looks at occupational access and economic returns conditional on one's educational attainment

and occupational destination. Before conducting the principal analyses on earnings, I first regressed the logged gross weekly earnings on social origin among people in each destination class to test whether the highest IGE among top earners also holds for the elite occupation group. The use of the occupational grouping, instead of children's economic distribution, will be vindicated by the larger gaps at the upper-level occupations, which parallel previous findings of the highest IGE at the top of the income distribution.

Figure 2.6 shows that the higher the children's destination class, the larger the social origin gap in earnings. Although it is noteworthy that nontrivial gaps exist among children with lower managerial or professional (NS-SEC 2) occupations, the increase in earnings by social origin is steeper among elite (NS-SEC 1) occupation holders than among members of the lower managerial or professional occupations. My study further tests whether the size and pattern of the social origin gap vary across children's educational attainment or the type of elite occupation they have. By doing so, it aims to investigate whether taking heterogeneity into account would change our views on the boosting effect hypothesis. Table 2.5 shows the results of Ordinary Least Squares (OLS) regression models that regress logged gross weekly earnings on social origin separately for nine education-occupation groups.

In Table 2.5, Model 1 includes only the social origin and demographic controls. Thus, this model estimates the total social origin gap in earnings among children with the same educational attainment and occupational destination. In Model 2, details of the final qualification are added. Estimates from this model represent the social origin gaps in the labour market that are not explained by qualification differences. Therefore, significant gaps in this model imply that meritocratic principles, as defined in this study, are not operative in the case of economic rewards in the corresponding labour market. Lastly, Model 3 includes a large number of job-related characteristics. This step examines how much of the gap is explained by different choices or progression in the labour market and how much of the gap remains. All coefficients are exponentiated and thus can be interpreted as predicted percentage

Figure 2.6: Mean Gross Weekly Earnings by Social Origin and Occupational Destination



changes.

Let us first look at the results for men. The most notable finding among men regarding the third research question is the substantial size of social origin gaps in earnings both among non-graduates and members of the non-elite occupation group. Also, the size of the gaps is not significantly larger among the highly educated elite members (four groups at the upper left corner in Table 2.5), as compared to the non-graduates (third row) or the non-elite occupation group (third column). This finding suggests that as much as there is a boosting effect on economic returns for the educationally and occupationally successful, there is a compensatory effect on economic returns for the educationally or occupationally less successful or unsuccessful. The only heterogeneity is observed across educational attainment. Among advanced degree holders, regardless of occupational destination, the gap is pronounced only between the highest and the lowest origins. This is evidenced in Table 2.5 by coefficients for NS-SEC 2 and NS-SEC 3 to 5 origins for advanced de-

gree holders, all of which are almost zero and statistically not significant. However, among non-graduates, children from the lowest origins earn less than children of all other origins. Therefore, only the children from the highest origins (NS-SEC 1 origins) enjoy advantageous earnings among the highest educated, whereas the social origin gaps in earnings are more prevalent among the lower educated.

A more significant and surprising finding is that such social origin gaps do not appear for all highly educated elite members. Table 2.5 shows that coefficients for the NS-SEC 1 origins among terminal BA holders in the elite occupation group are substantially smaller compared both with the higher and the lower educated group and are not statistically significant. This result confirms the U-shaped pattern of intergenerational association (Torche 2011), indicating the equalising potential of terminal BA degrees in economic returns. This result also suggests that social origin works differently in offspring's occupational access and economic returns, especially among college graduates. Unlike in occupational access, where types of elite occupations divide the size and patterns of social origin gaps, they are heavily affected by the level of children's degree in economic returns. Whether this educational difference in earnings gap among college graduates is driven by differences in the labour market, human resources of children, or parental engagement between advanced degree holders and terminal BA holders will be a significant question for future research.

The results for women are drastically different from those for men. The most pronounced difference is null social origin gaps among college graduates who end up in the non-elite group. The gap for men in this group was as large as the gap in the elite group. Again, this could be attributed either to gender inequality in the non-elite labour market or behavioral differences of parents towards their sons and daughters when they attain a degree but do not make it into an elite group. The second difference concerns where the gaps are pronounced. For men, the social origin gaps were most marked among advanced degree holders. However, for women, they are more pronounced among terminal BA holders and non-graduates. In particular,

gaps are largest among women who reach an occupational destination for which barriers to access are high – women terminal BA holders in merit subgroup elite occupations and women non-graduates in non-merit subgroup elite occupations. This evident gender difference in the pattern of social origin gaps in earnings suggests the necessity of more attention to intergenerational economic mobility for women in future research.

Table 2.5: Coefficients from OLS Regressions (DV: Gross Weekly Earnings)

	Men	Elite Group						Non-elite Group		
		Merit Subgroup			Non-merit Subgroup					
		Model1	Model2	Model3	Model1	Model2	Model3	Model1	Model2	Model3
Advanced degree holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.150	1.160	1.119	1.218**	1.187*	1.159*	1.201*	1.112	1.051
		(0.113)	(0.119)	(0.087)	(0.091)	(0.089)	(0.072)	(0.103)	(0.090)	(0.071)
	NS-SEC 1 origins (non-merit)	1.196*	1.191*	1.057	1.173**	1.166**	1.155***	1.154**	1.116*	1.099*
		(0.098)	(0.094)	(0.075)	(0.059)	(0.056)	(0.050)	(0.057)	(0.053)	(0.046)
	NS-SEC 2 origins	1.029	1.032	1.027	1.023	1.007	1.009	1.016	1.008	1.015
		(0.069)	(0.072)	(0.065)	(0.054)	(0.051)	(0.047)	(0.050)	(0.048)	(0.041)
	NS-SEC 3 to 5 origins	1.001	1.026	1.021	1.034	1.032	1.049	1.004	1.004	1.013
		(0.075)	(0.077)	(0.071)	(0.049)	(0.047)	(0.044)	(0.057)	(0.054)	(0.045)
	N	485	485	485	1,181	1,181	1,181	1,586	1,586	1,586
	R^2	0.021	0.056	0.375	0.024	0.062	0.197	0.039	0.098	0.359
Terminal BA holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.058	0.876	0.848	1.102	1.073	1.037	1.159	1.143	1.058
		(0.205)	(0.187)	(0.184)	(0.076)	(0.073)	(0.065)	(0.089)	(0.085)	(0.067)
	NS-SEC 1 origins (non-merit)	1.142	0.971	0.900	1.059	1.046	1.018	1.178***	1.157***	1.085*
		(0.200)	(0.180)	(0.175)	(0.044)	(0.044)	(0.042)	(0.050)	(0.047)	(0.039)
	NS-SEC 2 origins	1.036	1.022	0.961	1.078*	1.066	1.040	1.090*	1.090*	1.043
		(0.186)	(0.177)	(0.170)	(0.039)	(0.039)	(0.036)	(0.042)	(0.041)	(0.035)
	NS-SEC 3 to 5 origins	1.021	0.961	0.930	1.032	1.024	1.000	1.080*	1.077*	1.054
		(0.169)	(0.153)	(0.153)	(0.036)	(0.035)	(0.033)	(0.039)	(0.038)	(0.032)
	N	199	199	199	1,957	1,957	1,957	2,507	2,507	2,507
	R^2	-0.014	0.141	0.204	0.017	0.036	0.167	0.054	0.089	0.339
Non-degree holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.194	1.079	0.956	1.148	1.143	1.069	1.174***	1.087	1.119**
		(0.206)	(0.193)	(0.379)	(0.083)	(0.082)	(0.072)	(0.054)	(0.050)	(0.044)
	NS-SEC 1 origins (non-merit)	1.733**	1.490*	1.46	1.155***	1.142***	1.110***	1.199***	1.148***	1.131***
		(0.281)	(0.264)	(0.482)	(0.037)	(0.038)	(0.033)	(0.022)	(0.021)	(0.018)
	NS-SEC 2 origins	1.446*	1.443*	1.478	1.082*	1.075*	1.053	1.135***	1.087***	1.081***
		(0.224)	(0.215)	(0.588)	(0.034)	(0.034)	(0.031)	(0.019)	(0.018)	(0.015)
	NS-SEC 3 to 5 origins	1.058	1.035	0.944	1.074**	1.072**	1.056*	1.074***	1.047***	1.038***
		(0.179)	(0.157)	(0.243)	(0.027)	(0.027)	(0.025)	(0.012)	(0.011)	(0.009)
	N	57	57	57	2,674	2,674	2,674	14,410	14,410	14,410
	R^2	0.411	0.460	0.235	0.025	0.033	0.185	0.064	0.097	0.392

(*Table continues*)

	Women	Elite group						Non-elite group		
		Merit subgroup			Non-merit subgroup					
		Model1	Model2	Model3	Model1	Model2	Model3	Model1	Model2	Model3
Advanced degree holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.159	1.128	1.064	1.045	1.010	0.995	0.963	0.944	1.052
		(0.109)	(0.106)	(0.084)	(0.097)	(0.096)	(0.076)	(0.058)	(0.057)	(0.046)
	NS-SEC 1 origins (non-merit)	1.149	1.109	1.016	1.149*	1.136	1.104	0.960	0.949	0.990
		(0.100)	(0.097)	(0.072)	(0.076)	(0.075)	(0.060)	(0.045)	(0.044)	(0.033)
	NS-SEC 2 origins	1.144	1.116	1.057	0.979	0.978	0.989	0.954	0.946	0.994
		(0.086)	(0.084)	(0.061)	(0.065)	(0.066)	(0.053)	(0.041)	(0.040)	(0.031)
	NS-SEC 3 to 5 origins	1.107	1.092	1.105	0.993	0.991	1.002	0.978	0.972	1.010
		(0.084)	(0.080)	(0.060)	(0.059)	(0.060)	(0.051)	(0.039)	(0.039)	(0.030)
	N	588	588	588	742	742	742	2,712	2,712	2,712
	R^2	0.024	0.032	0.348	0.030	0.059	0.391	0.000	0.007	0.515
Terminal BA holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.700***	1.662**	1.465**	1.097	1.081	1.057	1.058	1.043	1.049
		(0.265)	(0.281)	(0.185)	(0.101)	(0.099)	(0.075)	(0.067)	(0.067)	(0.050)
	NS-SEC 1 origins (non-merit)	1.117	1.141	1.085	1.138*	1.127	1.040	1.018	1.011	1.068**
		(0.169)	(0.163)	(0.119)	(0.069)	(0.070)	(0.052)	(0.036)	(0.036)	(0.025)
	NS-SEC 2 origins	1.195	1.195	1.120	1.053	1.052	0.993	0.993	0.986	1.040
		(0.171)	(0.172)	(0.123)	(0.062)	(0.062)	(0.049)	(0.035)	(0.035)	(0.025)
	NS-SEC 3 to 5 origins	1.055	1.080	1.097	1.042	1.040	0.992	0.991	0.985	1.019
		(0.141)	(0.140)	(0.112)	(0.053)	(0.054)	(0.042)	(0.030)	(0.030)	(0.020)
	N	299	299	299	995	995	995	4,057	4,057	4,057
	R^2	0.082	0.194	0.506	0.007	0.011	0.361	0.008	0.015	0.550
Non-degree holders	Origin (vs. NS-SEC 6 to 8 origins)									
	NS-SEC 1 origins (merit)	1.355	1.348	1.446	1.344*	1.322*	1.110	1.114*	1.007	1.075*
		(0.597)	(0.561)	(0.582)	(0.155)	(0.153)	(0.115)	(0.053)	(0.047)	(0.039)
	NS-SEC 1 origins (non-merit)	1.72	1.64	1.73	1.208**	1.197**	1.130*	1.166***	1.094***	1.076***
		(0.686)	(0.646)	(0.664)	(0.077)	(0.076)	(0.058)	(0.023)	(0.021)	(0.013)
	NS-SEC 2 origins	1.323	1.245	1.380	1.157*	1.148*	1.107*	1.115***	1.050**	1.059***
		(0.453)	(0.376)	(0.424)	(0.067)	(0.067)	(0.056)	(0.020)	(0.018)	(0.012)
	NS-SEC 3 to 5 origins	1.174	1.138	1.330	1.105*	1.101*	1.062	1.052***	1.024*	1.030***
		(0.337)	(0.277)	(0.408)	(0.051)	(0.051)	(0.041)	(0.012)	(0.012)	(0.008)
	N	94	94	94	1,194	1,194	1,194	18,082	18,082	18,082
	R^2	0.147	0.120	0.179	0.027	0.029	0.317	0.013	0.062	0.609

Notes: Exponentiated coefficients; Standard errors in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

2.5 Discussion

This study began with the puzzle of seemingly discrepant findings of weaker intergenerational association in socioeconomic outcomes among high-educated children and stronger intergenerational economic persistence among high-earning children. Noting that a disproportionate amount of the low intergenerational association observed among high-educated children relates to an occupational association, some scholars have suggested a hypothetical interpretation that parental involvement changes its form according to the offspring's educational success. That is, parental involvement is pronounced in occupational access among lower-educated children, whereas parents of higher-educated and thus occupationally successful children focus on economic returns. However, this hypothesis is relevant only when educational and economic distributions overlap. If they do not overlap entirely, the two distributions' intersectional nature needs to be considered to precisely depict the labour market social origin gap. This study does not aim to determine an answer to the puzzle, mostly because the available data does not have the full spectrum of measures necessary for such an investigation. Nonetheless, in the course of its analysis, this study was able to draw inferences to understand the current state of the social origin gaps more precisely by addressing limitations in the previous research and testing the mechanisms that have been hypothesized as explaining the puzzle. Furthermore, this exercise allowed us to identify where the equalising effect of higher education can be found among the economically successful.

I introduced a new analytic approach whereby both occupational access and economic returns can be examined consistently at the intersection of two distributions. I see educational attainment, occupational destination, and economic returns as sequentially determined outcomes and redirect the focus on economic returns prevalent in economic mobility research towards economic returns conditional on educational attainment and occupational destination. In doing so, I choose occupation rather than earnings as a basis for the operationalization of socioeconomic destination and further distinguish within-elite occupational subgroups by whether

they require a degree to gain entry. This operationalization not only enables one to smoothly link the literature on social mobility to that on economic mobility but also allows a test of long-standing hypotheses on the relationship between credential barriers and social origin gaps.

Based on the descriptive finding of the intersectional nature of educational and occupational distributions and heterogeneity within the highly educated or elite occupation members, this study first examined social origin gaps across educational attainments in access to different types of elite occupations. Although the gap was substantial for non-graduate men, my results showed equally considerable social origin gaps among college graduates, mostly in access to elite occupations that require a degree for access. If we look more closely, the class closure could be even more severe among college graduates than among non-graduates. Not only is the size of the gaps larger among college graduates than among non-graduates, but access to merit subgroup elite occupations among college graduates is more exclusive than non-graduates' access to non-merit subgroup elite occupations. It is notable that, in contrast, the gap was substantially smaller or not significant in college graduates' chances of accessing a non-merit subgroup elite occupation, suggesting the equalising role of higher education in obtaining access to such occupations. Patterns were similar for women, but the gaps were smaller and more of them were explained by educational differences among women college graduates than men.

As in the social origin gap in occupational access, results of the preliminary analysis on economic returns were also consistent with previous literature, showing a larger gap in the elite occupation group than in the non-elite occupation group. However, when we compare the gaps across educational attainments for each occupation group, they were not significantly larger among graduates than among non-graduates, regardless of which occupation they ended up holding. More importantly, some segments of college graduates in the elite group did not show significant social origin gaps in earnings – terminal BA holders for men and advanced degree holders for women. These findings counter previous explanations of the large social

origin gap in earnings among high earners, namely, that it results from resource mobilization by privileged families to secure even higher economic returns within the elite occupation group for their educationally and thus occupationally successful children.

Overall, this study's results run counter to the notion of a marked contrast in the type of the social origin effect experienced by lower and higher-educated children. Previous studies have suggested that the social origin effect for the low-educated (compensatory advantage) may occur in the context of contending with unequal occupational access and for the high-educated (boosting effect) in obtaining unequal economic returns (Bernardi and Ballarino 2016; Bernardi and Gil-Hernández 2020). Rather, the results of the present study show that social origin affects both occupational access and economic returns, regardless of children's educational attainment. The gap by social origin persisted from occupational placement to earnings, and the pattern was much more complicated than might have been expected.

At the same time, my analyses on occupational access and economic returns identify significant exceptions to such influences, from which we can infer the role of higher education as a potential equaliser. Among college graduates, I found relatively small social origin gaps in access to non-merit subgroup elite occupations and non-significant gaps in earnings among elite members with terminal BA degrees (for men) or advanced degrees (for women). These results do not confirm the equalising role of higher education because my data do not have measures to deal accurately with varying selection into higher education by social origin. However, given that graduates from underprivileged origins are more likely to be positively selected on aspirations or effort, the small or non-significant gap is a necessary condition for the equalization argument.

In sum, the results of this study shed light on the effect of social origin in the labour market, both theoretically and empirically. Sociological theories have long suggested contrasting hypotheses on where the effect of social origin will be more pronounced, especially in the elite labour market, but supported by little empirical

evidence. My results show that the answer can vary depending on which outcome or group is under consideration, portraying the unequal labour market as operating in ways specific to varying contexts. In occupational access, substantially larger gaps in access to merit subgroup elite occupations confirm the reproduction hypothesis from the Neo-Marxist perspectives. However, it should be noted that the less-credentialed job market is also effectively used as a means of intergenerational transmission of advantages, especially when children do not attain a degree that is required for accessing the merit subgroup elite occupations. The results of earnings analyses present a less clear picture than the results of occupational analyses. The social origin gaps do not vary by whether the labour market is more or less credentialed. Also, where the potential equalising role of education was found differed between men and women. What can be said with the current evidence is that earnings depend more on educational attainment than on the extent of credentialing required to enter the elite occupation one occupies.

Empirically, my study suggests slightly different conclusions on the labour market class gap in the UK than has been presented in earlier studies. In access to elite occupations, my results partially support the equal access argument by Sullivan and her colleagues (2018) only for college graduates, and only in the case of access to elite occupations that do not require a degree. Simultaneously, the results reveal exceptions to the class earnings gap that lend support to the notion of higher education's equalising role, extending Laurison and Friedman's (2016) finding of a substantial class earnings gap in the elite occupation group. Taken together, the results indicate that the sequential outcomes approach and large sample size allow us to depict a more comprehensive and nuanced picture of the class gap.

This study suggests several directions for future research. First, the results point more precisely to where researchers should look when exploring mechanisms of the social origin gaps. Second, as has been noted from the beginning, the results of the decomposition analyses are probably best interpreted as suggestive due to the evident data limitations. For example, even if we know that degree characteristics

explain much of the social origin gap in occupational access among women college graduates, the exact mechanism underlying it – whether meritocracy in the labour market or different selection by social origin – cannot be specified in this study. Therefore, more research on the mechanisms that account for the absence or presence of the social origin gap is necessary. Third, the present study revealed gender differences in the size and the pattern of social origin gaps. Due to the complexities of analyzing women's labour market outcomes, intergenerational mobility research has often been focused exclusively on men. Future research will need to focus on the heterogeneities and mechanisms of the labour market social origin gap among women. Lastly, as our findings pointed towards rich accounts on the heterogeneity of social origin gaps in the UK, comparative studies from this perspective will generate similarly rich accounts on general patterns along with country-level specificity.

Chapter 3

Educational Careers in Higher Education and Intergenerational Occupational Association among the Highest Educated in the UK

3.1 Introduction

Weak intergenerational socioeconomic association among college graduates (Breen 2010; Breen and Jonsson 2007; Breen and Luijkx 2007; Hauser and Logan 1992; Hout 1984, 1988; Pfeffer and Hertel 2015; Torche 2011; Vallet 2004) has been one of the most influential findings in research examining education and mobility. From this finding, an important inference has been drawn that people of different origins can have equal opportunities for upward mobility once they make it to college. Although the mechanism by which this occurs remains under debate, with some scholars pointing to the equalising power of college (Karlson 2019) and others to different selection into it (Zhou 2019), both strands of argument agree that substantially weak intergenerational socioeconomic association prevails among college graduates.

Against this backdrop, a relatively strong intergenerational socioeconomic association among postgraduate degree holders (Falcon and Bataille 2018; Oh and Kim 2019; Torche 2011, 2018; Wakeling and Laurison 2017) can be puzzling, because both equalisation and selection arguments suggest an even weaker association

among this group than among those with only a bachelor's degree. More specifically, if one believes that college is a passage leading to equal intergenerational mobility opportunities either because of the meritocratic labour market for college graduates (*equalisation effect*) or because of positive selection into college on mobility-facilitating attributes of lower-origin children (*selection effect*), we would expect both patterns would be more pronounced further up the ladder of higher education.

While no studies have yet to address this puzzle directly, some have attempted to investigate the sources of intergenerational socioeconomic associations among this education group. They demonstrated that the association is explained mostly by differences in postgraduate degree characteristics, such as degree type, institutional selectivity, or field of study (Oh and Kim 2019; Torche 2018). In other words, unequal socioeconomic outcomes are highly likely to result from differentiated postgraduate education by socioeconomic origin. One of these studies' significant contributions is that they proposed a new approach to studying unequal socioeconomic outcomes among college graduates. Stratification scholars' long-standing interest in the equalising role of a college education has developed along two lines, one having distinct interest in educational opportunity beyond undergraduate education (Mare 1980; Mullen, Goyette, and Soares 2003; Stolzenberg 1994) and the other emphasising socioeconomic outcomes (Hauser and Logan 1992; Hout 1984, 1988; Torche 2011). Meanwhile, recent studies on US postgraduate degree holders have focused on postgraduate educational opportunities, not as an outcome for college graduates, but as a medium of intergenerational transmission of advantages. As an increasing number of college graduates are pursuing postgraduate degrees, and economic returns to those degrees have been showing a steeper increase than returns to college (Lemieux 2008; Valletta 2015), this change in perspectives was timely.

However, postgraduate education does not exist in a vacuum and the extent of unequal distribution at the level of postgraduate education hinges to a varying degree on inequality in undergraduate education or unequal sorting into postgraduate

education. Therefore, the implications of recent findings on the role of postgraduate-level stratification as a medium of intergenerational transmission of advantages are limited, leaving much room to ask how postgraduate-level stratification relates to lower-level higher education. Indeed, in sociology, compared to the literature on pathways to college, the literature on pathways to postgraduate education is rather limited (Posselt and Grodsky 2017). Furthermore, to the author's knowledge, no studies have not yet explored the entirety of careers in higher education, including both undergraduate and postgraduate levels, as a link that connects socioeconomic origin and destination.

Consequently, given the current state of research, one cannot tell whether the postgraduate-level stratification that leads to unequal socioeconomic outcomes for individuals of different socioeconomic origins results from unequal sorting into college followed by a strong path dependency between undergraduate and postgraduate education or from unequal sorting into postgraduate education, albeit one that is conditioned by relatively equal distribution at the undergraduate level. Ethnographic studies demonstrating familial involvement in offspring's navigation within and beyond college (Armstrong and Hamilton 2013; Hamilton 2013; Lareau 2015:6; Lee 2016; Ostrove and Long 2007; Yee 2014) imply that college graduates' socioeconomic origin may affect their pathways to postgraduate education, which often begin even further upstream in one's educational career, such as college or high school. The present study aims to investigate such mechanisms by limiting itself to higher education. It thus advances recent attempts of stratification scholars that established the link between postgraduate education and socioeconomic outcomes to explain intergenerational transmission of (dis)advantages by encompassing undergraduate education in its analysis. By doing so, although the study is exclusively on postgraduate degree holders, it will also shed light on the (dis)equalising role of college that translates into postgraduate-level phenomena.

To study vertically and horizontally stratified higher education (Dale and Krueger 2011; Davies and Guppy 1997; Gerber and Cheung 2008; Goyette and Mullen 2006;

Jackson et al. 2008; Karen 2002; Kim, Tamborini, and Sakamoto 2015; Roksa and Levey 2010; Shamsuddin 2016; Thomas and Zhang 2005) and multiple transitions from socioeconomic origin to outcome through higher education, this study depends on two primary approaches to educational transitions studies - the sequential logit model (SLM) suggested by Mare (1980) and the multinomial transition model (MTM) that was proposed by Breen and Jonsson (2000) as an alternative way of analysis to the SLM for educational systems with multiple and unordered options. In particular, despite the extensive use of multinomial logit models for educational transitions analyses, only a few studies have considered more than one transition in stratification research (Karlson 2011). Also, even when multinomial logit models are used, most of the studies have focused on the transition from secondary schools to college rather than the one from college to postgraduate education (e.g., Becker and Hecken 2008; Tieben and Wolbers 2010; Tolsma, Need, and De Jong 2010). Therefore, this study builds on the previous methodological developments in educational transitions studies by applying them to an understudied empirical setting of educational and occupational transitions through and beyond higher education.

The UK Labour Force Survey (LFS) offers a unique opportunity to investigate multiple transitions through higher education with regard to intergenerational transmission of advantages by providing information about both undergraduate and postgraduate education, as well as respondents' social origin and occupational destination. Of equal importance, the UK provides a good case study of the strong intergenerational socioeconomic association among postgraduate degree holders. Previous studies on this topic have paid disproportionate attention to the US, leaving similar patterns in other countries (e.g., Falcon and Bataille 2018 for France; Wakeling and Laurison 2017 for the UK) less studied. Moreover, in contrast to the US, where the majority of top managerial or professional occupations require a postgraduate degree (Bowen and Bok 1998), a nontrivial number of professional or managerial occupations in the UK do not require a postgraduate degree for occupational access. This distinguishing feature leads us to question whether the composition of UK

postgraduate degree holders and the mechanisms of inequality among them would be different from those of the US. This study thus fills these gaps in the scholarly literature by presenting mechanisms of intergenerational occupational association among postgraduate degree holders of different social origins in a non-US context.

3.2 Theoretical Background

3.2.1 What We Know about the Puzzle: Stratification at Graduate Education and Intergenerational Socioeconomic Association

While confirming Hout's (1984, 1988) long-standing finding of null intergenerational occupational association among college graduates for younger cohorts, Torche (2011) presented a new finding of re-emerging intergenerational socioeconomic associations among postgraduate degree holders. For stratification scholars, this finding was counter-intuitive because they would expect at least similarly weak or weaker intergenerational socioeconomic associations among postgraduate degree holders. Given that attaining a postgraduate degree is even harder than attaining a bachelor's degree for children from disadvantaged socioeconomic origins, postgraduate degree holders from such origins are likely to be more positively selected on abilities or aspirations than college graduates from similar origins. Moreover, if the null or weak intergenerational associations among college graduates are attributable to a more meritocratic labour market for the highly skilled (Breen and Jonsson 2007), the labour market for postgraduate degree holders would presumably be even more meritocratic. However, Torche's finding held across different measures of socioeconomic outcomes, such as class, occupational status, or earnings. Also, this finding has been corroborated by studies using more recent and larger US data and by studies on other countries, such as France and the UK (Falcon and Bataille 2018; Oh and Kim 2020; Posselt and Grodsky 2017; Torche 2011, 2018; Wakeling and Laurison 2017).

While few in number, some studies have attempted to explain the strong intergenerational socioeconomic associations among postgraduate degree holders. In her original study, Torche (2011) herself suggested a tentative mechanism for the strong intergenerational socioeconomic association among postgraduate degree holders by showing an unequal distribution of postgraduate degree holders of different socioeconomic origins in postgraduate education and occupational allocation. She found that postgraduate degree holders from advantaged socioeconomic origins are more likely to choose remunerative fields and degree programs at postgraduate education than their counterparts from disadvantaged origins. Furthermore, they are more likely to have more lucrative occupations and earn more even when they end up with occupations similar to those held by postgraduate degree holders from disadvantaged origins. This analysis, however, was descriptive, and the data represented only one point in a lifetime for specific cohorts – those who were born between 1957-64 and those who earned their bachelor's degree in 1992-93. Torche (2018) later applied this idea to a sample of doctorate holders in the US. Albeit to a lesser extent than for the professional degree holders, access and returns to the doctoral degree have been found to be unequal by socioeconomic origin in the US (Mullen, Goyette, and Soares 2003). Torche (2018) demonstrated that differences in postgraduate education, such as selectivity of the degree-awarding institution, fields of study, and institutional control, as well as occupational mediators, such as occupational status and employment sector, account for the association between parental education and children's earnings among white and black men with a doctoral degree.

Oh and Kim (2019) tested similar mechanisms for each type of postgraduate degree holders for a large sample of US male and female college graduates between 35-54 years of age. They found that the association between parental education and earnings of postgraduate degree holders is fully explained by stratification in postgraduate education and early degree completion. They further tested a hypothetical explanation discussed by Torche (2011) for the contrasting patterns of intergenerational socioeconomic associations between terminal BA holders and postgraduate

degree holders. She had suggested that the role of college as a sorting machine for postgraduate education (Stevens et al. 2008) might explain the difference. The supposition was that children from advantaged origins are more likely to choose undergraduate fields that could increase their chances of obtaining access to desirable postgraduate education. In contrast, children from disadvantaged origins are more likely to focus on maximizing their chances of securing a decent job right after college graduation because their chances of reaching postgraduate education are slim (Goyette and Mullen 2006). Therefore, there are more children from disadvantaged origins whose undergraduate educational choices end up being optimal among terminal BA holders, whereas there are more such children from advantaged origins among postgraduate degree holders. Oh and Kim (2019) advanced previous studies by showing empirically that heterogeneous choices of undergraduate fields and differentiated sorting into postgraduate fields are responsible for the contrasting patterns of intergenerational socioeconomic associations between terminal BA holders and postgraduate degree holders.

Overall, these studies have contributed to our understanding of intergenerational socioeconomic associations among those at the top of the educational distribution by using rare data sets that allow separate analyses of representative samples of postgraduate degree holders. Nevertheless, there are several limitations in these studies. First, as Oh and Kim (2019) themselves note, the lack of ability measures did not allow them to rule out the possibility that the association is due to a positive selection of children from advantaged origins on ability. Second, their exclusive focus on the US left other countries with different higher education systems but with similar phenomena unaddressed. For instance, in contrast to the US, medicine and law education are conducted at the undergraduate level, and postgraduate-level education is not a prerequisite to practice in these fields in the UK. In this regard, the relative importance of undergraduate and postgraduate stratification as well as the sorting between them can be different across countries. Lastly, but most importantly, these studies paid disproportionate attention to postgraduate-

level stratification. Despite the advancements made by Oh and Kim (2019), it is still unclear whether undergraduate- or postgraduate-level stratification is more decisive in explaining unequal socioeconomic outcomes among postgraduate degree holders. Also, pathways from undergraduate to postgraduate education were only included as part of a supplementary analysis. The following section thus reviews the literature on the mediating role of pathways in higher education in the association between socioeconomic origin and destination and seeks to extend the previous analytic frame by incorporating undergraduate-level stratification into this study's analysis of inequality among postgraduate degree holders.

3.2.2 What We Know about the Paths from Socioeconomic Origin, Higher Education, and Socioeconomic Outcomes

One of the most well-studied stratification elements in higher education research is institutional selectivity. Ample evidence has shown that there is a gap by children's socioeconomic origin in the selectivity of their college destination. Since Hearn (1991) found that students from lower-income or lower-educated families are less likely to attend universities with higher status, selectivity, or tuition for 1980 high school graduates, subsequent studies have corroborated the result for more recent cohorts (e.g., Davies and Guppy 1997; Karen 2002). Although these studies have reported that prior academic performance or preparedness is the most important predictor, socioeconomic origin still was a significant factor that determines the selectivity of children's college destination net of other ascriptive or achievement measures.

The extent to which this relationship between socioeconomic origin and college selectivity relates to intergenerational socioeconomic association depends on the relationship between college selectivity and individuals' socioeconomic outcomes, where the evidence is still inconclusive. While earlier studies showed a significantly positive effect of attending an elite private college on post-graduate economic returns

(Brewer, Eide, and Ehrenberg 1999; Loury and Garman 1995; Thomas 2003; Thomas and Zhang 2005), recent studies that take into account more seriously the effect of selection into college or other educational characteristics have yielded mixed results: weaker or non-significant effect in the US, Sweden, and Norway (Brand and Halaby 2006; Cunha and Miller 2014; Dale and Krueger 2002, 2014; Kirkeboen, Leuven, and Mogstad 2016; Öckert 2010), in contrast to a relatively strong effect in the US and the UK (Broecke 2012; Monks 2000; Witteveen and Attewell 2017). Due to the lack of pre-college ability measures, my study is unable to address heterogeneous selection into college. Although this study does not aim to make any causal claims about the effect of college selectivity on socioeconomic outcomes, depicting the impact of undergraduate-level stratification, if any exists, requires a cautious approach that allows for the effect of unequal pre-college distribution and sorting into college to be taken into account.

One plausible mechanism that may link college selectivity and differentiated post-graduate socioeconomic outcomes is the impact of college selectivity on graduate education, an important consideration given growing returns to postgraduate education (Autor 2014; Fisher et al. 2018; Keister 2014; Lemieux 2008; Posselt and Grodsky 2017; Valletta 2015). Studies have documented positive associations between attending a selective college and better outcomes in postgraduate education (Bowen and Bok 1998; Eide, Brewer, and Ehrenberg 1998; Ethington and Smart 1986; Lang 1987; Tinto 1980; Zhang 2012). College graduates from selective institutions are not only more likely to attain a postgraduate degree but also tend to attend more selective programs and institutions. Furthermore, they complete their postgraduate education earlier than their peers from less selective colleges. These results on the link between college selectivity and differentiated postgraduate education, together with heterogeneous college destination by socioeconomic origins, imply that at least part of the explanatory power of postgraduate-level stratification for strong intergenerational socioeconomic association among postgraduate degree holders could be attributable to undergraduate-level stratification.

Along with institutional selectivity, other stratification elements in higher education research that have been widely discussed are fields of study at the undergraduate level (Gerber and Cheung 2008) and degree type at the postgraduate level (Posselt and Grodsky 2017). Scholars have paid attention to these stratification elements mostly because of their influence on post-graduate socioeconomic outcomes. For fields of study, research has shown that earnings for college graduates majoring in technical or STEM fields are significantly higher than others (Altonji 1993; Berger 1988; Grogger and Eide 1995; Grubb 1993; Kim et al. 2015; Rumberger and Thomas 1993; Sullivan et al. 2018). Recent studies added that people majoring in business fields in the US and LEM (Law, Economics, and Management) fields in the UK also earn more than those majoring in other fields, such as social sciences and humanities (Kim et al. 2015; Sullivan et al. 2018). Meanwhile, earnings vary also by degree type among postgraduate degree holders, for example in the US, with the highest earnings for professional degree holders, followed by those with doctoral and master's degrees. (Day and Newburger 2002; Ma, Pender, and Welch 2016).

What could be even more interesting but has been relatively less studied is the link between undergraduate fields and postgraduate degree types. Studies have long conjectured that some students may choose their undergraduate fields intending to pursue postgraduate education (Eide and Waehrer 1998). Goyette and Mullen (2006) found that college graduates who major in arts and sciences fields are more likely to attend postgraduate school than those with vocational majors. Despite varying nuances, findings are consistent in other studies. For example, when Zhang (2005) found that majoring in less lucrative fields in college is associated with a high probability of postgraduate school attendance, those less lucrative fields were mostly in arts and sciences (with the exception of education). These results suggest that disadvantages induced by majoring in some less lucrative undergraduate fields could be compensated at the higher educational level for those who proceed to postgraduate education.

The question that then follows is whether socioeconomic origin is related to spe-

cific patterns in the choice of fields that leads to unequal socioeconomic outcomes. Earlier studies found no significant role of fields in mediating one's socioeconomic origin and destination, both in the US and European countries (Davies and Guppy 1997; Jackson et al. 2008). However, these studies did not separate postgraduate degree holders from terminal BA holders, which could lead to the neglect of dynamics that may emerge as college graduates of varying socioeconomic origins make different choices of undergraduate fields, yet also are selected differently on the basis of undergraduate fields into different types of postgraduate education. For example, in the US, students of advantaged origins are more likely to choose arts and sciences fields (Goyette and Mullen 2006) or less-lucrative fields such as Art/Humanities, Science, or Math (Oh and Kim 2020) than their peers from disadvantaged origins. However, a disproportionate number of them are absorbed into lucrative postgraduate fields compared to their peers from disadvantaged origins with similarly less lucrative majors (Oh and Kim 2020). Taken together, it is likely that, for graduates from advantaged origins, some reduction in socioeconomic outcomes that might have been induced by their choice of less lucrative undergraduate fields could be compensated for by advantages attached to postgraduate education, which, in turn, is disproportionately available to them. These patterns can be concealed when college graduates are not distinguished by their degree level, leading to a misrepresentation of the role of fields of study in social mobility and inequality among highly educated individuals.

In sum, research on higher education and inequality has accumulated extensive evidence on the links between socioeconomic origin, higher education, and postgraduate socioeconomic outcomes. Nonetheless, in stratification research, educational opportunity beyond college (Mare 1980; Mullen et al. 2003; Stolzenberg 1994) and post-graduate socioeconomic outcomes (Hauser and Logan 1992; Hout 1984, 1988; Torche 2011) have been studied, forming separate traditions that examine the equalising role of college education. In this regard, my study, by incorporating undergraduate-level stratification into the analytic frame, advances recent

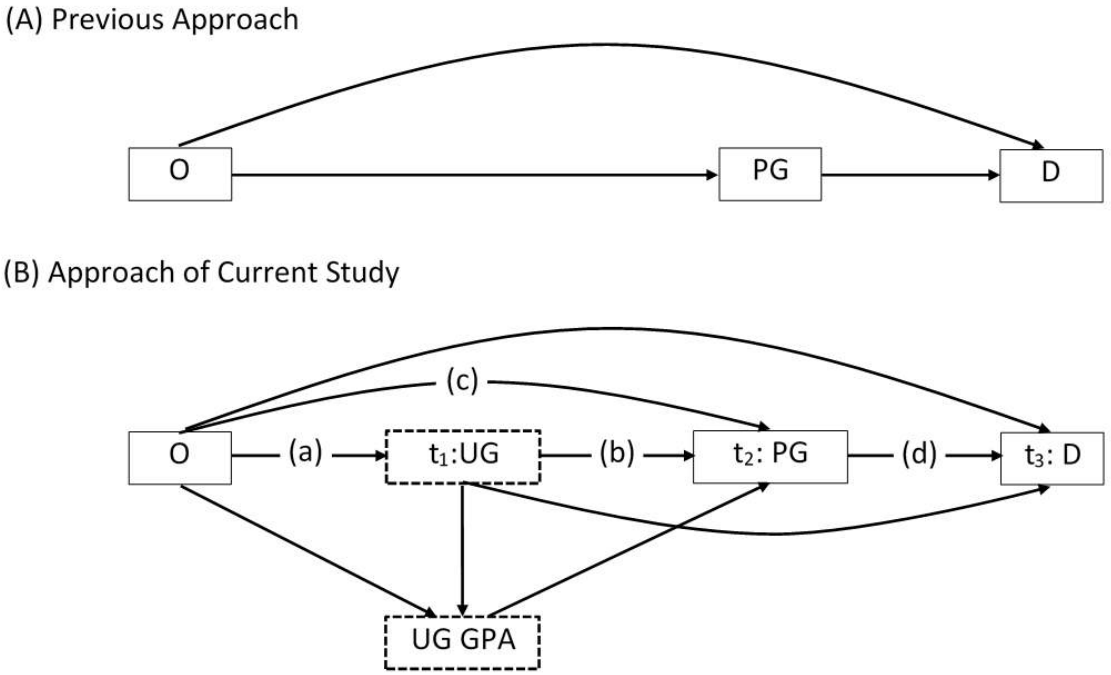
attempts (Oh and Kim 2019; Torche 2011, 2018) that linked these two research traditions. This approach is underpinned especially by the interactive dynamics between undergraduate and postgraduate education. On the one hand, people of different socioeconomic backgrounds make heterogeneous choices in undergraduate education with heterogeneous considerations for career or educational prospects. On the other hand, one's postgraduate education is destined to a varying degree by the undergraduate education one receives. Therefore, sources of inequality can be fully captured only when the entire pathway from undergraduate to postgraduate education is located between socioeconomic origin and destination. My study focuses on postgraduate degree holders and looks into the role of undergraduate education in unequal socioeconomic outcomes among individuals of different social origins. By doing so, although the focus of the study is on postgraduate degree holders, some implications for the (dis)equalising role of college can also be drawn.

3.3 Analytical Approach

The advances of this study, as compared to previous research, are illustrated in Figure 3.1. As shown in Figure 3.1A, previous studies on the mechanisms of unequal socioeconomic outcomes among postgraduate degree holders have paid most of their attention to the role of stratification in postgraduate education. However, my approach, as presented in Figure 3.1B, focuses on the transition from undergraduate to postgraduate education and aims to identify which educational level is more significant in maintaining inequality by social origin among postgraduate degree holders. Following the literature, this study stresses two stratifications for each education level. While undergraduate education comprises two horizontal stratifications (institutional selectivity and fields of study), postgraduate education consists of a horizontal (institutional selectivity) and a vertical stratification (degree type). I do not include postgraduate-level fields in analyses because multicollinearity between undergraduate and postgraduate fields was huge when fields were measured in three categories. Finally, by adding undergraduate academic performance to the model,

I partly control for the effect of origin-based selection into postgraduate education on academic ability.

Figure 3.1: Flowchart showing potential pathways of intergenerational association between social origin and destination through and beyond higher education



Notes: O = Social Origin, UG = Undergraduate-level Stratification, UG GPA = Undergraduate-level Academic Performance (Degree Class in the UK), PG = Postgraduate-level Stratification, D = Occupational Destination (Elite vs. Non-elite Group)

Another critical difference is that this study focuses on the association between one's social class origin and destination, whereas previous studies (Oh and Kim 2020; Torche 2018) examined the association between parental education and children's earnings. My approach was adopted from both practical and theoretical considerations. Practically, using earnings instead of occupational destination reduces the sample size substantially in the UK Labour Force Survey. While earnings are asked only for currently employed people, social class is measured based on respondents' current or past occupation, resulting in fewer missing cases. My approach, however, is also theoretically grounded. The occupational (social class) destination precedes earnings in the temporal order of individuals' economic careers. Thus, one potential problem of using earnings as a dependent variable is that mediation by occupational assignment must be addressed. Because this study places its focus on the

transition in higher education, it can be more appropriate to limit the number of transitions. Furthermore, using parental and children's social class also allows a more straightforward examination of how the cultural transmission of upper-class families translates into academic capital that supports offspring's access to high-class positions (Bourdieu 1984, 1986, 1991).

The analysis begins with two logistic regression models that regress a binary measure of occupational destination where one indicates being in the elite occupation group (NS-SEC 1 class) and zero indicates being in the non-elite occupation group (NS-SEC 2 to 8 classes) on the measure of social origin, firstly controlling for postgraduate-level stratification and secondly replacing it with undergraduate-level stratification. The aim of these exercises is to examine the possibility that the mediation of intergenerational occupational association by postgraduate-level stratification could also be the mediation by undergraduate-level stratification. Given that undergraduate education precedes and affects postgraduate education, substantial mediation by undergraduate-level stratification will provide support for this supposition.

The next step is to examine the additional mediation of the intergenerational association by each element of undergraduate- or postgraduate-level stratification by directly comparing coefficients in nested logit models to which I added covariates sequentially from social origin to destination. Because the models are nonlinear, the re-scaling effect cannot be separated from mediating or confounding. I used the reformulated KHB method (Breen, Karlson, and Holm 2013; Karlson, Holm, and Breen 2012; Kohler, Karlson, and Holm 2011), which is called the linear predictor approach (Breen, Karlson, and Holm 2018), to address this re-scaling issue and compare the coefficients from the nested models. If the role of postgraduate-level stratification is indeed substantial, adding elements of postgraduate-level stratification to the model that already controls for the undergraduate-level stratification will change the estimates of social origin to a large degree.

However, through the comparison between the coefficients across nested models,

we can only identify when the intergenerational class association appears. What it does not show is how the paths in higher education relate to intergenerational occupational association. In particular, given that multiple stratification elements at each educational level affect and are affected through and beyond higher education, it is crucial that the right way to investigate multiple transitions with multiple alternatives be chosen. Before the proposal of the multinomial transition model (Breen and Jonsson 2000), educational careers had been seen as sequential transitions across educational levels (Boudon 1974; Mare 1980). The type of transition assumed in the model, however, did not capture some educational systems where the transition has multiple and unordered choice alternatives (Karlson 2011). Given the vertically and horizontally stratified characteristics of higher education mentioned above, two analytic traditions with a respective focus on sequential and parallel features of educational pathways could be jointly used in this study to capture the educational paths that connect social origin and occupational destination.

3.4 Data and Measures

3.4.1 Data

The UK Labour Force Survey (LFS) is a nationally representative cross-sectional survey, similar to the US Current Population Survey (CPS). The LFS asks about respondents' qualifications and labour market activities. This data provides a unique analytical opportunity because, since 2011, it has captured characteristics of both undergraduate and postgraduate education, such as degree-awarding institution, subject of degree, academic performance (for undergraduate education only), and type of postgraduate degree. These measures are included only in the secure access data, which requires a special permit to access. From 2014, the LFS also began to ask mobility-related questions in every July-September quarter survey. My study used the question about the main earner's occupation when respondents were age 14 to construct a social origin variable. Accordingly, the analytic sample

was constructed using seven years of LFS data (2014-2020), and it includes 25,211 respondents (11,561 men and 13,650 women) aged between 35 to 59 with at least a bachelor's degree. 2.46% (621 respondents) of the sample have at least one missing value for covariates other than undergraduate institutions. Observations with missing values were omitted, leaving 24,590 respondents (11,266 men and 13,324 women).

One critical limitation of this data is that degree characteristics are asked only for the highest degree. For example, suppose one's highest qualification is a doctorate. In that case, questions are asked only about the doctorate, leaving characteristics of a bachelor's degree, a prerequisite for attaining the doctorate, missing. Therefore, in principle, the characteristics of undergraduate education for all postgraduate degree holders cannot be known. Fortunately, around three-quarters of the postgraduate degree holders in our sample also answered questions about their undergraduate degrees in the July-September quarter survey between 2014 and 2020. Because the LFS has a five-wave rotational structure, where respondents are surveyed for five consecutive quarters, I used the responses to this question in all waves to minimize missingness. By doing so, the number of postgraduate degree holders with a missing value for the undergraduate institution decreased to 18.57%. The final sample of the study comprises 22,878 college graduates (10,465 men and 12,413 women), of whom 7,482 respondents (3,269 men and 4,222 women) are postgraduate degree holders.

To further address the issue of residual missing data on the undergraduate institution for some postgraduate degree holders, I applied inverse probability weights (IPW) (Seaman and White 2013; Wooldridge 2007). The process of adjustment is straightforward. For all postgraduate degree holders, I computed the probability that they responded to questions about undergraduate institution by using a logit model that regresses the binary measure of having answered undergraduate institution on possible predictors of this outcome variable, such as sex, age, marital status, country of birth, ethnicity, residential region, economic status, social origin, and class destination. Both Pearson's chi-square and Hosmer-Lemeshow goodness-of-fit

test for the logit model confirmed the validity of the logit model specification. I then multiplied the survey weights with the inverse of these probabilities. The final weight for terminal BA holders thus is just the survey weight.

3.4.2 Outcome Variables

As in Figure 3.1, I considered two transitions to examine the paths from social origin to destination: one from undergraduate education (t_1) to postgraduate education (t_2) and the other from higher education (t_1 and t_2) to occupational destination (t_3). Thus the outcome variables are stratification in postgraduate-level education and occupational destination. For postgraduate education, two types of stratifications were taken into account: type of degree (*vertical stratification*) and institutional selectivity (*horizontal stratification*). The type of degree consists of four categories: doctorate, master's, PGCE, and others. For institutional selectivity, I recoded names of universities in the raw data into four categories, following previous works on UK higher education (Boliver 2013; Crawford et al. 2016; Sullivan et al. 2018b; Sullivan and Brown 2015; Wakeling and Savage 2015); global top 20 (4 universities), Russell Group (24 universities), pre-1992, and post-1992 or other universities. For the next transition, I focused on the likelihood of having an elite occupation, defined as an occupation that belongs to the National Statistics Socio-economic Classification (NS-SEC) 1 category ('Higher managerial, administrative, and professional occupations') rather than having a non-elite occupation (NS-SEC 2 to 8 occupations). This distinction is not only the conventional approach adopted in UK class analyses (e.g., Sullivan et al. 2018b) but also supported by the results from the descriptive analysis in Table 3.1.

3.4.3 Explanatory Variables

The primary explanatory variable in this study is the respondents' social origin. The LFS provides the social origin (NS-SEC codes) based on the household's main earners' occupation when respondents were age 14. The sample was restricted to

those who lived with family members, and at least one of them had earnings when respondents were 14 years old. I regrouped eight NS-SEC codes[1] into four categories such that they correspond to the four-class categories customarily used in class analyses for a parsimonious representation of the social origin gap (Gugushvili, Bukodi, and Goldthorpe 2017). These categories are the NS-SEC 1 (higher salariat), NS-SEC 2 (lower salariat), NS-SEC 3 to 5 (intermediate), and NS-SEC 6 to 8 (working) origins. For stratification at undergraduate education, along with institutional selectivity measured in the same way as in postgraduate level, I also used the subject area of undergraduate degree as a measure of horizontal stratification. Twenty subject areas were grouped into three categories, following previous studies (Sullivan et al. 2018b; Walker and Zhu 2011): LEM (Law, Economics, and Management), STEM (Science, Technology, Engineering, and Mathematics), and OSSAH (Other Social Sciences, Arts, and Humanities) or combined areas. Lastly, as a performance measure at the undergraduate level, the degree class of four ordered categories was used: first, upper second, lower second, and third/pass/other.

3.5 Results

3.5.1 Descriptive Statistics: Social Origin, Higher Education, and Occupational Destination

Table 3.1 shows the distribution of the sample by social origin across each stratification element at each transitional point. First, for the undergraduate level, the origin gap was marked in institutional selectivity both for men and women. For instance, individuals from the NS-SEC 1 origin were three times for men and more than six times for women more likely to graduate from the global top 20 universities than their peers from the NS-SEC 6 to 8 origins. Less drastic than for the global top 20

[1]The NS-SEC code largely consists of nine categories: (1.1) Large employers/higher managerial occupations; (1.2) Higher professional occupations; (2) Lower managerial/professional occupations; (3) Intermediate occupations; (4) Small employers and own-account workers; (5) Lower supervisory and technical occupations; (6) Semi-routine occupations; (7) Routine occupations; and (8) Never worked and long-term unemployed.

universities, the gap for the Russell Group universities stood at about ten percentage points. In contrast, a disproportionate number of individuals from the NS-SEC 6 to 8 origins graduated from the lowest tier universities. No substantial gaps in attendance at the pre-1992 universities indicated polarisation in the institutional distribution of individuals with different social origins at the level of undergraduate education.

The gap in subject areas or degree class, on the other hand, was much smaller than that in institutional selectivity. For subject areas, only slightly more graduates from the NS-SEC 1 origin majored in STEM areas, whereas more graduates from the NS-SEC 6 to 8 origins majored in OSSAH or combined areas. Likewise, although more children from the NS-SEC 1 origin achieved the upper degree classes and more children from the lowest origins received the lower ones, the gap again was trivial. In this study, the lack of pre-college ability measures precludes commentary about socioeconomic inequality in educational opportunities at the undergraduate level. However, the descriptive analysis at least shows drastic distributional disparities by social origin at the undergraduate level, concentrating on educational selectivity.

For the postgraduate level, it is first noted that higher-origin children were more likely to attain a postgraduate degree. The gap between the highest and the lowest origins was around seven percentage points for both men and women. The gap in institutional selectivity, however, changed both in magnitude and pattern compared to the undergraduate level. Although the gap was still evident at the top and the bottom of the selectivity scale, its size decreased at the postgraduate level. For example, the number of individuals who attended global top 20 universities was now two times for men (three times at the undergraduate level) and five times for women (six times at the undergraduate level) higher for individuals from the NS-SEC 1 origin than for those from the NS-SEC 6 to 8 origins. More surprisingly, the social origin gap was not present (men) or very small (women) in attendance at the Russell Group universities. Therefore, the distributional disparities in institutional selectivity decreased at the postgraduate level compared to the undergraduate level.

Table 3.1: Descriptive Characteristics of Analytic Sample

	Men				*Women*			
	Social Origin				Social Origin			
	NS-SEC 1	NS-SEC 2	NS-SEC 3 to 5	NS-SEC 6 to 8	NS-SEC 1	NS-SEC 2	NS-SEC 3 to 5	NS-SEC 6 to 8
t_1: Undergraduate Level								
Institution								
Global Top 20	9.88	7.27	4.33	3.15	6.54	4.77	3.11	1.04
Russell Group	32.39	28.50	24.45	22.45	31.21	26.17	20.88	19.34
Pre-1992	23.62	25.26	25.57	25.84	25.07	26.34	26.27	25.53
Post-1992	34.11	38.97	45.65	48.56	37.18	42.72	49.74	54.09
Subject Area								
STEM	45.40	43.41	45.23	44.56	32.63	30.34	30.83	29.63
LEM	20.91	16.90	18.63	18.92	16.11	14.85	14.97	15.21
OSSAH/COMB	33.68	39.69	36.14	36.52	51.26	54.81	54.20	55.16
Degree Class								
First	11.86	10.26	11.34	11.83	10.44	10.43	9.17	8.09
Upper Second	42.84	44.32	42.99	40.71	50.59	49.58	48.83	47.89
Lower Second	29.77	30.42	29.66	30.67	26.16	27.23	27.90	29.60
Third/Pass/Other	15.53	14.99	16.01	16.79	12.81	12.76	14.10	14.42
t_2: Postgraduate Level								
Attendance	40.82	36.60	32.63	33.83	41.38	41.40	36.51	34.73
Institution								
Global Top 20	14.37	9.96	8.50	7.08	9.46	6.17	5.16	1.82
Russell Group	27.66	29.20	28.83	27.74	28.38	24.39	23.76	22.57
Pre-1992	30.07	29.83	28.04	30.57	23.49	28.45	28.01	27.75
Post-1992	27.90	31.02	34.62	34.62	38.67	40.99	43.07	47.86
Subject Area								
STEM	46.44	41.95	42.48	37.56	32.85	27.58	28.77	29.24
LEM	21.43	17.95	18.66	21.86	15.58	13.38	14.69	12.76
OSSAH/COMB	32.13	40.10	38.86	40.58	51.57	59.04	56.54	58.00
Degree Type								
Doctorate	17.26	16.88	15.69	13.27	11.44	10.15	8.85	5.47
Masters	56.33	52.02	53.98	53.87	45.83	43.63	43.59	43.78
PGCE	13.95	18.81	16.44	20.35	26.17	30.67	31.06	33.00
Other	12.45	12.30	13.89	12.52	16.57	15.55	16.51	17.76
t_3: Occupational Destination								
NS-SEC 1	52.56	46.06	47.13	40.36	35.28	29.76	27.35	27.52
NS-SEC 2	36.26	40.71	38.60	44.27	48.41	52.06	54.33	57.20
NS-SEC 3 to 5	7.63	9.89	10.79	9.61	10.51	11.59	12.09	10.25
NS-SEC 6 to 8	3.55	3.34	3.49	5.75	5.80	6.59	6.23	5.04
Total College Graduates	3,237	2,702	3,569	1,758	3,640	3,241	4,380	2,063
Postgraduate Degree Holders	1,305	976	1178	602	1,494	1,337	1,591	711

On the other hand, the gap in the subject areas was more pronounced at the postgraduate level than at the undergraduate level. Individuals from the NS-SEC 6 to 8 origins majored in STEM areas at lower rates and in OSSAH areas at higher rates than their peers from the NS-SEC 1 origin. Given that it is rare to change

subject areas in the transition from undergraduate to postgraduate education (based on the analytic sample), this distributional change by social origin in the subject area at the postgraduate level implies a different selection into postgraduate education on the undergraduate subject area by social origin. That is, more children from the highest origin tended to attain a postgraduate degree among STEM majors, whereas more children from the lowest origins tended to attain a postgraduate degree among OSSAH or combined majors. Lastly, the gap was also apparent in the degree type, particularly for the doctorate and PGCE degree. While more individuals from the NS-SEC 1 origin tended to attain a doctorate, more individuals from the NS-SEC 6 to 8 origins attained a PGCE degree. In particular, the gap in attaining the doctorate was more than double among women.

Lastly, the social origin gap was also evident in postgraduate degree holders' occupational destinations, mostly at the top two tiers of the NS-SEC class schema (NS-SEC 1 vs. NS-SEC 2), where more than 80% of men and women postgraduate degree holders are settled. Individuals from the highest origin were around 1.3 times more likely to have NS-SEC 1 occupations than those from the lowest origins. In contrast, children from the lowest origins tended to enter NS-SEC 2 occupations at greater rates than their peers from the highest origins. No substantial social origin gap was observed for the lower-class destinations. Therefore, for postgraduate degree holders, the social origin effects were most visible among those who have higher (NS-SEC 1) and lower (NS-SEC 2) managerial/professional occupations.

3.5.2 Two Mediations of Educational Stratification

The next analysis compared two sets of models, one of which focused on mediation by postgraduate-level stratification (Table 3.2A) while the other replaced it with undergraduate-level stratification (Table 3.2B). Table 3.2A thus shows results from multinomial logit models regressing binary measure of occupational destination on social origin without (Model 1) and with (Model 2) controls of postgraduate-level stratification. Models are the same in Table 3.2B except that postgraduate-level

stratification was replaced by the undergraduate-level one. The third columns for each gender represent indirect effects (upper row) and the percentages of the total effect mediated by them (bottom row). All indirect effects were statistically significant at the conventional significance level ($p < 0.05$).

Table 3.2A: Results from Logistic Regression Models (Linear Predictor Approach) with Controlling for Postgraduate-level Stratification Measures

	Men			*Women*		
	Model 1	Model 2	Indirect Effects	Model 1	Model 2	Indirect Effects
Social Origin (Ref. NS-SEC 1)						
NS-SEC 2	-0.293*	-0.148	-0.144	-0.294**	-0.147	-0.147
	(0.115)	(0.107)	49.29%	(0.106)	(0.100)	50.14%
NS-SEC 3-5	-0.237*	-0.107	-0.130	-0.454***	-0.296**	-0.158
	(0.107)	(0.103)	54.80%	(0.108)	(0.100)	34.80%
NS-SEC 6-8	-0.562***	-0.325*	-0.238	-0.444**	-0.184	-0.260
	(0.145)	(0.140)	42.28%	(0.135)	(0.129)	58.53%
Control Variables	Yes	Yes		Yes	Yes	
Postgraduate Degree Type		Yes			Yes	
Postgraduate Institution		Yes			Yes	
Postgraduate Subject Area		Yes			Yes	
Postgraduate Degree Type						
(Ref. Doctorate)						
Master's		-0.867***			-1.035***	
		(0.123)			(0.119)	
PGCE		-2.290***			-2.445***	
		(0.177)			(0.147)	
Others		-0.631***			-1.069***	
		(0.165)			(0.140)	
Postgraduate Institution						
(Ref. Global Top 20)						
Russell Group		-0.150			-0.131	
		(0.153)			(0.160)	
Pre-1992		-0.264			-0.443**	
		(0.156)			(0.165)	
Post-1992		-0.360*			-0.356*	
		(0.162)			(0.156)	
Postgraduate Subject Area						
(Ref. STEM)						
LEM		0.057			0.366**	
		(0.110)			(0.118)	
OSSAH/Other		-0.777***			-0.583***	
		(0.097)			(0.092)	
N		3,260			4,222	

Notes: Bootstrapped standard errors in parentheses; Control variables include age, age squared, marital status, ethnicity, and country of birth
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

In Table 3.2A, indirect effects and percentages of the mediation show that postgraduate-level stratification meditated around half of the total social origin gap

in an occupational destination. Estimates of postgraduate-level stratification presented at the bottom of the table further reveal which characteristics were associated with higher or lower chances of having an elite group occupation. For both men and women, the most significant factor for reaching an elite group was the type of postgraduate degree. While all degree types were related to lower chances of having an elite occupation than the doctorate, they were exceptionally slim for those with the PGCE degree. For instance, the odds of having an elite occupation for male PGCE holders were 0.10 (exp(-2.290)) that of male doctorate holders. For institutional selectivity, the gap was pronounced between the lowest (post-1992) and the top tiers for men and between the lower two and the top tiers for women. Lastly, for both men and women, having majored in OSSAH or combined areas lowered the odds as compared to those who majored in STEM areas, whereas majoring in LEM areas increased the odds for women net of other postgraduate-level educational characteristics. Overall, factors associated with higher chances of reaching an elite occupation group corresponded with stratification points where the distributional disparities by social origin were pronounced in the descriptive analysis in Table 3.1.

Next, in the second exercise in Table 3.2B, I replaced postgraduate-level stratification with the undergraduate-level one. This exercise did not change the mediation in Table 3.2A dramatically. Similar to Model 2 in Table 3.2A, undergraduate-level stratification accounted for almost half of the total social origin gap. Although it explained slightly less the gap between the highest- and the lowest-origin men than postgraduate-level stratification did, the results overall show that undergraduate-level stratification explains intergenerational occupational association among postgraduate degree holders considerably. Because undergraduate education precedes postgraduate education in sequential order, this result leads one to suspect that any additional role played by postgraduate education in accounting for intergenerational occupational association would be marginal. The next analysis tested this hypothesis.

Table 3.2B: Results from Logistic Regression Models (Linear Predictor Approach) with Controlling for Undergraduate-level Stratification Measures

	Men			*Women*		
	Model 1	Model 2	Indirect Effects	Model 1	Model 2	Indirect Effects
Social Origin (Ref. NS-SEC 1)						
NS-SEC 2	-0.263*	-0.144	-0.119	-0.267**	-0.143	-0.124
	(0.108)	(0.103)	45.37%	(0.098)	(0.098)	46.51%
NS-SEC 3-5	-0.223*	-0.098	-0.125	-0.416***	-0.283**	-0.133
	(0.100)	(0.098)	56.03%	(0.101)	(0.099)	32.01%
NS-SEC 6-8	-0.520***	-0.341*	-0.179	-0.413**	-0.196	-0.217
	(0.135)	(0.134)	34.35%	(0.127)	(0.124)	52.59%
Control Variables	Yes	Yes		Yes	Yes	
Undergraduate Institution		Yes			Yes	
Undergraduate Subject		Yes			Yes	
Undergraduate Degree Class		Yes			Yes	
N		3,260			4,222	

Notes: Bootstrapped standard errors in parentheses; Control variables include age, age squared, marital status, ethnicity, and country of birth
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

3.5.3 Test of Mediation of Intergenerational Association among the Highest Educated

Table 3.3 shows results from six nested logit models that regress occupational destination on social origin with stepwise additions of educational mediators. Model 1 only included the main explanatory variable (social origin) and demographic controls. This model regressed whether one ends up having an elite occupation on social origin. Models 2 to 4 added measures of undergraduate-level stratification and Models 5 and 6 further added measures of postgraduate-level stratification. Because the coefficients were rescaled using the linear predictor approach, they can be compared across nested models.

In Model 1, all lower social origins were associated with a lower chance of having an elite occupation relative to the NS-SEC 1 origin among postgraduate degree holders. When I introduced selectivity of the undergraduate institution (Model 2), estimates of social origin decreased substantially for the NS-SEC 3 to 5 origins (by 42.0% for men and 19.4% for women) and the NS-SEC 6 to 8 origins (by 21.3% for men and 29.1% for women). The estimate for men from the NS-SEC 3 to 5 origins

Table 3.3: Results from Nested Logistic Regression Models (Linear Predictor Approach)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
			Men			
Social Origin (Ref. NS-SEC 1)						
NS-SEC 2	-0.291*	-0.266*	-0.167	-0.16	-0.141	-0.139
	(0.116)	(0.116)	(0.112)	(0.111)	(0.109)	(0.108)
NS-SEC 3 to 5	-0.238*	-0.148	-0.087	-0.102	-0.097	-0.097
	(0.108)	(0.109)	(0.105)	(0.105)	(0.104)	(0.105)
NS-SEC 6 to 8	-0.567***	-0.446**	-0.366*	-0.372*	-0.309*	-0.314*
	(0.147)	(0.148)	(0.145)	(0.145)	(0.144)	(0.144)
			Women			
Social Origin (Ref. NS-SEC 1)						
NS-SEC 2	-0.295**	-0.257*	-0.168	-0.158	-0.148	-0.133
	(0.107)	(0.108)	(0.106)	(0.106)	(0.102)	(0.102)
NS-SEC 3 to 5	-0.458***	-0.369**	-0.324**	-0.312**	-0.282**	-0.271**
	(0.110)	(0.110)	(0.107)	(0.107)	(0.102)	(0.102)
NS-SEC 6 to 8	-0.443**	-0.314*	-0.217	-0.203	-0.137	-0.121
	(0.137)	(0.138)	(0.134)	(0.134)	(0.131)	(0.132)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Undergraduate Education						
Institution		Yes	Yes	Yes	Yes	Yes
Subject Area			Yes	Yes	Yes	Yes
Degree Class				Yes	Yes	Yes
Postgraduate Education						
Degree Type					Yes	Yes
Institution						Yes
N (Men)			3,260			
N (Women)			4,222			

Notes: Bootstrapped standard errors in parentheses; Control variables include age, age squared, marital status, ethnicity, and country of birth
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

became statistically not significant at the $p < .05$ level. The additional introduction of undergraduate subject area led to a further decline in the social origin gaps. It is noteworthy that the estimates for the NS-SEC 2 origin decreased by more than 30% and lost their significance when subject area was added to the model. This pattern is in contrast to the substantial decreases in estimates for the lowest two origins when institutional selectivity was added. It implies that the gap between the highest and the next-to-the-highest origins was mediated more by their choice of subject area than by the selectivity of the institution they attended. This heterogeneous mechanism of the social origin gap could be concealed when using any continuous

measure of socioeconomic origin.

From Model 3 onward, a distinct gender difference was observed. Unlike men, whose gap was largest between the two most distant points on the origins scale (i.e., between NS-SEC 1 and NS-SEC 6 to 8), for women the gap was largest between the NS-SEC 1 and the NS-SEC 3 to 5 origins. These gaps remained significant in Model 6 when both undergraduate- and postgraduate-level stratifications were held constant, whereas gaps observed among other origins lost their statistical significance when undergraduate-level institutional selectivity and subject area were held constant. A comparison of the estimates in Model 1, 4, and 6 reveals that additional mediation by postgraduate-level stratification was not substantial when undergraduate-level stratification was already taken into account.

3.5.4 Unequal Paths Across and Beyond Higher Education and Their Implications

We now know that introducing postgraduate-level stratification in the model added little in the way of explanatory power already attributable to the role of undergraduate-level stratification in accounting for intergenerational occupational association. Nevertheless, earlier exercises demonstrated that postgraduate education mediates the association as much as undergraduate education does. Taken together, these results indicate that the product of paths (c) and (d) would be relatively small, contradicting the substantially large product of paths (a) and (b). Furthermore, given that path (d) was substantial and significant (see the coefficients of covariates representing postgraduate-level stratification, conditioning on the social origin and demographic controls, in Table 3.2A), we may expect that the direct effect of social origin on postgraduate-level stratification (path (c)), in particular, would be limited. Therefore, this section tested these contrasting suppositions on paths (b) and (c) using the sequential logit models and multinomial logit models, further revealing points and mechanisms of the social origin gap in occupational destination through higher education.

I first examined the path (d), which is a direct effect of social origin on postgraduate-level education. Table 3.4 shows the total (Model 1) and direct effect (Model 2) of social origin on postgraduate-level stratification, net of undergraduate-level stratification. To determine where the social origin gap emerges, I fit a series of logit models, dropping individuals in the lowest categories of educational stratification. The underlying assumption for this approach is the hierarchical character of the two postgraduate-level stratifications. Postgraduate-level subject area was excluded from the analysis because it rarely changes from undergraduate-level subject areas. Total effects (Model 1) in this table show that the gap by social origin in the transition to postgraduate education was not prevalent across all stratification points, and it also differed by gender. For instance, in degree type, the gap existed only in the likelihood of attaining a doctorate or master's degree rather than a PGCE degree (for both men and women) and the choice between the doctorate and master's degree (for women only). More importantly, two main points of the gap – the odds of attaining a PGCE degree and attending a post-1992 university – corresponded with factors that are strongly associated with lower chances of reaching an elite occupation group. In this sense, the most substantial gap in institutional selectivity – the likelihood of attending global top 20 universities relative to Russell Group ones – might not play a significant role in the transmission of class-based advantages in one's occupational assignment, because there was no significant gap between these two tiers in graduates' chances of having an elite occupation (see Table 3.2A).

Next, estimates in Model 2 represent the direct path from social origin to postgraduate education, net of undergraduate-level stratification. The results are consistent with the earlier supposition regarding the limited size of the direct origin effect on postgraduate education. Both for men and women, when undergraduate-level stratification was added to the model, most of the coefficients became non-significant. In particular, the stronger tendency of attending post-1992 universities rather than upper-tier ones among individuals from the lowest origin was almost exclusively attributable to the different undergraduate education they received. This

evidence of the weak direct effect adds support to path dependency between undergraduate and postgraduate education.

The pattern was slightly different for women. While all other patterns were similar to men's, the social origin gap in the likelihood of attending the upper two tiers of universities rather than the pre-1992 ones remained significant even net of undergraduate education for women. That is, women of lower origins tend more to attend pre-1992 universities than more prestigious universities than their similarly qualified female peers from the highest origin. Given that attending the pre-1992 universities is associated with a lower chance of having an elite occupation for women (see Table 3.2A), this significant direct path explains why the additional explanatory power of the postgraduate-level stratification was greater for women than for men (see coefficients in Model 4 and 5 in Table 3.3).

Lastly, I examined the path from undergraduate to postgraduate education (path (b)). Figures 3.2 and 3.3 illustrate the average marginal effects from the multinomial logit models regressing postgraduate-level stratification (institutional selectivity and degree type) on undergraduate-level stratification (institutional selectivity and subject areas). Figure 3.2 illustrates paths to postgraduate institutions. It is evident, in the first row of Figure 3.2, that the path dependency between undergraduate and postgraduate institutions is very strong. For men with a postgraduate degree, the probabilities of attending the same-level universities for their undergraduate and postgraduate degrees were nearly 60%, regardless of which level of institutions they attended. The persistence was particularly pronounced at the top. The chance of attending global top 20 universities at the postgraduate level was extremely slim for individuals with a bachelor's degree from the non-global top 20 universities. On the flip side, those with a bachelor's degree from the global top 20 universities were highly unlikely to attend lower-tier universities for their postgraduate degree. A similar pattern was observed for women, albeit with a weaker persistence. Also, for women, the probability of attending a bottom-tier university for their postgraduate degree was relatively higher than among men for all undergraduate institutions.

Table 3.4: Result from Sequential Logit Models Regressing Postgraduate Stratification on Social Origin and Undergraduate Education

	Acquisition		Postgraduate Degree Type						Selectivity of Postgraduate Institution					
	PG Degree vs. No PG		PhD/MA/PGCE vs. Other		PhD/MA vs. PGCE		PhD vs. MA		GTT/RG/Pre vs. Post		GTT/RG vs. Pre		GTT vs. RG	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
Men														
Social Origin (Ref. NS-SEC 1)														
NS-SEC 2	-0.203**	-0.138*	0.025	0.006	-0.452**	-0.179	0.092	0.035	-0.181	-0.098	-0.053	0.035	-0.509*	-0.362
	(0.063)	(0.062)	(0.163)	(0.162)	(0.171)	(0.153)	(0.172)	(0.150)	(0.131)	(0.123)	(0.148)	(0.141)	(0.240)	(0.223)
NS-SEC 3 to 5	-0.381***	-0.262***	-0.098	-0.087	-0.344*	-0.052	-0.024	-0.019	-0.372**	-0.114	0.003	0.210	-0.611**	-0.376
	(0.060)	(0.058)	(0.144)	(0.148)	(0.161)	(0.146)	(0.166)	(0.151)	(0.124)	(0.114)	(0.146)	(0.139)	(0.234)	(0.218)
NS-SEC 6 to 8	-0.346***	-0.201**	0.059	0.127	-0.706***	-0.343	-0.344	-0.078	-0.361*	0.026	-0.128	0.234	-0.853**	-0.437
	(0.075)	(0.074)	(0.192)	(0.193)	(0.201)	(0.176)	(0.234)	(0.212)	(0.149)	(0.137)	(0.180)	(0.167)	(0.324)	(0.302)
N	10,465	10,465	3,260	3,260	2,866	2,866	2,263	2,263	3,260	3,260	2,243	2,243	1,283	1,283
Women														
Social Origin (Ref. NS-SEC 1)														
NS-SEC 2	0.011	0.059	0.104	0.065	-0.288*	-0.053	-0.042	0.116	-0.092	0.013	-0.455***	-0.344**	-0.345	-0.251
	(0.056)	(0.056)	(0.120)	(0.119)	(0.128)	(0.113)	(0.161)	(0.153)	(0.095)	(0.092)	(0.120)	(0.118)	(0.240)	(0.221)
NS-SEC 3 to 5	-0.227***	-0.123*	0.035	0.055	-0.363**	-0.149	-0.233	0.008	-0.200*	0.025	-0.451***	-0.260*	-0.484*	-0.287
	(0.053)	(0.052)	(0.117)	(0.118)	(0.125)	(0.110)	(0.172)	(0.161)	(0.097)	(0.092)	(0.121)	(0.119)	(0.238)	(0.225)
NS-SEC 6 to 8	-0.307***	-0.167**	-0.047	-0.073	-0.586***	-0.217	-0.660**	-0.451	-0.408***	-0.108	-0.612***	-0.395*	-1.445***	-0.881*
	(0.064)	(0.064)	(0.162)	(0.163)	(0.161)	(0.142)	(0.248)	(0.232)	(0.115)	(0.110)	(0.164)	(0.155)	(0.402)	(0.394)
N	12,413	12,413	4,222	4,222	3,569	3,569	2,212	2,212	4,222	4,222	2,456	2,456	1,352	1,352
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Undergraduate Institution		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Undergraduate Subject Area		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Undergraduate Degree Class		Yes		Yes		Yes		Yes		Yes		Yes		Yes

Notes: Standard errors are in parentheses: Control variables include age, age squared, marital status, ethnicity, and country of birth; PG=Postgraduate Education, GTT: Global Top 20, RG=Russell Group, Pre=Pre-1992, Post=Post-1992

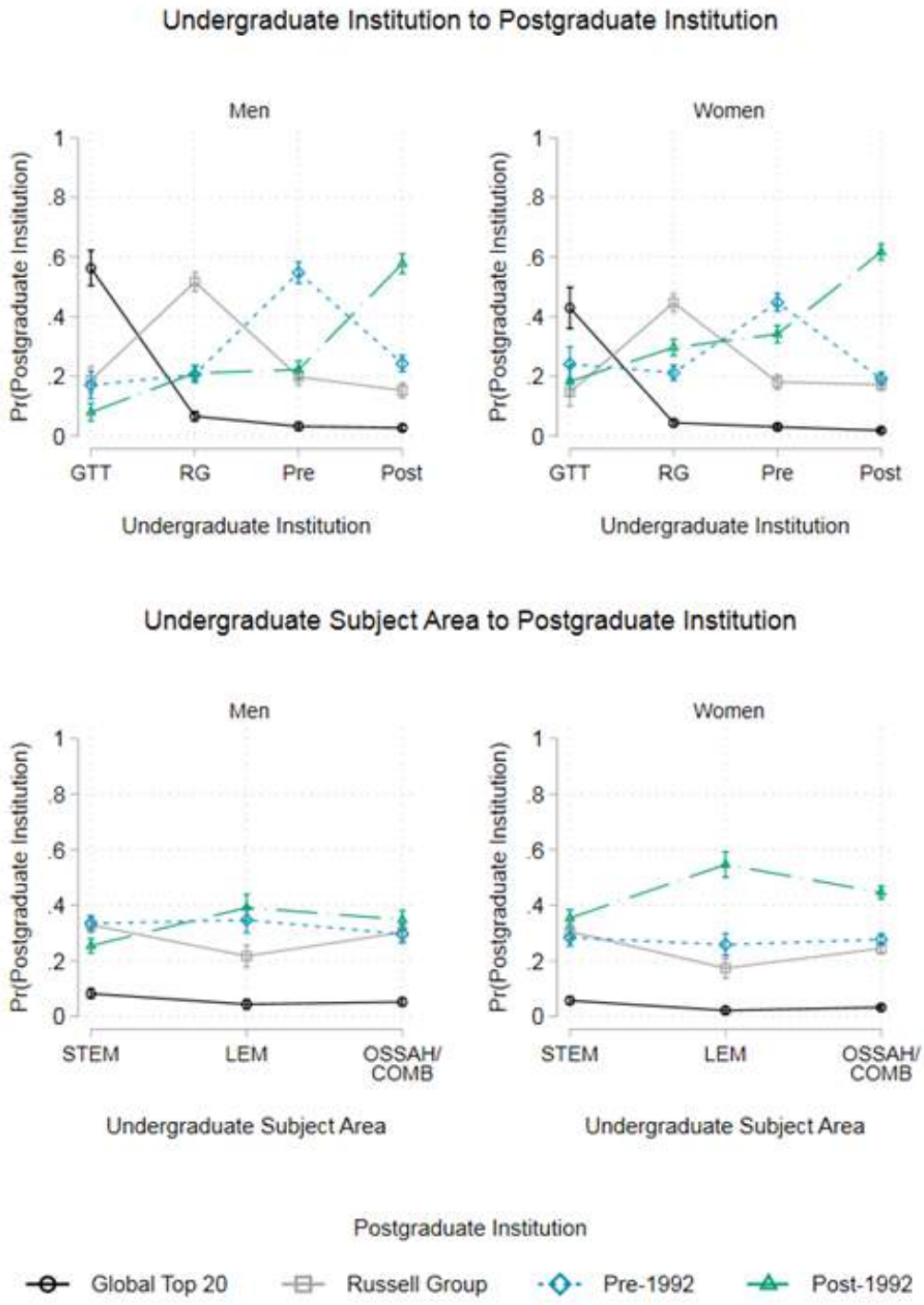
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Meanwhile, the path from undergraduate subject area to postgraduate institution shown in the bottom row of Figure 3.2 was not as strong as the one between the institutions. Nonetheless, majoring in LEM or OSSAH/combined areas significantly increased the probability of advancing to the post-1992 universities compared to majoring in STEM areas, which was especially the case for women. In sum, considering sizable social origin disparities shown in the descriptive analysis in the distribution across undergraduate institutions and selection on undergraduate subject areas into postgraduate education, these path dependencies found in the transition to postgraduate institutions suggest that much of the unequal distribution at the postgraduate-level institution has already been destined before they choose which institution they will attend.

Next, Figure 3.3 shows the paths to postgraduate degree type. The path dependencies were evident for both elements of undergraduate stratification. When it comes to undergraduate institutions, while a majority of postgraduate degree holders held a master's degree, a change in the probability of attainment by undergraduate institutions was prominent for all degree types. Among men, the gap was present between the top, middle (Russell Group and pre-1992), and bottom tiers. Individuals from the global top 20 universities were more likely to attain a doctorate or Master's degree, while those from the post-1992 universities were more likely to attain a PGCE degree. Graduates from the Russell Group or pre-1992 universities were in-between the two extremes, and their probabilities for each degree type were undifferentiated. The pattern was different and more dramatic among women. While it was pronounced mostly between the top- and the bottom-tier universities for men, the gap among women was present between the global top 20 universities and others. Put differently, among women, even graduates from the prestigious Russell Group universities did not have different probabilities of attaining a doctorate or PGCE degree compared to graduates from lower-tier universities. Therefore, in contrast to men, women's undergraduate institution can lower their chances of having an elite occupation by negatively affecting their postgraduate degree type even when

they earned their bachelor's degree from the highly- or at least moderately-selective universities.

Figure 3.2: Results from Multinomial Logistic Regression Regressing Postgraduate Institution on Undergraduate-level Stratification

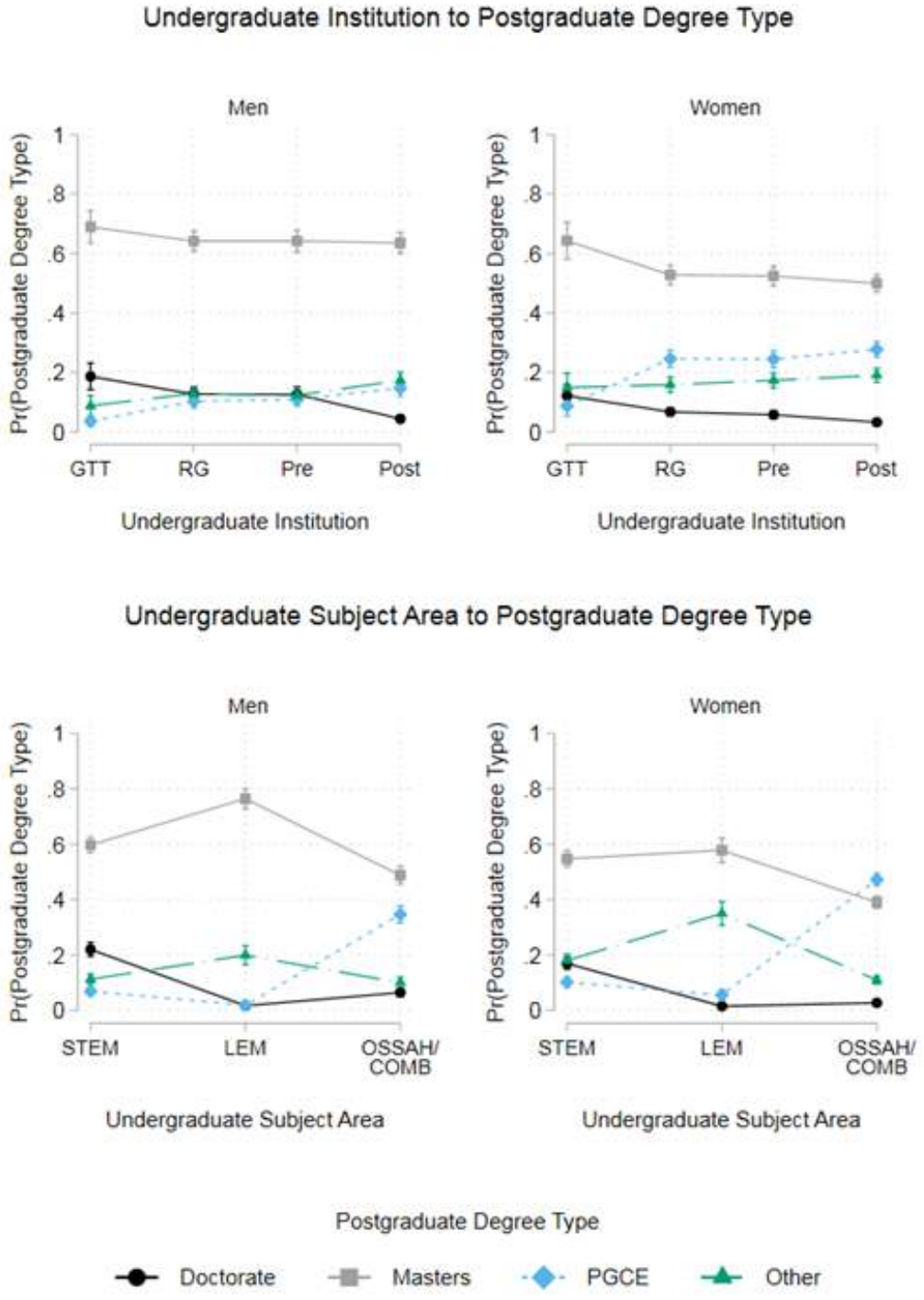


Unlike the paths to postgraduate institutions, undergraduate subject area was

a better predictor than the institution attended for postgraduate degree type. The bottom row in Figure 3.3 shows a solid path from the OSSAH undergraduate area to the PGCE degree. On the flip side, those who majored in STEM areas had a relatively higher chance of attaining a doctorate than other majors. In line with descriptive findings on the social origin gap in the distribution across postgraduate stratification, this pattern revealed class-specific pathways responsible for the strong intergenerational association. Table 3.1 showed that disproportionately more NS-SEC 1 origin individuals advanced to postgraduate education among STEM majors, whereas pursuing it was more prevalent for the NS-SEC 6 to 8 origin individuals among OSSAH majors. Furthermore, the gap between these two origins was also notable in the number of doctorate and PGCE holders. Therefore, different selection into postgraduate education on undergraduate subject areas by social origin and a strong path dependency between undergraduate subject area and postgraduate degree type was responsible for the strong intergenerational occupational association.

In sum, the investigation of path (b) and (c), in addition to the descriptive results, jointly revealed two major mechanisms of intergenerational occupational association among postgraduate degree holders in the UK. The first mechanism was disparities by social origin in the distribution across differently selective undergraduate institutions when the undergraduate institutions strongly dictate postgraduate institutions. Second, undergraduate subject area was strongly associated with postgraduate degree type. Those who majored in OSSAH areas at the undergraduate level were relatively more likely to attain a PGCE degree, whereas those who majored in STEM areas were relatively more likely to attain a doctorate. It is important to note that these divided paths corresponded with different social origins. Children from the NS-SEC 1 origin were more likely to follow the STEM-doctorate path, whereas those from the NS-SEC 6 to 8 origins tended to follow the OSSAH-PGCE path.

Figure 3.3: Results from Multinomial Logistic Regression Regressing Postgraduate Degree Type on Undergraduate-level Stratification



3.5.5 Gender Difference and Double Disadvantage by Gender and Class

While patterns in educational mediation of intergenerational association and path dependencies in educational transitions were similar across gender, some interesting gender differences were pronounced in the paths from origin to destination through higher education. Above all, not only were the chances of having an elite occupation slimmer for women than men but their position on the educational stratification more heavily impacted women. For example, there was no significant gap in occupational access between men who graduated from the global top 20 universities and those from pre-1992 universities net of other postgraduate-level stratification elements and social origin. This pattern contrasts with the significant gap between these two institutional groups among women (see Table 3.2A). Accordingly, unlike men, women needed to attend at least a Russell Group university in order to avoid significant disadvantages in gaining access to the elite occupation group compared to female graduates of the global top 20 universities.

The gender difference was also present in educational transitions. More specifically, undergraduate education associated with less favourable educational prospects encumbered women with more penalties in their postgraduate transition (see Figures 3.2 and 3.3). For instance, when men and women both majored in OSSAH or combined areas at the undergraduate level, women tended to attain a PGCE degree at a higher rate than men. Likewise, women graduating from less selective universities are more likely than their male peers graduating from similarly less selective universities to attend post-1992 universities. This pattern, in part, can be seen as a result of downward educational mobility prevalent among women. Relative to men, women showed a higher risk of attending post-1992 universities at the postgraduate level and attaining a PGCE degree than men at all levels of undergraduate stratification.

Furthermore, larger total and direct effects of social origin on postgraduate education among women presented in Table 3.3 suggest that women from lower origins

may face even more disadvantages in educational or occupational transitions, in addition to gender-unequal pathways, due to the stronger social origin impact on educational pathways than among men. Even though Table 3.3 shows that social origin gaps in postgraduate education lost their significance when undergraduate-level stratification was held constant, the size of the gaps was greater for women both for total and direct effects. Moreover, the tendency of advancing to pre-1992 universities rather than upper-tier universities, net of undergraduate-level educational characteristics, was observed only among women from lower origins, not among men from similarly low origins. This direct effect of social origin affecting negatively on postgraduate-level education for lower-origin women implies another source of gender-specific disadvantages that may originate from behavioural patterns or opportunity structures rooted in the intersectionality (McCall 2005) of gender and class.

3.6 Discussion

Intergenerational socioeconomic association among the highest educated has remained a puzzle since the first finding of its resurgence among postgraduate degree holders (Torche 2011). It is puzzling because if higher education is an arena where one's social origin loses its power, either through the effect of selection (Zhou 2019) or equalisation (Karlson 2019), this effect is presumably even stronger among those at the top of the educational distribution. Recent studies conducted exclusively on postgraduate degree holders, with the benefit of representative and large-sampled data on American postgraduate degree holders, have revealed that postgraduate-level educational stratification substantially accounts for this strong intergenerational socioeconomic association (Oh and Kim 2019; Torche 2018). Those studies also found that the heterogeneous paths from undergraduate to postgraduate subjects by parental education are associated with income inequality among postgraduate degree holders (Oh and Kim 2019), proving the hypothetical explanation suggested earlier by Torche (2011).

However, no studies have yet examined comprehensively the paths from undergraduate to postgraduate education as a bridge that connects social origin and postgraduate socioeconomic outcomes. Consequently, it is still not clear when and how inequality emerges among postgraduate degree holders. Furthermore, although stratification and mobility processes have been found to be different by gender, studies have rarely paid equal and sole attention to women postgraduate degree holders. Lastly, even though strong intergenerational association among the highest educated has been reported in several other countries (e.g., Falcon and Bataille 2018 for France; Wakeling and Laurison 2017 for the UK), studies on its mechanisms have paid disproportionate attention to the US. This paper does not focus on comparing different educational systems, but it aims to expand the scope of research by suggesting that different mechanisms of intergenerational socioeconomic associations may exist across countries with different higher education systems.

Against this backdrop, this study explored the mechanisms underlying intergenerational occupational association among men and women postgraduate degree holders in the UK, where the context of higher education slightly differs from that of the US but has shown similarly strong intergenerational socioeconomic associations among the highest educated. For that aim, I used a reformulated KHB method (linear predictor approach) in addition to the joint adoption of two analytical approaches in educational transitions studies – sequential logit and multinomial transition models – to compare coefficients from the nested nonlinear models and identify the sources and patterns of inequality. The UK Labour Force Survey, which provides detailed information on respondents' undergraduate and postgraduate educations, along with their social origin and destination, made this approach possible.

The results suggest two primary findings on the educational mediation of intergenerational occupational association. First, the size of the mediation is similar between undergraduate- and postgraduate-level stratifications when they are separately modelled. Second, postgraduate-level stratification does not add much explanatory power over that attributable to mediation by undergraduate-level stratifi-

cation. The sequential logit and multinomial logit models indicate two main reasons for these findings. First, the direct effect of social origin on children's postgraduate education is limited when their undergraduate education is taken into account. Second, there are strong path dependencies between undergraduate and postgraduate education.

One of the major contributions of this study is that it uncovered the paths in higher education that are associated with unequal access to elite occupations among the highest educated of different origins. Individuals' undergraduate institutions greatly impact which postgraduate institution they are able to attend, which is closely associated with the likelihood of accessing an elite occupation. Along with institutional selectivity, individuals' undergraduate subject area is also strongly associated with the type of degree one attains at the postgraduate level. Again, the type of degree has a considerable impact on occupational prospects. More importantly, divides between these paths extend from individuals' social origins, and they begin much earlier than the point at which one reaches postgraduate education. The difference between two undergraduate-level stratification elements – institutional selectivity and subject area – is that the origin gap emerges at the undergraduate distribution for institutional selectivity, whereas for subject area, it emerges when sorting into postgraduate education.

This study also contributes to the literature by unveiling gender differences in social origin inequality among postgraduate degree holders. The results show that women from the lower origins are doubly disadvantaged, by gender inequality on the one hand, and by the gender-specific pattern of social origin gap, on the other, in educational or occupational transitions. As women, they need to occupy a higher stratum in educational stratification than men to attain an elite occupation. Also, when their undergraduate institutions or subject areas are disadvantageous in accessing the types of postgraduate education that better facilitates access to elite occupations, they experience more penalties for their undergraduate education. In addition to these gender inequalities, unlike among men, women from lower origins

are more likely to attend the pre-1992 universities than the global top 20 or Russell Group universities than their peers with similar undergraduate education. This is problematic because attending pre-1992 universities is associated with a lower chance of accessing an elite occupation among women. These results imply that more attention should be paid to the processes driving gender and socioeconomic inequalities among highly educated women.

As mentioned earlier, caution should be taken in relating the results of this study to different educational systems. Without undertaking the same analyses on the US, it is not possible to argue with confidence that this study's results are due to the differences in the UK's higher education system. Indeed, the substantial amount of mediation by postgraduate-level stratification found in the US may actually be mediation by undergraduate-level stratification, as was found in this study. If that is the case, the difference by country would manifest only in the relative size of the mediation by each educational level, not the pattern. Still, there are some differences we can interpret as resulting from the different systems. For example, in the US, where the professional degree gives the highest socioeconomic returns, majoring in arts and sciences subjects at the undergraduate level and advancing to the professional degree is the best-known class reproduction route. However, without such a system, children's post-graduate socioeconomic outcomes could be destined much earlier, for example, at the point when they choose either medicine or law as their undergraduate major, resulting in the pathway observed in the US from less lucrative undergraduate subject areas to more lucrative postgraduate education less visible. In this study, indeed, advancing to postgraduate education among OSSAH majors is the pattern more prevalent among lower-origin individuals, rather than those from higher origins. A promising future study would examine how these systemic differences in higher education affect social mobility and inequality processes. Also, the extent to which the postgraduate degree adds economic advantages to those who majored in medicine or law when it is not a prerequisite for occupational access, and if so, whether it varies by social origin would be interesting questions to

explore.

Lastly, although this study focuses exclusively on postgraduate degree holders, it sheds light on a long-studied subject in stratification research: the equalising power of college education. My study demonstrates that a large portion of inequality among postgraduate degree holders has its roots in their undergraduate-level education. Therefore, even if there is no social origin inequality in post-graduate socioeconomic outcomes among terminal BA holders, the finding in this study alone provides evidence that refutes the college-as-a-great-equaliser argument. While it was less problematic in the past to draw conclusions by studying terminal BA holders or college graduates as a whole without distinguishing the level of degree, it has become more so as more college graduates pursue postgraduate education. This study suggests that future research will need to take educational transitions in higher education more seriously into account in the study of intergenerational mobility and stratification among highly educated people.

Chapter 4

Educational Assortative Mating and Household Income Inequality in the United States, 1996-2020

4.1 Introduction

Assortative mating is a non-random matching of individuals into marriage or cohabitation on various socioeconomic characteristics, such as education, income, social origin, religion, or race/ethnicity. It has been studied extensively by sociologists and economists concerned with the relationship between demography and inequality for two reasons. First, it reflects how boundaries are drawn among people of different characteristics in society. Second, and more importantly, it affects resource distributions between households and household members, possibly impacting intra- or intergenerational inequality.

Among the various socioeconomic factors, an increase in educational assortative mating (Blossfeld 2009; Hou and Myles 2008; Kalmijn 1991a, 1991b; Mare 1991; Qian 1998; Qian and Preston 1993; Schwartz and Mare 2005; Smits, Ultee, and Lammers 2000) was first viewed as evidence of modernization. A rather positive connotation was attributed to it because the increase implied that the basis of sorting had moved from ascribed to achieved characteristics, and was possibly accounted for more by romantic love than institutional regulation (Kalmijn 1991b; Rosenfeld 2006, 2008; Rosenfeld and Thomas 2012). However, the increase in the association between spouses' earnings and its non-negligible contribution to the inter-household

economic inequality (Blackburn and Bloom 1995; Frémeaux and Lefranc 2020; Reed and Cancian 2012; Schwartz 2010) led to concerns over the disequalising effect of the increase in educational homogamy (Burtless 1999; Fernández and Rogerson 2001; Greenwood et al. 2014; Mare 1991, 2000; Schwartz 2010). This is because education is the primary basis of mate selection (Blossfeld 2009; Blossfeld and Timm 2003) and one of the major predictors of economic success.

A handful of studies exploring this question have found no significant effect of educational assortative mating on the increase in economic inequality between households (Boertien and Permanyer 2019; Breen and Salazar 2010, 2011; Eika, Mogstad, and Zafar 2019; Western, Percheski, and Bloome 2008). Furthermore, recent studies have suggested that the rise of economic homogamy and its contribution to inter-household economic inequality were driven primarily by changes in the pattern of women's labour force participation after marriage than changes in sorting behaviours (Gonalons-Pons and Schwartz 2017; Pestel 2014). These studies suggest that the focus of research on sorting should be shifted to the division of paid labour within marriage.

However, these studies are based on long periods that range from the late-1960s or 1970s to the early 2000s or 2010s. Over these periods, changes in economic inequality have not necessarily been even. For instance, the recent increase in overall inequality has been moderate compared to the rapid growth of inequality in the 1980s (McCall and Percheski 2010). Also, the inequality driven by top earners holding disproportionately large shares of income is a relatively recent trend (Piketty and Saez 2006) that followed a period of stabilized inequality between the middle and bottom of income distribution in the 1990s (Burtless and Jencks 2003; Daly and Valletta 2006; Western et al. 2008). Moreover, other factors accounting for economic inequality, such as men's and women's education, labour force participation, or income levels, have also changed dramatically over decades. Therefore, it is highly likely that those previous studies based on extended time frames captured phenomena occurring in earlier periods displaying a sharp rise in economic

inequality.

My study fills this gap and focuses on the effect of educational assortative mating on inequality for the past two decades in the United States. Inequality has increased, albeit less dramatically than in the 1980s or 90s, in the recent two decades. More importantly, this period displays different changing patterns of educational and labour market distributions from the previous period. Therefore, by focusing on the period from 1996 to 2020, the study investigates whether changing conditions in the twenty-first century have induced an increase in educational sorting and contributed to the rise of economic inequality in a period of moderate inequality growth, differently from the null impact of educational sorting on inequality from the closing decades of the 20th century (Breen and Salazar 2011).

Furthermore, building on this comparison, this study advances previous studies by testing two possible factors behind the null effect. First, Breen and Salazar (2011) suggested that the null effect could appear because increasing educational differentiation was not fully captured by the educational classification that they employed, especially at the top end of the educational distribution. The present study addresses this limitation by exploiting the finer educational categories distinguishing types of degrees that were included in the Current Population Survey (CPS) since 1992. Second, they also suggested that the relationship between educational assortative mating and inequality at different points of the earnings distribution may run in opposite directions. If this is the case, educational assortative mating could appear to have no impact on overall inequality even as it exerts offsetting effects on different points of the earnings distribution. This study tests this possibility by applying decomposition and counterfactual analysis for different locations of the earnings distribution.

4.2 Empirical and Theoretical Background

Previous studies have suggested educational homogamy as a function of opportunity structure consisting of educational or labour market conditions, on the one hand,

and individual preferences or choices, on the other. Thus, empirical evidence of how the conditions on which those individuals' behaviours are based have changed over recent decades could shed light on how educational sorting and its contribution to inequality between households may also have changed in the recent two decades. In the following section, I will lay out changes in educational and labour market distributions and why I expect these changes to affect educational sorting in the twenty-first century differently from the previous periods.

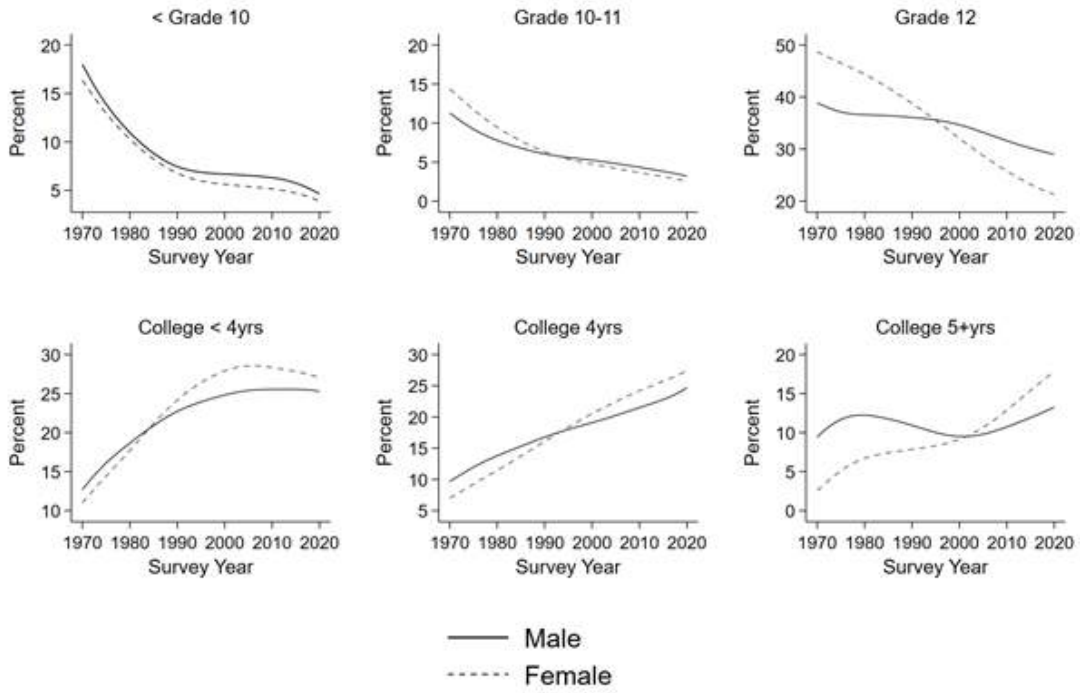
4.2.1 Changes in Educational Distribution

While most previous studies on educational sorting and inequality have covered extended periods starting from the late 1960s or the 1970s, there are qualitative differences in the change of educational distribution between periods. Figure 4.1 shows the proportion of men and women in each education level by year. This analysis was limited to those aged between 30 and 39 to capture the population of men and women who are in the marriage market after completion of education. The overall trend for the past five decades shows an educational upgrade both for men and women. The proportion of the low-educated ($< Grade12$) has dropped dramatically, especially by the end of the twentieth century, whereas the college-educated population has steadily increased. There is a sharp contrast by gender in the high school (*Grade 12*) level. Compared to men showing a rather moderate and steady decline, the number of women with a high school diploma has dropped sharply for the past four decades, falling below men in the 2000s and dropping to almost half the proportion of diploma holders accounted for by men in 2020.

This trend corresponds with the gendered pattern in higher education. For all higher education levels (bottom row of Figure 4.1), women's increase is steeper than men's, and the proportion accounted for by women comes to exceed that of men, with this reversal in numerical superiority occurring earliest at the lower the degree levels. There are other differences by level of higher education in the trend. A steep increase in men and women attaining some college education ($College < 4yrs$)

stopped its growth in early 2000s, with the gender gap remaining stable thereafter. Meanwhile, the growth of people with four years of college education (*College 4yrs*) is still on the rise for both men and women over the twenty-first century. For those with more than five years of college education (*College 5+yrs*), it is notable that the proportion accounted for by men has shown a slight decrease since the 1980s to early 2000s, contributing to the rapid filling of the gender gap driven by steeper growth among women.

Figure 4.1: Educational Attainment of Men and Women by Survey Year (smoothened)

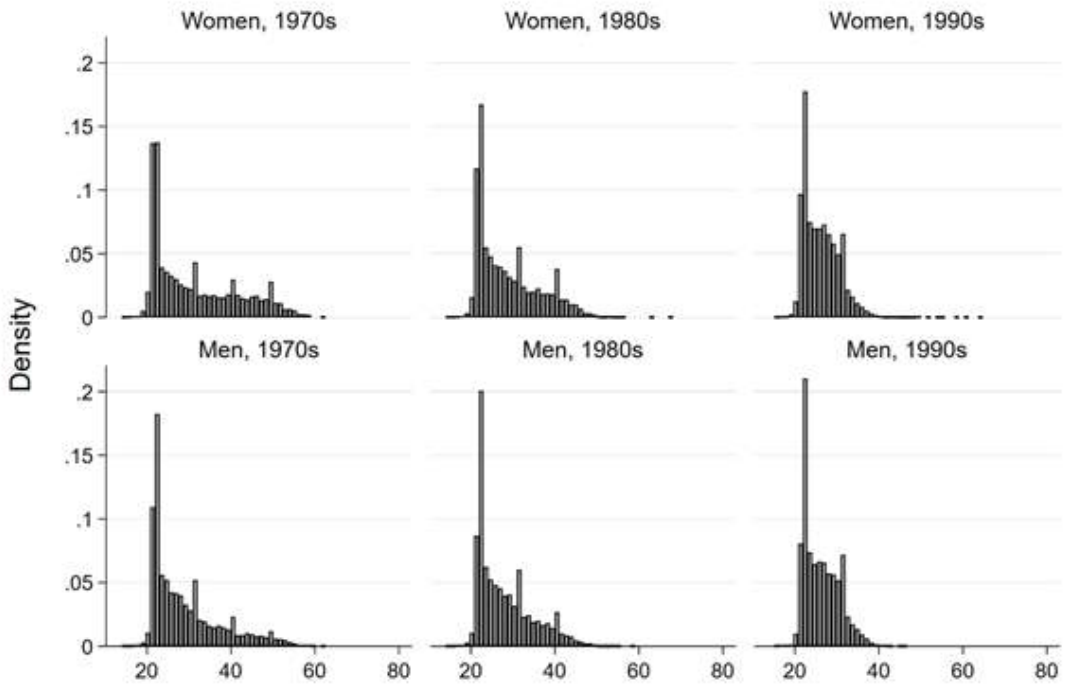


Source: Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS)
Notes: Samples include individuals aged between 30 and 39; 'Grade 12' includes individuals who completed 12th grade but did not obtain a high school or equivalent diploma; for college and graduate education, before 1992, the CPS had collected years of college education completed. Since 1992, it began to collect information combining a type of degree program attended and whether the degree was obtained. Thus, for the period between 1970 and 1991, 'College 4yrs' is defined as those who completed 4 years of college education, whereas 'College 5+yrs' is defined those who completed more than 5 years of education. From 1992, the classification is based on the degree completion. Thus, the 'College 4yrs' includes those with a bachelor's degree, and the 'College 5+yrs' includes those with a master's, professional, or doctoral degree.

In sum, the trend depicted in Figure 4.1 shows differences in recent educational changes compared to previous periods. Although the recent two decades continue the trend of educational expansion and a decreasing gender gap, educational com-

positions of men and women in 2020 are very different from those in the early 2000s, especially for women. While educational expansion before the 2000s was driven mostly by some college and four-year college, the drivers in the twenty-first century are four-year college and graduate education. As a result, the total number of individuals with more than a bachelor's degree exceeds those with some college education in 2020. More importantly, gender reversal in higher education occurred and/or became more pronounced during this recent period. For all educational levels above high school, there now are fewer men than women.

Figure 4.2: Distribution of Age at Obtaining Graduate Degrees



Source: National Survey of College Graduates (2013)

A gendered change is observed not only on the population volume but also on the timing of education, especially for graduate education. Compared to earlier periods, an increasing number of women attend graduate school at earlier ages. Figure 4.2 shows distributions of age at degree acquisition for women and men who graduated high school in the 1970s, 1980s, and 1990s. The figure indicates the age of acquisition has become younger and concentrated to a narrow age band, and such

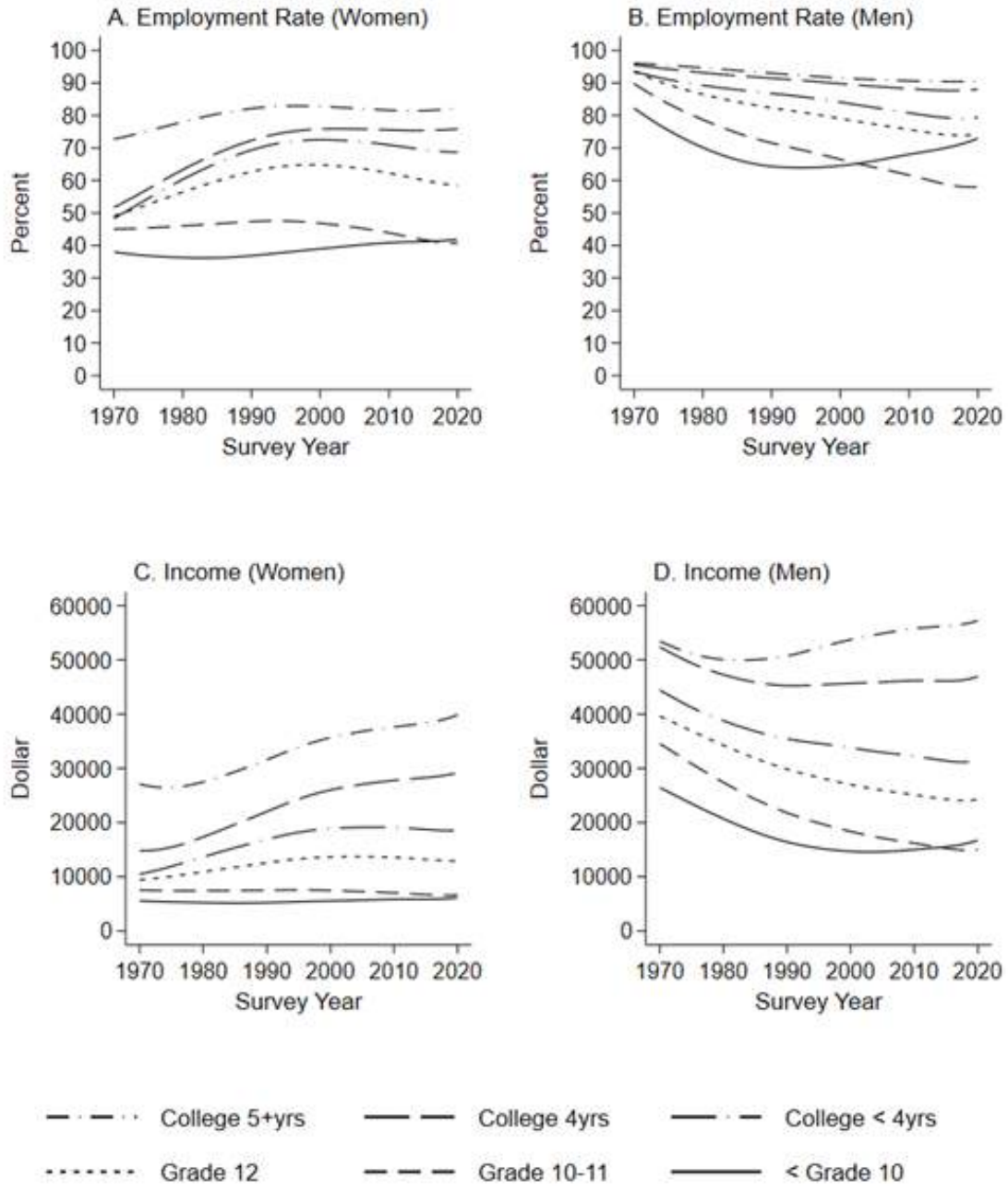
a pattern is more pronounced for women than men. Indeed, the median age at most recent graduate degrees for women has decreased from 35 in the 1970s to 27 in the 1990s (Posselt and Grodsky 2017). This was mostly due to the age reduction among masters and doctoral degrees (author's own calculation). The median age fell only slightly among men over this period.

4.2.2 Changing Educational Gradient in the Labor Market

The extent to which educational assortative mating impacts income inequality between households depends on women's labour market participation or income and how much they are stratified by women's educational level (Breen and Andersen 2012; Breen and Salazar 2011; Schwartz 2013; Sudo 2017). On the one hand, if only a small number of women participate in the labour market or their income level is considerably lower than men's, even the very high level of educational sorting will only have a limited impact on inequality because women with high education will not contribute much to household income. On the other, the association between educational sorting and inequality can be observed only when women with different education behave differently or receive different returns in the labour market. Therefore, I will explore such trends, focusing on comparison among women with different education. Figure 4.3 shows the trend of employment rate (upper two panels) and labour income (lower two panels) by year among men and women aged between 30 and 64 with different education levels.

First, I will focus on the employment rate. Trends for women are consistent with previous studies, showing a sharp increase until the late 1990s (Cohen and Blanchi 1999) and stabilizing or decreasing thereafter (Goldin, Katz, and Kuziemko 2006). However, differences are present by education level. The highest and the lowest educated groups' employment rates have been almost stable, at around 80% and 40% respectively, even before the 2000s. The pattern found in previous studies has thus been driven mostly by three educational categories in the middle, which show different patterns before and after the mid-1990s. Previously, all three categories'

Figure 4.3: Employment Rate and Mean Income for Men and Women by Survey Year (1999 Dollars, smoothened)



Source: Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS)
Note: Samples include individuals aged between 35 and 64; educational attainment is defined in the same way as in Figure 1.

employment rate has shown a steep increase, albeit with varying slopes. However, the pattern has divided since then between the lower two categories and four-year college. Because the rate has stabilized for those with at least four years of college education while decreasing for high school and some college groups, a growing gap has resulted between women with more than four years of college education and the less educated.

It is noteworthy to recall that previous studies have claimed that increases in the labour force participation of wives have mitigated the increase of economic inequality between couples (Cancian and Reed 1998, 1999; Cancian and Schoeni 1998; Daly and Valletta 2006; McCall and Percheski 2010; Pencavel 2006; Treas 1987), by offsetting the effect of the growing number of single-mother households (Albrecht and Albrecht 2007; Nielsen and Alderson 1997; Western et al. 2008). Figure 4.3 implies that this mitigation of inequality by increasing women's labour force participation might have been weakened in the twenty-first century. Meanwhile, a steady decrease in the employment rate with larger slopes for lower educated men (except for the lowest educated men) might still have contributed to inequality in the same period. This trend is in line with previous findings (Jacobs and Gerson 2004), claiming it to have contributed substantially to the growth of family income inequality, especially in the 1970s (Lee 2001).

Trends of labour income, shown in the bottom panels of Figure 4.3, do not contradict the trends of the employment rate. As for the employment rate, there is an educational gradient in mean earnings both among men and women. For women, earnings of the two lowest education levels have been steadily low. The middle two levels (high school and some college) had shown increases by the late 1990s, but they stopped growing thereafter and have maintained the same level, thereby increasing the gap from those who have at least four years of a college education. Meanwhile, the highest two categories display a steady increase even during the recent two decades, while maintaining the gap between them. A gender difference observed in the employment rate is also observed for income. Unlike women, the income of

lower educated men (some college or less education, except for the lowest educated) dropped even in the recent decades. In other words, only men with a bachelor's or graduate degree maintained or increased their income levels in the same period.

4.2.3 Educational Assortative Mating and Inequality in the Twenty-First Century

Two structural changes in education that are important for change in educational homogamy are each education level's size and the gender ratio within each education level (Becker and Jann 2017; Katrňák and Manea 2020). Regarding the former, continuing educational expansion in the past two decades, especially at the top two categories (*College 4yrs* and *College 5+yrs* in Figure 4.1), leads us to predict a higher probability of educational homogamy among college graduates. Studies have suggested that educational expansion rendered school the most important marriage market (Blossfeld 2009; Blossfeld and Timm 2003; Kalmijn 1991a). Notably, the number of women who graduate education surpassed men in the early 2000s, leading to a large reversed gap between women and men by 2020. There are 50% more women than men in this highest education level. Therefore, as more women access higher education, especially the graduate level, and at earlier ages (Figure 4.2), men in college or graduate school have better opportunities to meet their future mate in school than ever before. Along with this increase in the size of similarly-aged men and women in higher education, increasing economic inequality and accompanying segregation between education or income group may have contributed to the decrease in educational heterogamy (Fernandez, Guner, and Knowles 2005; Rytina et al. 1988; Smits, Ultee, and Lammers 1998)

For educational homogamy at the higher education level to increase with educational expansion, men and women need to prefer highly educated partners. Earlier economic theories suggested heterosexual marriage as a trade between two specialized functions – men's breadwinning and women's care work (Becker 1981). From this perspective, unlike women, men with higher education tend to have little in-

centive to prefer a woman who also has higher education. However, empirical studies have provided more support for the opposite claim (England and Farkas 1986; Kalmijn 1991a; Mason and Jensen 1995; Oppenheimer 1994), showing the increasing importance of women's earning power in the marriage market, and that men tend to see these women as more desirable for their future spouse (Buss et al. 2001; Sweeney 2002; Sweeney and Cancian 2004). Since the beginning of the twenty-first century, women with a college education have shown a steadily high rate of labour market participation and continuing increases in their income level (Figure 4.3). Therefore, unless men had changed their preference drastically, we can predict that educational homogamy would have increased at the higher education level, especially at the graduate level, in the past two decades.

Along with the size of the population in higher education, the concentration of educational expansion on women may have impacted educational assortative mating and household income inequality in two senses. First, women's increasing enrolment in higher education has been accompanied by diverging paths between women with at least four years of college education and women with lower education in labour market participation and labour income (Figure 4.3). Therefore, if we suppose an extreme example where all women remain single, inequality between households would increase. However, the divergence is not limited to their own labour market prospects. It is also evident in their chances of getting married or staying in the marriage, leading to a turn of the direction of the educational gradient in marriage from negative to positive by the end of the twentieth century (Budig and Lim 2016; Goldstein and Kenney 2001; Isen and Stevenson 2010; Torr 2011). Studies that stressed the beneficial effects of higher education or income of women in their likelihood of marriage are in the same vein (Cherlin 2009; Goldstein and Kenney 2001; Oppenheimer 1997; Sweeney 2002; Sweeney and Cancian 2004). This gap among women in marriage can also contribute to an increase in household income inequality. Women with high labour market prospects marry disproportionately more and pool their income with their spouse's income, which is usually higher than their

own.

The concentration of educational expansion on women resulted not only in divergence within women but also in a reversal of the gender gap in education (De Hauw, Grow, and Van Bavel 2017; Diprete and Buchmann 2006, 2006; Schofer and Meyer 2005). This reversal could be influential in educational assortative mating because, given that both highly educated men and women compete for similarly high-educated partners (as predicted above), the imbalance of their population size will lead some of the excess group (women with high education in this case) to choose between remaining single or marrying with a man with lower education (De Hauw et al. 2017; Esteve, García-Román, and Permanyer 2012; Qian 1998; Schwartz and Han 2014; Van Bavel, Schwartz, and Esteve 2018). Previous studies stressed that women with higher education tend not to marry men of less education (Blossfeld and Timm 2003; Lichter, Anderson, and Hayward 1995). However, recent studies on the United States and European countries have claimed that highly educated women are more likely to be partnered with a man with less education rather than to remain single, resulting in an increasing number of hypogamy (wives having higher education than their husbands) (De Hauw et al. 2017; Esteve et al. 2012; Schwartz and Han 2014; Schwartz and Mare 2005).

Given that labour market participation and income of women with higher education have been steadily high and increasing for the past two decades and men with lower education have shown the opposite trend, household income inequality could be mitigated if these women and men marry and pool their income. Indeed, Kim and Sakamoto (2017) found that increases in the number of men who marry a woman with higher education (due to the reversal of the educational gender gap in higher education) had led to an improvement of married men's family standard of living. Meanwhile, a few studies presented a slightly different finding. Qian (2017) showed that husbands in hypogamous marriages still earn more than their wives with higher education in the United States. Katrňák and Manea (2020) suggested the possibility that, with educational expansion, highly educated individuals who

do not end up in educationally homogamous mating could represent a sorting on other valuable characteristics, such as social origin.

4.3 Data and Measures

I used the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS) that is available from the Integrated Public Use Microdata Series (IPUMS). From data covering 1996 to 2020, I limited the sample to single-family households headed by a heterosexual couple where the head of the household was between 30 and 64 years old. This includes both married and cohabiting couples but couples where the age gap between partners is more than 25 are excluded from the sample. Each household is treated as a couple or single household based on the presence of a spouse or partner. Therefore, the single household includes not only those who were never married, divorced, separated, or widowed without cohabiting partners but also those who are married but whose spouses are not present in the same household for most of the time, as in cases where the partner is incarcerated. As a result, the number of households for the earlier period (1996-2000) is 153,792 and that for the later period (2016-2000) is 206,823.

Two main variables of interest are education and household income. The education question of the CPS was changed in 1992 to ask about diploma or degree attained. (Previously, it asked about grade completed.) This change not only allows researchers to make precise educational classifications but also allows them to distinguish degree types among graduate degree holders. Based on this information, I used a six-category classification to describe changes in education and labour market participation for the past five decades: $< Grade10$, *Grade 10-11*, *Grade 12*, $college < 4yrs$, *College 4yrs*, and *College 5+yrs*. Because the measurement of education changed during the period of this study, I harmonized different measurements based on the assumption of necessary years of education for each level. For example, all graduate degree holders in 1992 and subsequent years and those who completed more than five years of college education before 1992 were treated the same. *Grade*

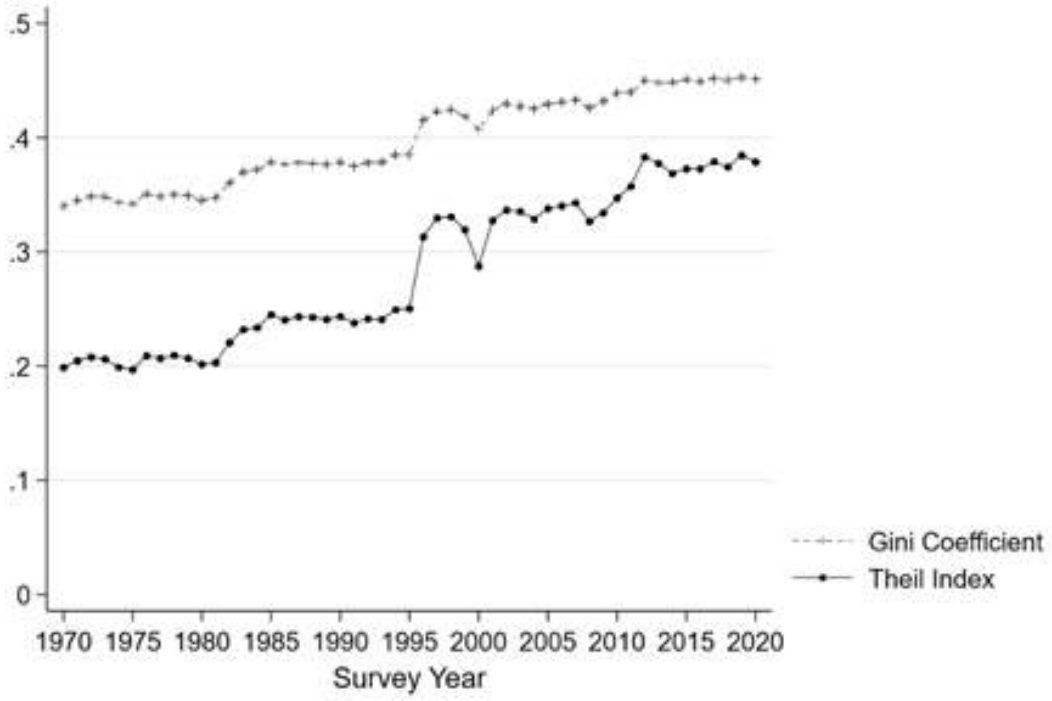
12 includes not only those with a high school diploma but also those who completed the 12^{th} grade but did not attain the diploma.

For main decomposition and counterfactual analyses, I used two types of educational classifications. For the aim of comparison with previous research (Breen and Salazar 2011; Schwartz and Mare 2005), I first used their five-category classification: $<$ *Grade*10, *Grade 10-11*, *Grade 12*, *College* $<$ 4*yrs*, *College 4+yrs*. Next, I used the six-category classification: $<$ *Grade*12, *Grade 12*, *Some College* (including *Associate Degree*), *Bachelor's Degree*, *Master's Degree*, and *Professional or Doctoral Degree*. Here, finer distinctions at the top are introduced to capture more detailed patterns of assortative mating among those with higher education. I amalgamated the lower and the upper two categories, respectively, because very few people were found in the household types where a man's and woman's educations are the opposite extremes (e.g., a household type in which the husband's education is lower than grade 10 and the wife has a doctoral degree). Also, relatively little difference was observed between the amalgamated categories in all factors determining inequality.

I used sums of each partner's pre-tax labour earnings, which includes incomes from wages, salaries, and self-employment (business or farming), as a measure of household income. As in previous studies (Breen and Andersen 2012; Breen and Salazar 2011), the focus of this study lies on testing the effect of changes in sorting on education, which may be the proxy of individual labour earnings. While household income defined only in terms of labour earnings may not fully reflect the extent of economic inequality between households, I excluded other types of income, such as rents or interest, because including them would have required different sets of research questions that take sorting on characteristics other than education into account. Also, labour earnings still make up a large share (on average, 79%) of individual total income. In this study, household income is equivalized by dividing the sum of incomes by the square root of the number of family members and deflated to 1999 US dollars. All negative earnings are set to zero, and they are converted into a very small number for the computation of the Theil indices.

Historically, there were two points where household income inequality rose rapidly in the US: in the early 1980s and in the late 1990s. Since then, household income inequality has grown at a relatively steady pace. The aim of this study is to update previous studies that included the earlier periods of rapid growth in inequality by exclusively focusing on more recent periods characterised by slow increases in inequality. Therefore, I chose two periods for comparison: 1996-2000 and 2016-2020. Because the CPS surveys individuals' income in the previous calendar year, the actual periods compared will be 1995-1999 and 2015-2019.

Figure 4.4: Theil and Gini Indices by Survey Year



4.4 Analysis

Following previous studies (Breen and Andersen 2012; Breen and Salazar 2010, 2011) in the same line of research, this study adopts the Theil index as a measure of inequality. The Theil index meets the conditions required to answer this study's inquiry because it can summarize inequality for the whole distribution of equivalized

household income and can be decomposed into inequality between and within group. More importantly, by using the counterfactual analyses that selectively change elements on which each part of the Theil index depends, we can examine the effect of those elements and their changes on total, within, and between group inequalities. Given that the research question of this study is whether changes in educational assortative mating since the mid-1990s could have affected changes in household income inequality, this decomposability can be useful. Educational assortative mating is reflected in the distribution of household types defined by the combination of man's and woman's education and is one of the elements that determine the total, within, and between group inequalities.

Because I chose two types (five- and six-categories) of educational classifications, the household type is also set to the corresponding two frequency distributions in the 5×5 and 6×6 tables, respectively. An extra category of "absent" is added to the rows and columns of the tables to take single households into account, leading to the 36 and 49 cells that include one cell of mutual absence which is treated as a structural zero. Thus, the number of household type is 35 and 48 for each classification. The single households include not only never married, divorced, separated, or widowed individuals but also those whose partner is not currently in the household (e.g., enlisted or incarcerated partners). Households headed by a couple constitute each household type by the combination of the man's and woman's education, whereas households headed by a single person is classified by their own education.

The Theil index is defined as

$$T = \frac{1}{n} \sum_{i=1}^{n} \frac{x_i}{\bar{x}} \ln \left(\frac{x_i}{\bar{x}} \right) \tag{4.1}$$

Here, x_i is individual earnings, $\overline{x}$ is overall mean earnings, and n is the total number of observations. In the study of household income inequality, x_i is equivalised income of each household, $\overline{x}$ is mean household income of all households, and n is the number of households. The index decomposes into two parts as in (4.2).

$$T = \sum_j p_j \frac{\bar{x}_j}{\bar{x}} \ln\left(\frac{\bar{x}_j}{\bar{x}}\right) + \sum_j p_j \frac{\bar{x}_j}{\bar{x}} T_j \tag{4.2}$$

$$T_j = \frac{1}{n_j} \sum_{i=1}^{n_j} \frac{x_{i|j}}{\bar{x}_j} \ln\left(\frac{x_{i|j}}{\bar{x}_j}\right) \tag{4.3}$$

Applying the equation to the current study, j denotes household type. $\bar{x}$ is overall mean income, $\overline{x_j}$ is mean income of household type j, and p_j is the proportion of j^{th} household type. Lastly, T_j is the Theil value for the within-j^{th} household type inequality and is defined as (4.3), where n_j is the total number of households in the j^{th} household type and $x_{(i|j)}$ is the earnings of the i^{th} household in the j^{th} household type. In (4.2), the first part denotes the between-group inequality which measures, in this study, the difference in the average income between household types, whereas the second part is the within-group inequality which measures the average variation in income within each household type.

$$T = \sum_j p_j \frac{\bar{x}_j}{\sum_j \bar{x}_j p_j} \ln\left(\frac{\bar{x}_j}{\sum_j \bar{x}_j p_j}\right) + \sum_j p_j \frac{\bar{x}_j}{\sum_j \bar{x}_j p_j} T_j \tag{4.4}$$

Given that $\bar{x}$ can be written as the sum of mean income of each household type weighted by the proportion of each household type, (4.2) can be rewritten as (4.4). This shows that the Theil index depends on three elements: the mean earnings of each household type, $\overline{x_j}$, the proportion of each household type, p_j, and the within-group Theil value for each household type, T_j.

To address the primary question on the role of changing educational assortative mating on the increase in household income inequality, I used a series of counterfactual analyses. Given that the Theil index and its between and within components depend on three elements, we can address the question of what would have happened to total, between-household type, and within-household type inequality if only the distribution of household type takes its later (2016-2020) value, while two other elements are held at their earlier (1996-2000) values. This process generates the counterfactual inequality level in the later period. By comparing this counterfac-

tual inequality with observed inequality at two periods, we can examine the extent to which change in the distribution of household types, which reflects the changes in educational assortative mating, affected changes in household income inequality. Based on the above equation (4.4), these counterfactual analyses can be written as (4.5a), (4.5b), and (4.5c), where the numeric subscript denotes each period (1 = 1996-2000 and 2 = 2016-2020).

$$T = \sum_j p_{1j} \frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{1j}} \ln \left(\frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{1j}} \right) + \sum_j p_{1j} \frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{1j}} T_{2j} \tag{4.5a}$$

The first counterfactual allows only the T_j to take its later value, while holding $\overline{x_j}$ and p_j at their 1996-2000 values. The resulting counterfactual inequality lets us examine the potential role of the changes in the within-group income variation in each household type.

$$T = \sum_j p_{1j} \frac{\bar{x}_{2j}}{\sum_j \bar{x}_{2j} p_{1j}} \ln \left(\frac{\bar{x}_{2j}}{\sum_j \bar{x}_{2j} p_{1j}} \right) + \sum_j p_{1j} \frac{\bar{x}_{2j}}{\sum_j \bar{x}_{2j} p_{1j}} T_{1j} \tag{4.5b}$$

The second counterfactual lets the $\overline{x_j}$ take its later value and keeps the other two elements at their earlier values.

$$T = \sum_j p_{2j} \frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{2j}} \ln \left(\frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{2j}} \right) + \sum_j p_{2j} \frac{\bar{x}_{1j}}{\sum_j \bar{x}_{1j} p_{2j}} T_{1j} \tag{4.5c}$$

The final counterfactual (4.5c) is the one that addresses the key research question of the study. It changes the p_j, the proportion of each household type, while holding other two elements at their earlier values.

4.5 Results

4.5.1 Changes in Household Types and Matching Pattern

Table 4.1 shows changes in the composition of household types over the past two decades. The first two rows show the proportion of households headed by a single man or woman, and the third one sums them up. It is noted that while both

single-man and single-woman households headed increased, single-woman households increased by a much smaller extent. This result contrasts with the earlier change (the 1970s-2000s), where similarly substantial increases were observed for both types of single households. The fourth and fifth rows show the proportion of educationally homogamous households out of entire households (fourth row) or couple households (fifth row) based on the five-category educational classification. They show that more than a third of total households are headed by educationally homogamous couples when education was defined rather broadly, and they account for almost 60% of all couple households in 2016-2020.

Table 4.1: Educational Assortative Mating and Household Structure

	1996-2000	2016-2020
Households headed by a single man	13.97	16.45
Households headed by a single woman	22.96	23.53
Households headed by a single person	36.94	39.98
Educationally homogamous households (5-category)	32.94	34.37
Educationally homogamous couples (5-category)	52.23	57.27
Educationally homogamous households (6-category)	29.11	27.34
Educationally homogamous couples (6-category)	46.15	45.55

Table 4.2 shows how educational homogamy changed over the two periods for each education level. First, under the five-category classification (first column), the proportion of heterogamous households decreased by about 10% from 1996-2000 to 2016-2020. The stability of educational homogamy among men and women with some college education is what makes the recent decades different from the earlier decades. Over the period from the 1970s to 2000s, the increase in educational homogamy occurred with educational expansion broadly encompassing lower-level college education. However, since the 1990s, when educational expansion began to be concentrated on four-year colleges and graduate schools, and the increase in attendance of community colleges started to slow down, the pattern of educational homogamy has also followed these changes in educational trends. Lastly, educational homogamy declined at the lower education levels, consisting now a very small pro-

portion of entire households. These figures are the results of the composite effect of several changes: a decrease in the number of men and women with lower educational attainment, a tendency to remain single among lower-educated men and women, and an increase in heterogamous matching to a partner with higher education among the lower-educated individuals.

Changing the educational classification to include finer distinctions at higher education (second column) lowers the proportion of educationally homogamous households, implying the presence of heterogamous mating among individuals by the type of degree they hold within higher education. For example, a couple in which a man with a bachelor's degree marrying a woman with a professional degree is counted as an educationally homogamous household under the five-category classification and assigned to the same household type as bachelor's-bachelor's households. However, under the finer classification, this household is regarded as heterogamous and assigned to a distinct household type. Therefore, the second column of Table 4.2 suggests that finer educational classification allows us to capture additionally the effect of changes in mating patterns between individuals with different types of degrees within higher education and changes in different types of hypogamous mating between college graduates of different degrees and non-graduates.

Table 4.2: Change in the Share of Educationally Homogamous Couples

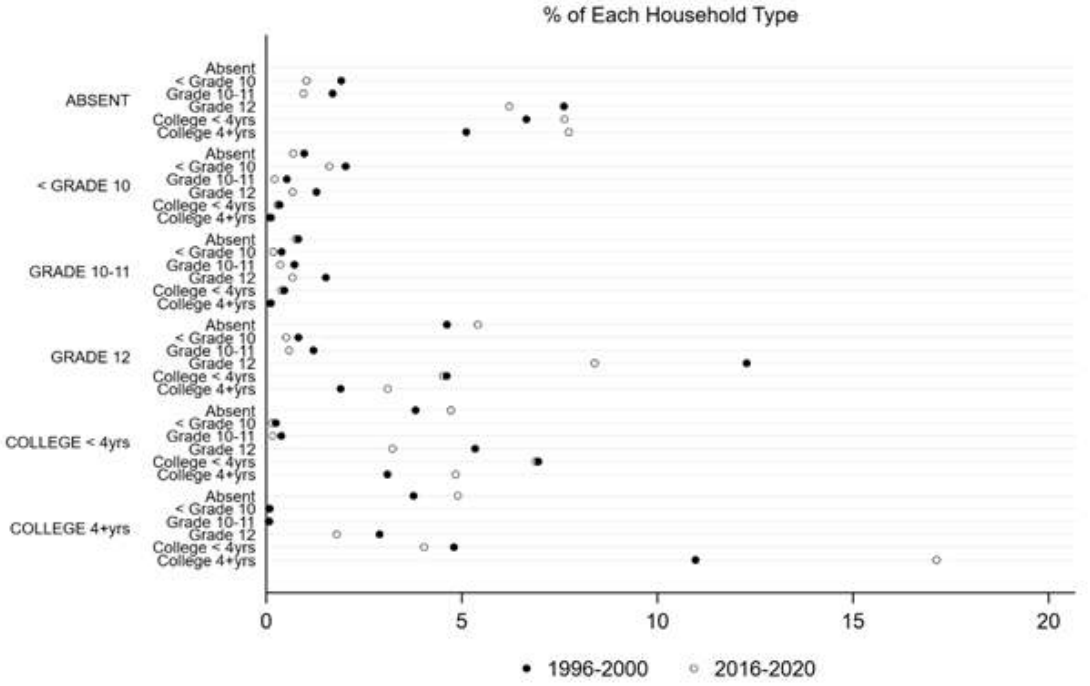
		5-category			7-category		
		1996-2000	2016-2020	*change (%)*	1996-2000	2016-2020	*change (%)*
Heterogamous		47.77	42.73	*-10.55*	53.85	54.45	*1.11*
Homogamous	< Grade 10	3.22	2.68	*-16.77*	5.79	3.92	*-32.30*
	Grade 10-11	1.14	0.60	*-47.37*			
	Grade 12	19.46	13.98	*-28.16*	19.46	13.98	*-28.16*
	Some college	11.02	11.47	*4.08*	11.02	11.47	*4.08*
	Bachelor's	17.39	28.54	*64.12*	7.67	11.37	*48.24*
	Master's				1.64	3.88	*136.59*
	Professional				0.30	0.38	*26.67*
	Doctoral				0.27	0.56	*107.41*
Total		100.00	100.00		100.00	100.00	

Figure 4.5 depicts changing patterns of educational assortative mating more comprehensively and with greater precision. In the figure, each row in the lower

case represents women's education, which are grouped by men's education level in the upper case. Because the filled dot represents the proportion of each household type in the first period and the hollow dot does the same for the second period, a comparison of two dots for each row indicates the changes across two periods. The first notable feature of the comparison is the contrast between the drastic increase in the number of households where both partners have at least a college degree and a sharp decline in the high school-high school households. In line with Table 4.2, the proportion of some college-some college households remains stable. As in the earlier decades, the mating pattern continuously diverged between men with more than high school education and those with lower education. All types of households decreased among men with the two lowest educational attainments, leading to a substantially smaller share of those households in the later period. Meanwhile, among men with more than high school education, the proportion of remaining single and having a college-educated woman as a partner increased. A notable difference from the previous decades is that the substantial increase in the number of households in which a wife has some college education is no longer observed in the recent decades. Figure 4.5 shows a decrease in the number of households with a college graduate husband and a wife of some college education and stability among households with a high school or some college educated husband and a wife of some college education.

Next, Table 4.3 shows the distribution of household types defined by man's and woman's degree type among college graduates in the second period (Panel A) and contributions of each household type to the total increase of household types among college graduates across two periods (Panel B). First, in Panel A, each cell represents the proportion of each household type out of all households. Thus, it shows that almost one-third of all households consist of households with two college graduate partners or with a single college graduate in 2016-2020 (all cells in Panel A sum to 29.74). However, the distribution is not even across different types of degrees. Only 4.2% of all households are headed by at least one professional or doctoral degree holder (all bolded cells in Panel A sums to 4.21).

Figure 4.5: Percentage of Household Types in Both Periods (Women's Education Grouped within Men's Education)



Panel B shows the contribution of each household type to the increase in the number of households headed by college-graduate partners or a single college graduate across two periods (here, all cells in Panel B sum to 100.00). It shows that 87.12% (a sum of bolded cells in Panel B) of such increase was due to the increase in the share of households headed by a couple or a single man or woman whose highest degree is either a bachelor's or a master's degree. Given that economic rewards are stratified within graduate degrees, and the rewards to the master's degree is substantially lower than professional or doctoral degrees (Day and Newburger 2002; Ma, Pender, and Welch 2016), the uneven distribution and disproportionate increase in educational assortative mating among highly educated men and women imply that its disequalising effect can be much weaker than was expected.

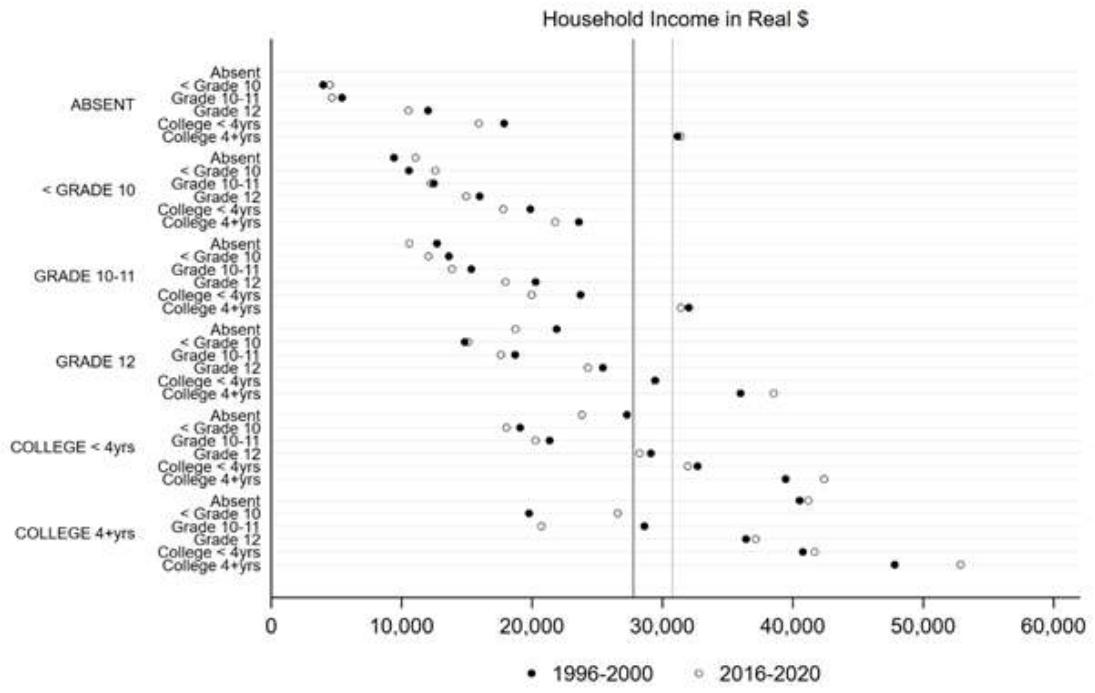
Lastly, Figure 4.6 shows how mean real earnings for each household type have changed across the two periods. Over the previous decades (the 1970s-2000s), earnings dispersion between the household types was the product of changes at upper

Table 4.3: Distribution of Educational Assortative Mating among College Graduates

Men's Education	Women's Education				
	Absent	Bachelor's	Master's	Professional	Doctoral
A. Proportion in 2016-2020 (%)					
Absent	-	4.68	2.44	**0.26**	**0.34**
Bachelor's	3.26	6.82	2.52	**0.21**	**0.30**
Master's	1.20	2.28	2.33	**0.15**	**0.29**
Professional	**0.18**	**0.34**	**0.27**	**0.23**	**0.04**
Doctoral	**0.25**	**0.48**	**0.48**	**0.05**	**0.34**
B. Contribution to Change (%)					
Absent	-	**14.45**	**9.59**	0.67	1.55
Bachelor's	**9.38**	**21.13**	**11.65**	0.85	1.77
Master's	**3.64**	**6.14**	**11.14**	0.53	1.66
Professional	-0.05	-0.31	0.59	0.52	0.11
Doctoral	0.32	1.38	1.62	0.17	1.49

and lower education levels than high school-high school headed households, which showed constant mean earnings. Thus, increased mean earnings of higher-educated households and decreased mean earnings of lower-educated households contributed to the increase of the between-type inequality over those decades. Notably, such an increase in mean earnings in the past was observed across a broad range of college-educated households, including marginally high-educated households (e.g., some college-high school headed households). It is not observed in more recent decades. Figure 4.6 shows that mean earnings of almost all household types have either been constant or decreased. The only exception was households headed by a woman with a bachelor's degree, and in which a man has at least a high school diploma. Thus, the changes in mean earnings in the recent decades do not manifest in a division between the higher- and the lower-educated households. The direction of the change is determined by whether the household is headed by a couple in which a wife has a bachelor's degree. Even if labour incomes of men with a high school or some college education have dropped over the two periods (Figure 4.3), household earnings for men with those education levels have increased if they have a wife with a four-year college education.

Figure 4.6: Mean Real Earnings in Each Household Type



4.5.2 Changes in Inequality

Table 4.4 shows Theil indices and their decompositions into between- and within-household type inequalities for the two periods. Over the past two decades, the Theil index increased by 0.050 points. This increase (14.83%) is much more moderate than the inequality increases in the previous three decades (the 1970s-2000s). Also, the recent decades have not shown a dramatic change in the shape of cross-sectional inequality. As in the earlier decades, a large share of inequality is due to within-type inequality, whereas less than one-third of it stems from between-type inequality. The increasing inequality from 1996-2000 to 2016-2020 is due more to the increase in within-type inequality.

The contributions of household types to each type of inequality in the two periods reveal where inequality has increased. Table 4.5 shows how much different types of households contribute to the between- and within-type inequality for each period. First, Panel A of Table 4.5, contributions of single and couple households to each type of inequality, shows that the increase in between-type inequality mostly came

Table 4.4: Theil Index and Its Components, 1996-2000 and 2016-2020 (5-category classification)

	Theil	Between	Within
1996-2000	0.3386	0.0950	0.2436
2016-2020	0.3888	0.1072	0.2816
Change	0.0502	0.0122	0.0380
As percentages			
1996-2000		0.281	0.719
2016-2020		0.276	0.724

from households headed by a couple (from 0.141 to 0.172). Within-type inequality increased due to both households headed by a couple (from 0.140 to 0.154) and those headed by a single person (from 0.104 to 0.128). Therefore, within-type inequality has increased in all types of households, unlike in the earlier decades (the 1970s-2000s) when it occurred only among the households headed by a single person. Panel B shows the contributions of households with different education levels. It shows that most of the increase in between-type inequality came from households headed by two college graduates. The reason can be found in their increased share of all households (Figure 4.5) and mean earnings (Figure 4.6). Within-type inequality was contributed by households headed by at least one college graduate. Figure 4.7, showing relatively small within-type inequality among these households, suggests the large contribution is more likely due to the increased share of this household type.

4.5.3 The Role of Changes in Educational Assortative Mating on Inequality

Then did the changes in educational assortative mating affect the increase in household income inequality? The answer is provided in Table 4.6. Panel A compares the observed inequality at two periods (first and fifth rows) against counterfactually supposed levels of inequality. For example, the second row shows the result of counterfactual analysis where only the within-group Theil index for each household

Table 4.5: Contribution of Each Household Type to Theil Components

	1996-2000		2016-2020	
	Between	Within	Between	Within
Theil component	**0.0950**	**0.2436**	**0.1072**	**0.2816**
A. Household structure				
Single HH	-0.0457	0.1040	-0.0647	0.1275
Couple HH	0.1407	0.1396	0.1720	0.1541
B. Household-level education				
Low-educ HH	-0.0899	0.0860	-0.0824	0.0683
Mid-educ HH	-0.0037	0.0678	-0.0401	0.0766
High-educ HH	0.0861	0.0618	0.0707	0.0866
Very high-educ HH	0.1025	0.0280	0.1589	0.0501

Note: 'Low-educ HH'-households in which both partners do not have any college education; 'Mid-educ HH'-households in which at least one partner has at least some college education but none of the partners have a bachelor's degree; 'High-educ HH'-households in which only one partner has at least a bachelor's degree; 'Very high-educ HH'-households in which both partners have at least a bachelor's degree; single households are sorted into 'Low-, "Mid-, "High-, 'or 'Very high-educ' household group following the head's own education.

type, T_j, takes its value in 2016-2020, and both mean earnings, $\overline{x_j}$, and distribution of household types, p_j, take their values in 1996-2000. Changing only the Theil indices of each household type thus changes only within-type inequality (from 0.2436 to 0.3073). This increase surpasses the observed within-type inequality in 2016-2020 (0.2816).

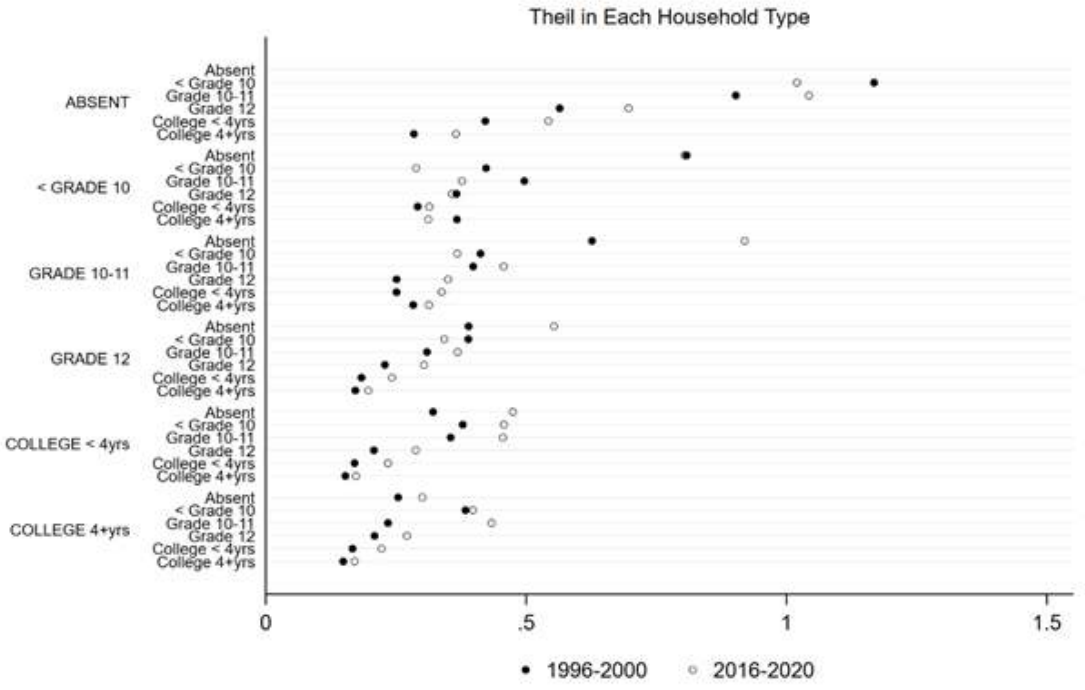
Table 4.6: Counterfactual Analyses

	5-category			6-category		
	Theil	Between	Within	Theil	Between	Within
A. Basic counterfactuals:						
1996-2000 observed	**0.3386**	**0.0950**	**0.2436**	**0.3386**	**0.0963**	**0.2423**
Change within-group Theil T_j	0.4023	0.0950	0.3073	0.4018	0.0963	0.3055
Change mean earnings $\overline{x}_j$	0.3571	0.1187	0.2383	0.3577	0.1210	0.2366
Change p_j	0.3130	0.0819	0.2311	0.3124	0.0844	0.2280
2016-2020 observed	**0.3888**	**0.1072**	**0.2816**	**0.3888**	**0.1107**	**0.2781**
Change T_j and $\overline{x}_j$ (keep p_j)	0.4175	0.1187	0.2988	0.4181	0.1210	0.2970
Change T_j and p_j (keep $\overline{x}_j$)	0.3728	0.0819	0.2909	0.3717	0.0844	0.2874
Change p_j and $\overline{x}_j$ (keep T_j)	0.3324	0.1072	0.2252	0.3327	0.1107	0.2219
B. Decomposing the distribution of p_j:						
Change distribution of couples only	0.3222	0.0914	0.2308	0.3217	0.0940	0.2277
Change educational homogamy only	0.3176	0.0862	0.2314	0.3155	0.0874	0.2282
Change marginal distributions of education only	0.3129	0.0817	0.2312	0.3114	0.0835	0.2279
Change husband-wife association only	0.3378	0.0943	0.2435	0.3382	0.0959	0.2423

Figure 4.7 shows the reason for such a large counterfactual inequality. Following the format of Figures 4.5 and 4.6, Figure 4.7 shows the within-type Theil indices of

each household type defined by woman's education (lower case) grouped by man's education (upper case) for two periods. The most pronounced change in the figure indicates that the Theil index has increased for almost all household types over the past two decades, and this led to an increase of overall within-type inequality. As in the previous decades, a large increase in Theil indices is observed among households headed by a single person, but more so in the middle education levels (*Grade 10-11*, *Grade 12*, and *College* $<$ *4yrs*) than in the two extreme levels ($<$ *Grade*10 and *College 4+yrs*). Among couples, especially when a man's education is a high school or higher, the Theil indices and their changing patterns are very similar. They increase as woman's education decreases but are affected little by man's education. Over the periods, Theil indices have increased more among couple households in which wife's education is lower.

Figure 4.7: Theil Value for Each Household Type



On the other hand, changing only the mean earnings (third row) affects mostly between-type inequality (from 0.0950 to 0.1187). This increase also exceeds the observed level of between-type inequality (0.1072) as was also the case in the earlier

decades, but the mechanism has changed slightly. As was shown in Figure 4.5, for the recent two decades, increase in substantial mean earnings occurred only when wives were college graduates, conditioning on husbands' education that are high school or higher. In the previous decades, earnings increased across a broad range of high-educated households. Therefore, it is highly likely that the recent increase in between-type inequality was mostly due to the rise in pooled income due to the increased contribution by college graduate women.

The third counterfactual analysis is the one that will answer the primary question of this study: the counterfactual level of inequality is 0.3130 when only p_j, the distribution of household types, is changed and both mean earnings and the Theil indices of each household type are held constant. This counterfactual inequality is even lower than the one observed in the previous period (1996-2000), both in between-type and within-type inequalities. Therefore, as in the earlier decades, changes in educational assortative mating over the recent two decades have been more likely to restrict the growth of inequality rather than to boost it. Slightly different counterfactual analyses corroborate this effect. If the distribution of household type is kept at its level in 1996-2000 and both mean earnings and Theil indices of each household type (sixth row) are changed, the counterfactual inequality (0.4175) is 7.38% higher than the observed one in 2016-2020 (0.3888). On the other hand, if the p_j along with T_j or $\overline{x_j}$ is changed, the counterfactual inequality is lower than when only the T_j or $\overline{x_j}$ was changed (T_j: from 0.4023 to 0.3728; $\overline{x_j}$: from 0.3571 to 0.3324).

Panel B distinguishes the change in the distribution of household type into two distinct mechanisms: changes in the propensity to marry or cohabit and those in educational assortative mating among couples. The first row of Panel B shows results from changing educational assortative mating among couples, and not propensity to have a partnership. The second row, again, changes only the distribution of the homogamous couples to take their later values to see their effect on inequality. In both cases, the counterfactual inequalities are smaller than those observed in 1996-2000. Finally, changes in assortative mating can be driven not only by changes in

the association between husband's and wife's education but also by changes in the marginal distribution of men's and women's educational attainment. The last row shows that changing the propensity of people to marry or cohabit with someone with a specific education level has little effect on inequality. Meanwhile, changing the marginal distribution of education only results in inequality that is close to the counterfactual inequality when we change the distribution of household type (third row of Panel A). Therefore, the distribution of household type was mostly driven by changes in the marginal distribution of men's and women's educational attainment.

Table 4.7: . Counterfactual Analyses for Three Income Groups

	Low-income Households			Mid-income Households			High-income Households		
	Theil	Between	Within	Theil	Between	Within	Theil	Between	Within
A. Basic counterfactuals:									
1996-2000 observed	**0.54087**	**0.03411**	**0.50676**	**0.02257**	**0.00094**	**0.02163**	**0.04928**	**0.00510**	**0.04417**
Change within-group Theil T_j	0.63483	0.03411	0.60072	0.02946	0.00094	0.02852	0.05471	0.00510	0.04960
Change mean earnings $\bar{x}_j$	0.54587	0.04419	0.50168	0.02336	0.00175	0.02161	0.04940	0.00523	0.04417
Change p_j	0.53577	0.02717	0.50860	0.02216	0.00088	0.02128	0.05091	0.00512	0.04579
2016-2020 observed	**0.64835**	**0.03864**	**0.60971**	**0.02971**	**0.00172**	**0.02799**	**0.05645**	**0.00510**	**0.05135**
Change between two periods (%)	(19.87)	(13.28)	(20.32)	(31.64)	(82.99)	(29.41)	(14.56)	(-0.10)	(16.25)
Change T_j and $\bar{x}_j$ (keep p_j)	0.62495	0.04419	0.58076	0.03025	0.00175	0.02850	0.05487	0.00523	0.04964
Change T_j and p_j (keep $\bar{x}_j$)	0.65683	0.02717	0.62966	0.02890	0.00088	0.02802	0.05645	0.00512	0.05133
Change p_j and $\bar{x}_j$ (keep T_j)	0.54087	0.03864	0.50223	0.02298	0.00172	0.02126	0.05088	0.00510	0.04578
B. Decomposing the distribution of p_j:									
Change distribution of couples only	0.54564	0.03280	0.51284	0.02227	0.00100	0.02128	0.05098	0.00529	0.04569
Change educational homogamy only	0.54288	0.03122	0.51166	0.02217	0.00088	0.02129	0.05094	0.00516	0.04578
Change marginal distributions of education only	0.54056	0.02949	0.51107	0.02214	0.00087	0.02127	0.05077	0.00503	0.04574
Change husband-wife association only	0.53490	0.03107	0.50383	0.02259	0.00096	0.02163	0.04946	0.00521	0.04425

Table 4.7 shows the results from precisely the same counterfactual analyses as those in Table 4.6, with one difference: analyses were conducted separately for low-, middle-, and high-income groups. These analyses were to address whether effects of changes in educational assortative mating appear differently at different points of the income distribution and they offset each other. Given that a relatively larger proportion of high earners are the highly educated, the increase in the number of women with a bachelor's or graduate degree could have had a disproportionately large impact on mating patterns among high earners. In particular, the large income growth among professional or doctoral degree holders over decades leads us to question whether the rise in the number of households led by a man and woman with these types of degrees has increased inequality among high-earning households. Although Table 4.6 showed that introducing a finely categorized educational clas-

sification did not reveal the effect of changes in educational assortative mating on inequality increase, it is still possible that such an impact at the top of the income distribution was hidden by the opposite impact of changing educational assortative mating at other points of the income distribution.

Table 4.7 shows that most of the income inequalities were due to within-household type inequality at all income levels for both periods. Also, over the past two decades, inequality grew at all points of the income distribution. However, no evidence of the disequalising effect of educational sorting at the top of the income distribution was found. At all income levels, the counterfactual inequality was not very different from the one observed in the previous period when the p_j was held to its 2016-2020 value with both T_j and $\overline{x_j}$ held at their previous value. Also, in Panel B, as in Table 4.6, changing marginal distribution only produced more similar counterfactual inequalities to the ones where only the $p_j s$ took their later values than changing the husband-wife association only. This result suggests that the changes in educational assortative mating at all income levels were driven mostly by the marginal distribution of men's and women's educational level.

4.6 Discussion

Despite concerns about the role of educational assortative mating on the increase in inequality across household incomes in the US, studies in recent decades have found no significant disequalising effect of educational assortative mating (Boertien and Permanyer 2019; Breen and Salazar 2010, 2011; Eika et al. 2019; Western et al. 2008). However, most of these studies were based on prolonged periods, potentially capturing mostly the most pronounced inequality pattern at a specific point in time. My study, in contrast, focuses on two recent decades to explore the role of educational sorting on inequality in the twenty-first century. Although household income inequality has increased moderately in recent decades, changes in educational and labour market distribution point to the possibility that they brought about changes in educational assortative mating and their impacts on inequality.

Disproportionately large and increasing numbers of women college graduates and growing within-women gaps in the labour market along this line of four-year college education suggest both equalising and disequalising effects are possible.

The results suggest that earnings inequality has increased both between household types and within each household type in the twenty-first century, albeit less dramatically than before. Among the contributing factors, most of the increase was due to growth in the variance of income within each household type defined by the composition of a man's and woman's education. The reason is evident in Figure 4.6, which shows increases in Theil indices over two decades for almost all household types. Breen and Salazar (2011) suggested the possibility that an educational classification that better reflects educational differentiation could capture some of this within-type variance. The present study tested this suggestion by introducing a classification with finer categories within higher education. If they capture some of the within-type variance, they should increase between-type inequality while decreasing the within-type one, compared to the results under previous educational classification. But Table 4.6 shows little change between the two classifications, suggesting that the new classification does not explain better the within-type income variance. Therefore, other earnings-related factors that are heterogeneous within the same household types defined by man's and woman's education may be more responsible for the increase in within-type variance.

The increase in between-household type inequality is largely due to the diverging patterns between college-educated households and others. More specifically, over the periods, average earnings have increased for households headed by a woman with a bachelor's degree and a man with at least a high school education, whereas almost all other household types have experienced decreases in earnings. This is also the case for households led by a single person. Average earnings have changed little for college graduate single men and women but have decreased for less-educated single households. In the twenty-first century, patterns in earnings are divided along the line of four-year college education (i.e., whether wife has a four-year college

education), whereas earnings increases were also observed among marginally high-educated households in previous decades.

Educational assortative mating affects inequality by reweighting within- and between-household type inequality. The results suggest that changes in educational assortative mating did not contribute to the increase in household inequality in the twenty-first century. Rather, they have mitigated the increase in inequality. The counterfactual inequality level was much higher than what was observed in 2016-2000 when only the distribution was held at the 1996-2000 level, while keeping both mean earnings and Theil index at their 2016-2000 level. The results suggest two possible reasons for this mitigating role of the distributional changes. First, the reversal of the gender gap in participation in higher education has led to an increase in women's marrying down, rather than staying single, over this period and a substantial increase was observed in these households' mean earnings. Moreover, including these hypogamous households, the proportion of highly educated households with at least one college graduate partner, where the least increase in within-type inequality was observed, has increased. In contrast, the number of households with less than some college-some college education, where a substantial decrease in mean earnings was observed, has decreased. Therefore, in the later period, increased weights are allocated to those households that contributed less to inequality increase.

Although the results indicate that the change in educational assortative mating has had little effect on the overall increase in household earnings inequality, it is still possible that impacts are observable only at a specific point in the distribution. For instance, given a disproportionately large number of the highly educated among high earners and the high level of labour market participation and earnings for both men and women in this group, increases in educational sorting might have played a disequalising role in this high-earning group. In particular, the increase in the number of households led by a couple in which both a man and woman have a graduate degree could have a larger weight in this subgroup. However, the results do not support this hypothesis, showing a very similar trend for all subgroups in the

household earnings distribution. One possible explanation can be found in the fact that my analytic sample dropped the top 2% of the household income distribution. If earnings inequality in the twenty-first century has been driven by those at the very top of the income distribution, it is possible that my sample failed to capture the pronounced inequality change and thereby the role of educational sorting on it.

The current research, both its findings and limitations, sheds lights on several promising lines of future research. First, the results suggest that the source of the increase in inequality could have been much harder to capture through conventional survey data in the twenty-first century. For example, Guvenen and Kaplan (2017) claimed that, in the twenty-first century, an increase in the top income share has been concentrated on capital incomes (e.g., income through a partnership for lawyers) at the very top (e.g., top 0.01%) of the income distribution. If this is the case, future research will require a large sample or population data that include both labour and capital income and is free from top coding. Second, for the lower 98% of the population, my findings showed that most of the increase in earnings inequality was due to increasing within-type inequality, which has increased disproportionately among lower-educated households. Therefore, more research on factors that determine income divides among these households will be necessary. Third, although educational assortative mating has little impact on the increase in income inequality, its effect on subsequent generations' achievements could be more pronounced. For example, college-college couples can differ greatly from college-lower couples in their values or behaviour towards their children's education. Lastly, a related line of research could examine the patterns and effects of educational sorting induced by the reversed gender gap in education.

Chapter 5

Conclusion

5.1 Summary and Implications

Although educational expansion and increased access to higher education in recent decades might have been expected to improve individual socioeconomic outcomes and reduce inequalities, the reality has been quite different. On the one hand, this might be because people's access to or benefits from higher education could differ according to their ascribed characteristics, and thus socioeconomic inequalities associated with such characteristics would remain, even among the highly educated. On the other hand, it might be because steeper growth in economic returns to a college education than lower education could expand the gap between college graduates and the less educated. This gap could further expand when those highly educated individuals prefer the similarly highly educated and pool their incomes at a household level.

Three chapters of my thesis address questions relevant to each of these concerns. The first two chapters seek to provide answers to the first concern (inequality within college graduates), and the third chapter examines the other (inequality between college graduates and others). Although both concerns are rooted in the same social phenomenon of educational expansion, it is important to note that they have formed distinct research traditions in sociology, focusing on different types of inequalities. Therefore, each chapter's key findings and their contributions need to be discussed within each research tradition and the distinct literature that each chapter drew on.

The first two chapters provide evidence of social origin's role in generating gaps in socioeconomic outcomes among people with the same educational attainment. In particular, results from the first chapter showed that social origin gaps are present among the highly educated in highly credentialised sectors in the labour market, just as much as they are among the less educated and in other sectors. Those gaps remained substantial and statistically significant when comparing individuals who graduated from colleges of the same selectivity and with the same academic performance. This finding implies that social origin can affect individuals far beyond their access to education, and this is also true among the very highly educated. For example, chapter two shows various mechanisms through which postgraduate degree holders from different social origins divide at different points in their progress through higher education and consequently have occupations of varying status. Overall, findings from these two chapters corroborate the first concerns over higher education and inequality.

A major methodological question addressed in these two chapters is how we can better understand the patterns or mechanisms of such (in)equality among people of different origins but with similar education. To grasp patterns or mechanisms of within-education inequality is challenging because most of the currently available datasets with a sufficient sample size for each education group do not provide the kind of rich measures that we can use to examine more than the gap itself. Because of this difficulty, most of the evidence on how social origin generates inequality in higher education or beyond college depends on qualitative research methods. Therefore, one of the first two chapters' primary aims was to identify strategic approaches and key elements necessary for studying patterns and mechanisms of inequality within education groups and potential interpretations that we can draw from those studies.

The first chapter showed that taking heterogeneity into account is one way to unveil mechanisms of inequality. Three sources of heterogeneity identified in the chapter regarding social origin inequality in the labour market were educational attainment, characteristics of the labour market sector, and the type of socioeconomic

outcome. Results show that incorporating three sources of heterogeneity provide better descriptions of the social origin gaps. More importantly, by intersecting education and labour market sectors and jointly considering different inequality patterns for each outcome, it is possible to identify where the social origin gaps are apparent and where higher education potentially functions as an equaliser. The key element that allowed a meaningful interpretation to be drawn from this approach was the availability of measures for detailed credential characteristics for college graduates, such as institutional selectivity, subject area, or academic performance. Overall, this approach advances previous mainstream research in the area by focusing on different implications of inequality in occupational access and earnings instead of dealing with them in separate analyses of different socioeconomic outcomes.

The second chapter suggests an analysis of multinomial transitions in educational careers between socioeconomic origins and destinations as another way to identify within-education inequality mechanisms, especially among those with a postgraduate degree. As in the first chapter, this education group has been understudied because widely used panel data sets that include rich education measures do not have a sufficiently large sample of this population. The chapter showed that large-scale cross-sectional data that introduced a few key measures from individuals' educational careers and measures of socioeconomic origins and destinations could provide an alternative approach. Using this opportunity, the second chapter identified how educational pathways that vary by one's social origin and gender explain the association between socioeconomic origin and destination.

While the first two chapters' focus was on capturing inequalities among those with a college education, the third chapter examined how changes in education and family formation processes might affect growing economic inequality between households. Although previous studies (mostly from the US) have suggested that the increase in educational assortative mating did not have a substantial or significant impact on inequality, changes in education and the labour market in recent decades called for the use of more recent data. Moreover, because the new data provides

finer educational classifications, especially at the higher levels of education, the role of educational differentiation at the top in growing inequality could be tested. The results were in line with previous conclusions, supporting the claim that the propensity to sort on education has not increased substantially and that changes in the distribution of households with different education levels have not contributed to the increase in economic inequality, at least for the lower 98 percentiles of the household income distribution.

5.2 Directions of Future Research

As was mentioned earlier, the first two chapters and the last chapter have their roots in different research traditions and make distinct contributions to each literature. However, joint consideration of the two lines of research gives us one important implication for future research on higher education and inequality. Studies of the gaps among the highly educated have mostly focused on individual socioeconomic outcomes, leaving marriage aside. Likewise, studies of the role of sorting on education in economic inequality have mostly focused on individuals' education or earnings, leaving their socioeconomic origins aside.

The third chapter showed that (1) a substantial number of the highly educated are in a heterogamous marriage, (2) individuals' household income varies not only by their own education but also by their partner's education, (3) there is a considerable variation in household income within the household type defined by husband's and wife's education. These findings raise the question of the role of socioeconomic origin as a determinant of marriage or labour market behaviours within the marital relationship, as well as a determinant of men's and women's economic prospects or behaviours over and beyond their educational attainment. Although a handful of studies on intergenerational association considered household income as an outcome measure, marriage has rarely been taken into account in studies on origin gaps among college graduates.

This approach would be especially relevant to studying inequality among women

college graduates. In the first two chapters, the extent and mechanisms of the social origin gap in socioeconomic outcomes were mostly similar between men and women. However, it is important to note that the selection into employment becomes a more serious issue for women than men. Because I only estimated the gaps among women who participated in the labour market, a substantial part of economic inequalities among women is left in a black box. To open this black box and to fully capture economic inequality among women, their partner's education, income, and socioeconomic origins will need to be included in the analytic frame. Given that the thesis only concerned labour income, marriage may matter more when other types of income or wealth, which could be affected more by one's origin, are considered.

Lastly, there are two limitations in the thesis that are relevant for future research on the relationship between higher education and inequality. The first limitation is a selection issue. Although my thesis does not aim to make causal inferences regarding the effect of higher education on inequalities or socioeconomic outcomes, not being able to address heterogeneous selection into college or postgraduate education still leaves some important questions unanswered. For example, even if there are no significant gaps in occupational access between college graduates from different origins, we cannot claim that this is because they get equal returns for their abilities or efforts. This remains an issue even when detailed degree characteristics (e.g., institutional selectivity, subject areas, or academic performance in college) are held constant. We cannot exclude the possibility that students from different origins systematically differ in properties that affect their future socioeconomic outcomes, even when they are similar on a range of measured educational characteristics. To address this issue, rich measures of pre-college characteristics that affect college attendance and post-college socioeconomic outcomes are needed.

The second limitation that applies to all three chapters is that they all covered a wide age range, leaving the possibility of cohort differences unanswered. The large age band could be problematic, especially in the study of higher education, because the sample including those who attended college before and after educa-

tional expansion can hide or bias some cohort-specific patterns. Previous studies of cohort differences in the origin gaps in college graduates' socioeconomic outcomes are inconclusive. More remains to be uncovered, especially regarding changes in social origin gaps, by introducing a cohort perspective into future research. This is also the case for the third chapter. Because the sample includes some older cohorts who had most likely married before the changes in the recent two decades occurred, analyses would benefit from using a subsample of a narrower age band.

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