# Social Mobility over Three Generations in Britain 

A Thesis submitted to the University of Manchester for the degree of Doctor of Philosophy in the Faculty of Humanities

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2017
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#### Abstract

The University of Manchester Min Zhang Doctor of Philosophy Social mobility over three generations in Britain September 2017


Social mobility has been extensively documented based on two-generational associations. Whereas a few studies suggest that the approach related to social inequalities should be open to multigenerational associations, the topic of social mobility over multiple generations is still at its blooming stage. Very little is known about multigenerational effects on education in Britain and about empirical evidence of the mechanisms that underlie multigenerational effects.

Drawing on the British Household Panel Survey and the UK Longitudinal Household Study, this thesis examines social mobility over three generations in Britain. The central aims of the thesis are to explore direct grandparental effects on grandchildren's educational and class attainments independent of parental influences. In particular, it focuses on mechanisms through which grandparental effects operate. The thesis finds that grandparental class is significantly associated with grandchildren's educational achievement, despite parental class, parental education, and parental wealth being taken into account. Regarding the mechanisms, the evidence suggests first that the impacts of grandparental class on education remain even though grandparents have passed away at the time of the survey, and second that the impacts disappear only when grandparents have only infrequent contact with the family. Furthermore, I find that grandparental effects are significantly stronger on grandchildren originating from advantaged parents than on those from disadvantaged parents, indicating the strong persistence of inequalities at the top of social stratification.

The research also highlights significant, albeit modest, effects of grandparental class on grandchildren's class attainment over and above parental influences. For grandsons, maternal grandparental class still matters even after grandsons' education has been controlled for. In particular, self-employed grandparents have a strong impact on grandsons' likelihood of engagement in self-employment, a pattern that holds true even when parents are not self-employed. For granddaughters, neither paternal nor maternal grandparental class is found to have a direct substantial impact on granddaughters' class after granddaughters' education has been controlled for.

The thesis suggests that the conventional social mobility approach based on parentchild associations may overestimate the effects of parental characteristics and underestimate the effects of family origins. Family advantages run deep; they are maintained over generations in Britain.

## Declaration

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## Acknowledgement

I would first like to thank the Social Change Scholarship, which has allowed me to undertake this research.

I am sincerely grateful to my supervisors, Professor Yaojun Li and Professor Anthony Heath, for all the constructive suggestions and encouragement they offered me throughout this PhD project.

Thank you to my friends in the UK, Haley, Yizhang, Magda, Frensis, and Nan. Thank you, Dey, for everything.

Thank you, so much, to my parents who always support me in any way they can. Without your support, this PhD would have been impossible.

## Publications

Sections of the literate review and empirical work from Chapter 4 and Chapter 6 have recently been submitted to peer-review journals. They are under review at the time of submission.

Zhang, M., Li, Y., 2017, Family fortunes: the persisting grandparents effects in contemporary British. Social Science Research

## Presentations

2017 Understanding Society Scientific Conference, Essex; Grandparental Effects on Education in Britain: Mechanisms of multigenerational influences [Available online: DOI: 10.13140/RG.2.2.32103.75681]

2017 British Sociological Association Annual Conference, Manchester; Do grandparents matter? Three-generational social mobility in Britain

2016 Politics of Marginalised Groups in the UK and Iceland, Manchester; A Long Helpful Hand: Grandparental Role on Grandchildren's Educational Attainment in Britain [Available online: DOI: 10.13140/RG.2.2.35666.76485]

2016 British Sociological Association Annual Conference, Birmingham; A Long Helpful Hand: Grandparental Role on Grandchildren's Educational Attainment in Britain

2015 Understanding Society Scientific Conference, Essex; Social mobility of three generations in Britain [Available online: DOI: 10.13140/RG.2.2.21406.13126]

2015 British Sociological Association Annual Conference, Glasgow; Social mobility over three generations in Britain [Available online:
DOI:10.13140/RG.2.2.11339.80164]
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## Chapter 1 Introduction

### 1.1 Introduction

Social mobility is the cornerstone of an open society. In western countries, liberals tend to endorse the theories of social justice that emphasise equality of opportunity: regardless of their family origins, gender, or race, individuals with equal skills and efforts should be equally rewarded. A great amount of social mobility may serve as a safety valve, reducing the pressure of class conflicts and struggles (Goldthorpe, 1987; Heath, 1981); it gives individuals, particular the working-class, the hope of a bright future for themselves and their offspring. Following the 2015 election victory, David Cameron delivered his speech: 'we can make Britain a place where a good life is in reach for everyone who is willing to work and do the right thing' (Cameron, 2015). After Theresa May became the Prime Minister in 2016, she wrote that 'we will create a fairer society by breaking down the barriers of privilege and making Britain a great meritocracy where success is defined by work and talent, not birth or circumstance'(May, 2017). But as seen from numerous reports and articles, this goal is a long way for Britain today. The government has sought to diminish the gap in education and the labour market between those from advantaged and disadvantaged families, but so far it has achieved only partial success. The Social Mobility Commission in the most recent State of Nation 2016 Report warned that 'Britain has a deep social mobility problem... for this generation of young people in particular, it is getting worse not better' (Social Mobility Commission, 2016, p.iii). Britain's international income mobility is also found to be significantly lower than Nordic countries and Canada (Blanden, Gregg and Machin, 2005).

The essential question in social mobility concerns the associations between family origins and individuals' destinations: to what extent do family origins shape the offspring's attainments in education, class, and wealth? Research in social mobility typically focuses attention on adjacent generations, that is, socioeconomic inheritance from parents to children. Mare in his influential paper (Mare, 2011) has challenged this approach and warned that without testing multi-generational associations, social mobility research may have underestimated the magnitude of family origins and misinterpreted the channels through which family advantages are passed on. Mare argues that the effects of family origins may be multigenerational, and therefore an empirical demonstration of two-generational social mobility may not suffice. Where attention is focused solely on the parents-related components of family origin, the neglect of grandparents' social position that have direct influences on the offspring would omit an important driver of intergenerational reproduction of family-based social inequality. Taking a three-generational view of inequality enables the social mobility research to examine the influences of grandparents, which would have been concealed in the two-generational studies.

This thesis aims to examine the persistence of inequalities in education and class over three generations and to appraise the existence of independent effects of grandparental class. This thesis focuses on the questions of whether grandparental class is directly associated with grandchildren's education and class attainments over and above parental characteristics. Research in multigenerational influences is still in its infancy stage, and empirical quantitative analyses in Britain are far and few between. One of the important contributions of this study is to make systematic analyses on three-generational mobility in Britain and to gain a deep insight into the
mechanisms through which grandparental effects operate on grandchildren's educational and occupational attainment.

### 1.1.1 Chapter structure

Section 1.2 discusses social mobility in parent-child associations, particularly the process of how education plays a crucial role in social mobility. The discussion outlines the basic concepts and important findings in studies on social mobility, which serve as a foundation for the exploration of three-generational mobility. This section establishes a baseline understanding of the effects of family origins on individuals' social attainments. In Section 1.3 I shall argue that parent-child associations may be not adequate to capture the impacts of family origins and specify the role of grandparental effects in a paradigm of three-generational mobility. Section 1.4 reviews previous findings on three-generational mobility in various social contexts. In particular, this section shows that grandparents may have impacts on grandchildren's educational and class attainment at different life stages, from kindergarten to the age of occupational maturity.

Section 1.5 discusses potential mechanisms through which grandparents-grandchild associations operate. These mechanisms explain why grandparents may have direct effects on grandchildren's achievements at different life stages. Section 1.6 focuses on causal inference of grandparental effects. Section 1.7 highlights the research motives. Section 1.8 presents the thesis structure and outlines the research questions of each empirical chapter.

### 1.2 Social mobility: parent-child associations

Being so near to the heart of social justice and social inequalities, social mobility has been a very lively topic in sociology. Research on social mobility has undergone long heated debates on 'the meritocracy thesis' (e.g., Young, 1958, Saunders, 1995; Marshall and Swift, 1996; Breen and Goldthorpe, 1999), the trend of changes over time (Blanden, et al., 2004; Goldthorpe and Mills, 2004; Breen, 2004; Breen, et al., 2009; Li and Devine, 2011; Li and Devine, 2014; Devine and Li, 2013; Li and Heath, 2016), cross-national difference (Erikson and Goldthorpe, 1992; Breen and Jonsson, 2005; Shavit, 2007), ethnicity inequalities (e.g., Li and Heath, 2016), and theoretical explanations for family transfer (DiMaggio, 1982; Bourdieu, 1986; Becker and Tomes, 1986; Lareau, 1987; Breen and Goldthorpe, 1997; Goldthorpe, 2007;). This section outlines current understanding of parent-child social mobility and family influences on education. It describes the underlying mechanisms through which family origins exercise their influences and provides a good foundation for the following empirical chapters on grandparental effects on grandchildren's educational and class attainments.

A social class approach is widely used to measure movements from parents to children within a social class structure. The concept of social class in social mobility research should not be confused with class identity and class struggle; social class here does not imply ideological awareness or collective actions that Marxist and the argument of 'death of class' (e.g., Beck, 2002) suggest. Instead, the concept of social class in social mobility represents the forms of social inequalities in economic resources that are most consequential for individuals' life chances and life choices (Goldthorpe, 2016a).

In social mobility research, it is crucial to distinguish absolute mobility and relative mobility (Goldthorpe, 2013). Absolute mobility describes the extent to which individuals stay in their class origins or move upward or downward within a class structure. Social changes that were characterised by the growth of service industry and contracting of agricultural and manufacturing sectors in the middle decades of the last century produced high demands for professionally and managerially qualified labour forces and reduced the reliance on unskilful manual occupations. As a result, the rise of the salariat and the corresponding decline of the working class created more 'room at the top' and significantly transformed the amount and pattern of social mobility in terms of absolute mobility rates. Research has found that while upward mobility among men has increased during this 'Golden Age’ (e.g., Goldthorpe, 1987), it began to level out (Goldthorpe and Jackson, 2007) or shows a slightly declining trend from the 1970s onward (Li and Devine, 2011).

Relative mobility rates are appreciated for its merit of being independent of upgrading of class structures; they describe the associations between parental class and children's class attainment net of class structural changes. Relative mobility rates, as usually represented by odds ratios, refer to the chance of individuals of different parental class arriving at one rather than the other class position. Absolute mobility and relative mobility will be discussed in methodological details in the chapter on data and methods. Researchers typically utilise absolute mobility rates that represent actual parents-to-child movements within the class structure and relative mobility rates that account for the openness of societies to examine class mobility over time or cross-national comparative studies. Failure to distinguish between absolute mobility and relative mobility would lead to misinterpretation of data and social fact (Aldridge, 2001; Goldthorpe, 2013).

Education is taken to be an important determinant of social mobility chances in the modern societies; empirical evidence, however, has found that educational system appears to serve to reproduce persistent inequalities related to family origins. Studies on educational inequalities have well documented that parents' socioeconomic status has significant impacts on children's educational choice and attainment (e.g., Breen and Goldthorpe, 1997; Iannelli and Paterson, 2005; Boliver, 2011; Shavit, 2007). To quote Halsey (1977, p.184), 'ascriptive forces find ways of expressing themselves as "achievement".

Breen and Goldthorpe (1997) used the rational action theory to explain why individuals from specific class backgrounds, while being aware of the significance of education as crucial and efficient strategies of moving upward, opt to make different educational decisions. Instead of simply pursuing highest educational qualification, individuals make decisions based on their evaluation of cost and rewards, as well as perceived possibilities of success. Individuals from disadvantaged families may leave academic education early and/or join vocational training because this strategy, as the safest option, reduces the possibility of unemployment and also offers good chances of modest upward mobility to intermediate classes. For this group, the option of carrying on academic education may be considered as involving the high possibility of failure. In contrast, individuals originating from advantaged backgrounds seek to maximise educational achievement to maintain their position. Advantaged families may translate family resources as much as possible into their children's educational attainment. For advantaged families, the pursuit of educational qualification is unlikely to be constrained by inadequate resources; they are able to make a long-term investment for education and absorb the risks of failure without lowering quality of life.

Parental class is certainly not the sole factor that determines children's education; parental class, parental education, and parental status may have distinctive effects which cannot be treated as essentially interchangeable (Bukodi and Goldthorpe, 2013). The mechanisms through which educational system operates to maintain existing inequalities involve the availability of various kinds of resources that parents possess. Lareau (1987) in her widely-cited qualitative study illustrated the mechanism of how educational system tends to favour socioeconomic and cultural characteristics of the advantaged families. For example, she finds that work flexibility and transportation arrangements, which are determined by parents' socioeconomic resources, had strong influences on parental involvement in schooling, and that parents' own educational experiences and cultural capital also made differences in their attitudes towards teachers and in expectation for children (Lareau, 1987; Lareau and Shumar, 1996). A great number of studies also provide the empirical evidence of the role of parents' non-economic resources, such as cultural capital and social capital ${ }^{1}$, in shaping children's educational choice (e.g., Jæger and Holm, 2007).

With educational attainment held constant, parental characteristics are found to remain to have independent influences on children's class attainment in the labour market (e.g., Marshall, Swift and Roberts, 1997). In other words, individuals from working-class households are less likely to attain advantaged occupations than their peers from salariat class households, even though they hold the same educational qualifications. Personal qualities and social resources, such as social network, social

[^0]skills, dress style, and personalities, that individuals obtain more through family socialization than through schooling, are often regarded as important recruitment criteria for professional and ancillary occupations, particularly in the service industry (Jackson, Goldthorpe and Mills, 2005; Goldthorpe, 2014). A recently published report by Social Mobility Commission shows a shocking class pay gap among professional occupations. Even those professional employees who originate from working-class families and have the same education and work experiences as their colleagues from more advantaged families are paid $7 \%$ less on average (Friedman, Laurison, and Macmillan, 2017). At least in the UK, the increased proportion of the population with university degrees does not automatically improve social mobility (Goldthorpe, 2013). Education indeed mediates a large part of the parent-child associations; but arguably, the educational expansion in its own right does not necessarily make the society more equal in terms of social mobility.

### 1.3 Paradigm of social mobility over three generations

Aforementioned studies of intergenerational mobilities have intensively examined the associations between two adjacent generations by using parents' socioeconomic characteristics to explain children's social attainment. The social mobility based on the two-generational association follows the process of a first order Markovian chain. According to this approach, grandparents convey their social advantages to parents, and parents then pass their advantages on to the grandchildren. Partly due to the scarce data of multigenerational family history, researchers outline a relatively transitory structure of intergenerational reproduction and assume that family resources, such as wealth, properties, social network, career values, and educational
traditions, are perishable and their transmission is restricted only within the parentchild associations. Family advantages/disadvantages would dissipate at a geometric rate over generations. In this process, no direct association is expected between grandparents and grandchildren as the association is fully mediated by parental effects.

The limitation is that the above scenario hardly fits the observation of everyday life. In his influential paper that challenges the two-generational paradigm, Mare argues that 'it is likely that we have overstated intergenerational mobility...or, at the very least, have misunderstood the pathways through which it occurs' (Mare, 2011, pp.19-20) and suggests that studies related to social inequalities should be open to a multigenerational approach. As compared with a two-generational approach, a multigenerational approach takes a long view of the persistence of inequality related to family background instead of simply multiplying the coefficients of intergenerational correlations to calculate the multigenerational effects. A multigenerational view of inequalities appreciates the possibility that the offspring receive additional benefits, either tangible or intangible, from grandparents and other extended family members, in addition to their parents' socioeconomic characteristics. Mare (2011) points out that family as institution outlives individuals and that families are able to maintain their advantages by more than two generations. Many scholars in social sciences of social stratification and inequalities respond to Mare's proposal (e.g., Chan and Boliver, 2013; Pfeffer, 2014; Solon, 2017) and encourage the application of a multigenerational mobility approach. In fact, a few studies suggest that social advantages or disadvantages of family origins have long-lasting effects across more than three generations in some social contexts (Bertaux and Bertaux-Wiame, 1997; Stuhler, 2012; Clark and Cummings, 2014; Hällsten, 2014;

Lindahl, et al., 2014). The present thesis focuses the research interests only on threegeneration associations.

Figure 1.1The paradigms of a two-generational approach and a three-generational approach Panel A: a two-generational approach


Panel B: a three-generational approach


Figure 1.1 describes the paradigms of how family transmits advantages and disadvantages according to a two-generational approach and to a three-generational approach. In two-generational and three-generational approaches, grandparents pass their social advantages on to parents. Grandchildren's attainment is in turn determined by parental characteristics. This is the first order Markovian process that a two-generational approach simulates (see Figure 1.1, Panel A) ${ }^{2}$. That is, a process that a generation $t$ is only affected by its earlier generation $t-l$ and that there is no direct association between the generation $t$ and the generation $t-2$.

[^1]Researchers question whether the reproduction of social inequalities follows the first-order Markovian chain. The three-generational approach is to examine the process of how grandchildren are influenced by their grandparents over and above parental effects. That is, a process that a generation $t$ is affected by its earlier generations, $t-1$ and $t-2$. When a study on three-generational mobility reports significant grandparental effects with parental effects being taken into account, it can be understood as the influences of grandparents, $t-2$, which exist independent of parental influences, $t-l$ (see Figure 1.1, Panel B).

### 1.4 Literature Review: evidence of grandparental effects

Research has focused on a wide range of grandparental influences on the offspring, for example, in term of health (e.g., Li, Adab and Cheng, 2015; Lê-Scherban, et al., 2014; Modin and Fritzell, 2009), disability (Lee and Gardner, 2010), behaviour development (Curley and Mashoodh, 2010), mortality rate (Bygren, Kaati and Edvinsson, 2001), birth rate (Kaptijn, et al., 2010), and emotional well-being (Hancock, et al., 2013). These are no doubt very important areas of life chances. The grandparental influences on various outcomes of grandchildren may be consequential for their attainment of education and class in the later life stages. The present discussion will focus on reviewing the literature concerning grandchildren's education, class, and socioeconomic outcomes.

### 1.4.1 Grandparental effects on education

A number of multigenerational studies have found evidence that over and above parental characteristics, grandparents have direct impacts on grandchildren's educational performance. Grandparents may play a role in grandchildren's education as early as grandchildren's kindergarten age. Using Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), Ferguson and Ready (2011) reported that after controlling for parents' education, income, and occupational prestige, collegeeducated grandparents had a positive influence on grandchildren's mathematics and literacy capacity when grandchildren entered kindergartens in the U.S. The size of the effects Ferguson and Ready (2011) observed was relatively small. However, they argued that the small differences at the early age could have profound implications for children's academic performance in school.

Young grandchildren who had highly-educated grandparents performed better in school than did those whose grandparents were little educated (Modin, Erikson and Vågerö, 2013; Hancock, et al, 2016). Drawing on the data from the Longitudinal Study of Australian Children (LSAC), Hancock and his colleagues (2016) reported that the association between grandparental education and grandchildren's reading and numeracy scores at Year 3 (approximately at the age of 8 or 9 ) remained significant after taking into account fathers' and mothers' education. They found that this association was conditional on grandparents' gender-with numeracy scores of grandchildren being related to grandfather's higher education and reading scores of grandchildren to grandmother's higher education. Similar results are also found in Sweden. With a focus on linguistic and mathematical skills of the ninth grade Swedish students (15-16 years of age) Modin, Erikson, and Vågerö found evidence on intergenerational transmission over three generations with a pattern that varied by
gender and domains (Modin, Erikson and Vågerö, 2013). The results show that after controlling for parents' education, grandfathers' school marks had direct impacts on grandsons' and granddaughters' linguistic and mathematical marks, and grandmothers' school marks were particularly important to their granddaughters' linguistic performance. Similar results are reported by Hällsten and Pfeffer (2017).

Children's cognitive ability is also found to be determined by multigenerational inequalities in neighbourhood poverty. Sharkey and Elwert (2011) using a sample of 1,556 parent-child pairs drawn from the Panel Study of Income Dynamics (PSID) found that among African-Americans, the influences of parents' own childhood environment may linger on to affect their children's cognitive ability in the U.S. Although the paper did not address grandparental characteristics directly, according to the data, grandparental characteristics significantly determined the poverty level of the neighbourhood in which parents lived during childhood. This paper suggests that whereas grandparents' socioeconomic characteristics are important, grandparents' neighbours matter as well. The results also shed lights on the pattern that multigenerational inequalities may particularly operate among the disadvantaged.

When it comes to grandchildren's choice of secondary education, Møllegaard and Jæger (2015) reported net impacts of grandparents in Denmark. Using a sample of 2,383 adults drawn from the Danish Longitudinal Surveys of Youth (DLSY), Møllegaard and Jæger (2015) found that grandchildren whose grandparents possessed high cultural capital were more likely to choose academically orientated track which may lead to university education than other types of education, whereas grandparents' economic and social capital was of little importance on
grandchildren's educational choice. One of the highlights of the study is that they utilise a comprehensive range of measures for economic, cultural, and social capital at the grandparental and parental generations. The direct effects of grandparents remained after detailed parental characteristics were included in models. This allows Møllegaard and Jæger to reduce the possibility that observed grandparental effects may pick up unobserved parental effects. The results of the study by Møllegaard and Jæger (2015) made a point that three-generational mobility patterns were related to specific institutional contexts. In the context of Danish society which is known for high-income redistribution, free education, and its universal social security system, economic resources may be little important to educational choice, relative to other types of family advantages. In contrast, grandparents who were identified as holding a great amount of cultural capital were able to provide a culturally rich environment which may directly benefit the grandchildren. It needs to be noted that observed grandparental effects were likely to be underestimated due to data limitation - one set of grandparents (either from the paternal side or from the maternal side) were included in data. They did not analyse all the potential effects of grandparents due to data limitation.

Grandparents are found to be important to grandchildren's educational attainment at the later stage. Drawing on the data from the National Longitudinal Survey of Youth (NLSY), Loury (2006) investigated the influences of old extended family members on the mother's side, including maternal grandparents, uncles and aunts, on grandchildren's education in the U.S. After controlling for parents' education and family environment, the research showed that whereas grandmother's schooling strongly affected granddaughters' test scores at age 14, grandfather's schooling had strong effects on grandsons' chance of attending college.

A study based on Chile reported similar patterns of gender differences in grandparental influences (Celhay and Gallegos, 2015). Celhay and Gallegos (2015) drew on the data from the Longitudinal Social Protection Survey and included the information on both paternal and maternal grandparents' years of schooling. They found persistence in educational inequalities between grandparents and grandchildren in the content of educational expansion even after controlling for parental education. In particular, while both paternal and maternal grandparents mattered to grandsons' education, granddaughters' education benefited mainly from grandmothers.

Mare (2011) points out that inheritance of social status works almost perfectly at the top and the bottom of social stratification, and a few studies on multigenerational transmission of education support his assumption (Jæger, 2012, Chiang and Park, 2014, Wightman and Danziger, 2014; Sharkey and Elwert, 2011). Using the data from Taiwan Youth Project, Chiang and Park (2015) found that the effects of multigenerational inequalities varied across the distribution of parents' education. The results suggested that after taking into account parental education and family income, the additional years of grandparents' schooling increased the chances of attending high school and university only for grandchildren who had highly educated parents. In other words, they found that direct grandparental effects operated at the top of social stratification. Chiang and Park (2015) referres to this pattern as the 'augmentation hypothesis' and explained that highly educated parents have a better capacity to activate and utilise the resources that grandparents provide. A limitation is that the data allowed the researchers to collect information only either on maternal grandparents or on paternal grandparents but not on the both sides. Due
to the lack of information on complete multigenerational lineages, the research may underestimate the effects of multigenerational inequalities.

Drawing on the data from the Wisconsin Longitudinal Study (WLS), Jæger (2012) examined years of completed schooling of children over the age of 25 . The results suggested that with parental education, income, and socioeconomic status being controlled for, grandparents' socioeconomic status was more important for the offspring's educational outcomes in disadvantaged families than those in advantaged families. In addition, the study did not find evidence that grandparental effects on education varied by the quality of biological, geographic, or social ties within families. Another study based on the U.S. also suggested similar results (Wightman and Danziger, 2014). Wightman and Danziger (2014) used the data from the PSID and focused on young adult respondents' high-school completion and college entry. The analysis suggested that multigenerational effects were conditional on parents' income. Grandparental effects are found to concentrate on the high-school completion of grandchildren with low-income parents. It is worth noting that the model has controlled for grandchildren's cognitive skill and Behaviour Problem Index as well as parents' education, income and marital status.

Grandparental effect on grandchildren's education may be conditional on the living arrangement or geographic proximity. This hypothesis postulates that grandparents who live nearby or live with the grandchildren are more likely to provide effective support to their grandchildren than are those who live far away. Using the data from the 2002 Chinese Household Income Project (CHIP), Zeng and Xie (2014) collected information on both paternal and maternal lineages over three generations. The analysis of logistic regression with interaction effects suggested that after taking
parents' education and occupation into account, co-resident grandparents' education had large and significant influences on grandchildren's likelihood of school dropout and that the influences of non-coresident grandparents were very weak. The effects of co-resident grandparents' education are found to be almost as strong as that of parental education.

However, this finding on the association between physical proximity and grandparental effects may not be echoed to other social contexts as multigenerational coresidence is common in rural China but rare in developed countries. Instead, researchers focusing on multigenerational inequalities in developed countries intend to consider the factor of the geographical distance between grandparents and their grandchildren. Researchers found no evidence that the impact of grandparents on grandchildren's education depends on geographical distance in the U.S. (Jæger, 2012) and in Netherland (Knigge, 2016).

A few studies reported refutation on direct effects of grandparents on grandchildren's education. Using Longitudinal Internet Studies for the Social Sciences (LISS), Bol and Kalmijn (2016) randomly chose grandparents either from the paternal side or from the maternal side but not the two sets of grandparents together, and examined the grandparental and parental effects in terms of occupations, education, and cultural capital on grandchildren's educational qualifications in Netherlands. The results show that after taking into account parental characteristics, the direct effects of grandparents disappeared. The direct effects of grandparents remained to be insignificant after Bol and Kalmijn incorporated interaction terms with geographical proximity and the strength of the grandparents-grandchild bonding. The analysis may have underestimated
grandparental effects because they did not include the full sets of grandparents but only one randomly selected lineage. However, the measures in their study were not necessarily weaker than were those in other studies, as a number of studies that were mentioned earlier also used family lineages on a single side.

Having seen the different findings on grandparental effects in different countries, I suggest that multigenerational inequalities may vary on the institutional settings. A cross-national study by Deindl and Tieben (2017) was in line with this assumption. Deindl and Tieben (2017) conducted a study of grandparental effects on education in Europe and Israel, using the fifth wave of the Survey of Health, Ageing and Retirement in Europe (SHARE), which provides a representative sample of the elderly population over the age of 50 in 20 European countries and Israel. They took the variable of whether the child attended tertiary education as the dependent variable, and material resources and education of parents and grandparents as the explanatory variable. Deindl and Tieben (2017) observed that after controlling for parents' education and material resources, both grandparents' education and material resources had significant effects in Germany, Israel, and Denmark. Whereas in the Czech Republic and Luxembourg only grandparents' education seemed to be important, in Italy only grandparents' material conditions mattered. In Sweden, Netherlands, Belgium, and Slovenia, none of the grandparental effect is found to be significant. Deindl and Tieben suggested that the existence of direct grandparental effects on education probably depended on social contexts, particularly on the welfare system and educational expansions.

### 1.4.2 Grandparental effects on class

A few studies focusing on multigenerational inequalities examine grandparental effects on grandchildren's class or socioeconomic outcomes and the findings are far from conclusive. It needs to be noted that these studies that shall be discussed have controlled for parental characteristics, but did not take into account the grandchildren's own education.

Drawing on the data from the UK's Millennium Cohort Study (MCS), Moulton and her colleagues (Moulton, et al., 2017) explored the impact of grandparental class on grandchildren's class aspirations at age seven. Moulton and her colleagues captured both paternal and maternal grandparents' class and controlled for family income and parents' education and class. They measured grandchildren's class aspiration at an age seven when grandparents are assumed to interact frequently with grandchildren (Moulton, et al., 2017). The path analysis results found small but significant effects of paternal grandmother's class net of parental backgrounds. Moulton and her colleagues (2017) argued that occupational aspiration at a young age may be unrealistic since the grandchildren were too young to be aware of advantages or disadvantages of their family background, and at the same time, high proportions of aspirations for managerial and professional occupations reduced the variance of results. When grandchildren's aspirations become more realistic, net impacts of grandparents may be stronger (Moulton, et al., 2017)

As early as in 1983, Beck found net associations between grandfather's class and grandson's class in the U.S. and argued that while father's occupation is the main component, it does not adequately capture the influence of family origins (Beck, 1983). Using the data taken from National Longitudinal Surveys of Mature Men
(NLS), Beck investigated the occupational associations among paternal grandfathers, fathers, mothers, and grandsons. The results from log-linear models indicated that after controlling for father's occupation, the grandfather-grandson association was stronger than was the mother-son associations, although both were statistically significant. Beck found that after taking into account father's occupation, grandfather-grandson associations operated at both the upper and lower levels: having white-collar grandfathers increased the chances of grandsons working in white-collar occupations and having blue-collar or farmer grandfathers increased the chances of grandsons working in the similar occupations. Beck summarised that the traditional father-son mobility model would be benefited by taking into account other family members such as grandfathers and mothers (Beck, 1983).

Also in U.S, Warren and Hauser (1997) reported the null-findings of grandparental effects. Using the data from the Wisconsin Longitudinal Study (WLS), Warren and Hauser (1997) collected information on education, occupation, and income of both paternal and maternal grandfathers and grandmothers, and the corresponding information of fathers and mothers. The regression analysis reported that after adding parental characteristic, the influences of grandparents on grandchildren's occupational status (as measured by Duncan Socioeconomic Index (Duncan, 1961)) disappeared. In structural equation models, Warren and Hauser found that grandparents did not directly affect grandchildren's education or occupational status.

Erola and Moisio (2007) used a census- and population-register-based dataset drawn from the Longitudinal Census Panel (LCP) Data 1950-2000 to build up threegenerational lineages from both paternal and maternal sides in Finland. Using the methods of log-linear modelling on the Erikson-Goldthorpe class positions of three
generations and linear regression with the continuous International Socioeconomic Index of Occupational Status (ISEI scores), Erola and Moisio explained that after controlling for the parents' class, grandchildren's social class was barely affected by grandfather's class. Chan and Boliver (2014) re-analysed their results and found that the evidence Erola and Moisio (2007) presented did not support their major argument. Chan and Boliver further suggested that a net association between grandparents' class and grandsons' class did exist in Finland.

A study which is highly relevant to the thesis is one by Chan and Boliver (2013) focusing on class mobility over three generations in Britain. Using three cohort studies, the National Study of Health and Development (NSHD), the National Child Development Study (NCDS), and British Cohort Study (BCS), Chan and Boliver (2013) built up maternal grandfather-father-grandchildren lineages and demonstrated that in Britain grandparental class had significant direct impact on grandchildren's class destination, net of parental backgrounds. The log-linear modelling analysis suggested that 'the grandparents effect in social mobility is quite a general social force, operating throughout the class hierarchy, and is not restricted to the two ends' (2013, p.13). Chan and Boliver explained that their findings did not necessarily contradict the pattern that multigenerational inequalities are the strongest at the top and bottom of social stratification because the class scheme they utilised, Register General four-level class classification, may not best describe the population at the two extreme ends. The observed grandparental effects are found to be the most prominent in upward counter mobility and they are too large and systematic to be explained by random processes.

Using the German Socio-Economic Panel (SOEP) and US-American Panel Study of Income Dynamics (PSID), Hertel and Groh-Samberg (2014) concentrated on the analysis of male patrilineal lineages-that is, the paternal grandfather-fathergrandson lineages. Hertel and Groh-Samberg (2014) reported that after controlling for father's class, the grandfathers' class was directly associated with their grandchildren's class in both Germany and the US. The authors discovered that there were no substantial cross-country differences in relative mobility rates over three generations between Germany and the U.S., which the authors considered as two least similar countries. Hertel and Groh-Samberg (2014) speculated that industrialised countries may share a common pattern of three-generational relative mobility, whereas the mechanisms differ regarding the institutional settings.

Grandparental effects are also found on the occupational status that adult grandchildren have achieved. Using the GENLIAS data, which contain information on marriage certificates in Netherlands between 1812 and 1922, Knigge (2016) found that grandsons' occupational status had a substantial association with grandfather's and great-grandfather's status after taking the social positions of fathers and uncles into consideration. Dribe and Helgertz (2016) reported clear grandfather effects on grandson's class and occupational status in Sweden after controlling for father-grandson associations. While both paternal and maternal grandparents are important, paternal grandfathers appear to have stronger associations with grandsons (Dribe and Helgertz, 2016). The grandfather-grandson associations are found to be stable over nearly 200 years, despite substantial changes in the occupational structures. However, Dribe and Helgertz (2016) found no significant grandfather-grandsons associations in earning.

### 1.4.3 Summary

The overall evidence across the literature on three-generational mobility studies is in favour of the existence of grandparental effects on a variety of outcomes, albeit far from being conclusive. Figure 1.2 summarises the aforementioned studies on grandparental effects on grandchildren's attainments at the life stages ranging from the kindergarten age to occupational maturity. The studies that report supportive evidence are presented above the age axis, while those that report null findings are presented underneath the axis. The outcome variables, the contexts of countries, and references are provided along with the axis of age stages.

I have discussed a number of empirical studies focusing on grandparental effects in various social contexts, including Britain (Chan and Boliver, 2013; Moulton, 2017; Ridge, 1973), the U.S. (Beck, 1983; Ferguson and Ready, 2011; Jæger, 2016; Hertel and Groh-Samberg, 2014; Sharkey and Elwert, 2011; Warren and Hauser, 1997; Wightman and Danziger, 2014), Australia (Hancock, et al., 2016), China (Zeng and Xie, 2014), Taiwan (Chiang and Park, 2015), Denmark (Møllegaard and Jæger, 2015), Sweden (Modin, Erikson and Vågero, 2013; Dribe and Helgertz, 2016), Netherlands (Bol and Kalmijn, 2016; Knigge, 2016), Germany (Hertel and GrohSamberg, 2014), Finland (Erola and Moisio, 2007; Chan and Boliver, 2014), and Chile (Celhay and Gallegos, 2015). Multigenerational effects may differ across geographical locations and time periods under the investigation. The reproduction of inequalities over three generations may operate in some social contexts during some time periods but not in others (Chan and Boliver, 2013; Mare, 2011). In some locations, for example in mid-twentieth century Wisconsin state, the persistence of
inequalities may be 'unusually weak' (Mare, 2011, p.16). The cross-national comparative study by Deindl and Tieben (2017), which I discussed earlier, suggested that welfare state provisions may play a role in determining the resource transfer from grandparents to grandchildren. The lack of consistent findings can also be explained by different measurements of grandparents' and parents' characteristics and statistical methods used. For example, Warren and Hauser (1997) and Jæger (2012) used the same data- Wisconsin Longitudinal Study-but reached different conclusions. By incorporating the interaction between intermediate family environments and grandparental characteristics, Jæger (2012) found that grandparental effects existed only on grandchildren whose parents were in low socioeconomic status. The comparisons between studies utilising different measures of family characteristics can be further complicated by the issue that grandparental effects estimated in the modelling may have picked up the influences of unspecified parental resources (which will be reviewed later in Section 1.6).

Regarding the UK on which this thesis is based, there are good reasons to envision the significant effects of grandparents on grandchildren's attainments. First, whereas Ridge (Ridge, 1973) did not find significant direct associations between grandparents and grandchildren in Britain, recent studies based on Britain do provide the empirical evidence of grandparental effects on adult grandchildren's class (Chan and Boliver, 2013) and young grandchildren's class aspiration (Moulton, et al., 2017). It is reasonable to assume that grandchildren's outcomes may be directly associated with grandparents' social characteristics and the influences of family backgrounds follow a multigenerational pattern in the context of contemporary Britain, a country which has long been held as exemplifying a 'sclerotic' class
rigidity (Olson, 1982, p.86) and which is still diagnosed as having 'a deep social mobility problem' (Social Mobility Commission, 2016, p.iii).

Second, whereas previous studies revealed net effects of grandparents' social characteristics on grandchildren's education in different contexts, no existing research, to my knowledge, has attended to multigenerational effects on education in Britain. This thesis seeks to fill these gaps by investigating the influences of both maternal and paternal grandparents' social class on their grandchildren's education and class outcomes.

Finally, a number of studies provided evidence that direct grandparental effects do exist as can be seen in Figure 1.2; however, with notable exceptions (Zeng and Xie, 2014; Knigge, 2016) the mechanisms through which grandparental effects operate have been barely empirically tested. This thesis recognizes the importance of understanding the mechanisms of multigenerational inequalities and aims at providing quantitative evidence of the mechanisms behind estimated grandparental effects. Next section, Section 1.5, will discuss potential mechanisms through which grandparents exert impacts on grandchildren's attainments.

Figure 1.2 Summary of previous studies on grandparental effects
Yes, net grandparental
effects exist

## Notes:

Upward pointing arrows represent the findings of existence of grandparental effects; downward pointing arrows represent the findings of non-existence of grandparental effects

### 1.5 Mechanism of grandparental effects

With the recognition that grandparents' socioeconomic positions may be directly associated with grandchildren's attainment net of parental influences, questions must be asked of how historical advantages (or disadvantages) that are rooted in the grandparent generation represent an additional resource of the variation of individuals' achievement. This section aims at addressing the question of how grandparents affect their grandchildren's well-being and life chances. While the grandparent-grandchild associations just started becoming a trendy topic in the area of social mobility, the topic of intergenerational influences has attracted much attention in the fields of family sociology and sociology of ageing.

Through reviewing relevant research that focuses on various aspects of grandparental involvement, I shall discuss grandparental support as multidimensional activities and the question of how these intergenerational effects are socially and demographically structured. To begin with, I will concentrate on the role of grandparents in grandchildren's life and discuss its flexibility and complexity that are generated due to few normative and institutional regulations imposed on grandparenthood. Next, I will devote the most space to the discussion of the mechanisms of how grandparents affect their grandchildren's well-being. The influences of grandparents on grandchildren can be identified as a need-directed relationship (Silverstein and Marenco, 2001), which operates through life course positions of both grandparents and grandchildren. An initial distinction is made between instrumental influences and symbolic influences, depending on the resources involved in transfers. Instrumental influences mainly include two types of supports, in-kind service, and financial transfers. Symbolic influence refers to the
transfers of attitudes and values that may shape grandchildren's aspiration and attainment. While most of the studies that I refer to focus on Western industrial countries, I assume that grandparents-grandchild relationships in Britain would not be dramatically different from those in these Western countries.

### 1.5.1 Grandparents' role in family relations

Compared to parent-child relations, which is strongly guided by the norms of the provision of assistance, grandparenthood is rarely governed by legal and institutional obligations (Pruchno and Johnson, 1996). Such a lack of explicit and specific prescription results in flexibility and heterogeneity in its practice and perception of the role of grandparents. As some grandparents enter grandparenthood at a relatively young age, they may be still in employment, enjoy in recreational activities, and have alternative lifestyle choices available to them (Silverstein and Marenco, 2001). Grandparenthood was described as a 'roleless role', 'ideological instead of real' (Clavan, 1978, p.351). Nevertheless, the traditional view of the family as a source of support at any age persists (Kemp, 2004). Articulated in different forms, for both the old and the young generations, a taken-for-granted expectation of grandparental support appears to remain in the practice of familial relations, especially in times of need (Kemp, 2004; Griggs et al., 2010; Hagestad, 2006). For instance, in response to the questions of to the extent which the grandparents were support persons for a child aged 10-12 during the period of parental separation and divorce, more than 90 per cent of parents and grandparents agreed that grandparents should assist the child in such context (Hagestad, 2006). Grandchildren, whether at young age or adulthood, also feel legitimate and obligated to spend time with their grandparents. The
closeness and supportiveness of the interaction between grandparents and grandchildren are generally valued and manifested.

In looking at the ambiguously defined nature of the interaction between grandparent and grandchild (Silverstein and Marenco, 2001), it is worth noting that the enactment role of grandparents is not automatically ascribed, but interpersonally negotiated and situationally directed (Kemp, 2004). These features of the grandparent-grandchild interaction do not necessarily indicate the disappearance of tradition and obligation. They coexist and give rise to the new opportunities and possibilities of the practice of a positive role of grandparents in promoting the wellbeing of grandchildren and in transferring family advantages. The weak legal and institutional corporation should not shadow but rather accentuate the functions of grandparental involvement in supporting the family and transferring resources. Current demographic and social changes have created the potential for the development of intergenerational interactions, and as shall be discussed below, grandparental involvement in supporting grandchildren works in diverse styles and at the various levels of intensity.

### 1.5.2 The mechanisms of resource transfer

## Instrumental influences

Providing babysitting and childcare is a common way that grandparents directly involve in pre-teen grandchildren's life. Grandparents are the most commonly used childcare in the UK. Drawing on a 1999 survey of over 5,000 parents conducted by the National Centre for Social Research on behalf of the Department for Education
and Skills, Woodland and his colleagues reported that 58 per cent of households with children under 14 in England had received childcare help from a grandparent in the past year (Woodland, et al., 2004). From the perspective of grandparents, the 1999 ONS Omnibus Survey shows that 27 per cent of grandmothers and 19 per cent of grandfathers helped to look after their grandchildren for their eldest child in Britain (Grundy, Murphy, and Shelton, 1999). Grandparents' contribution to childcare is common in households with young children. In the UK, 13.5 million grandparents provided some $60 \%$ of all the childcare in full-time or part-time, and approximately $1 \%$ of children live with their grandparent(s) (Tan, et. al, 2010). Grandparents were regarded the most satisfactory caregivers compared to other kinds of kinship (Meltzer, 1994). Gray (2005) using the British Household Panel Study (BHPS) deduced an increase in the provision of childcare by grandparents between 1991 and 2000. Drawing on the data from the UKHLS wave 1, I found that 45 per cent of the households with children had childcare help from grandparents during school term-time or school holidays.

Grandparental involvements that benefit their grandchildren may come through the middle generation, the generation of parents. Serving as complementary caregivers may be seen as the contribution to the young grandchildren's well-being that grandparents make in both direct and indirect ways. The mechanism is that while the free childcare that grandparents provide involves the direct face-to-face interactions between grandparents and grandchildren, it also frees parents from such pressures of looking after children, enabling parents to work longer and earn more wages in the labour market (Wheelock and Jones, 2002; Gray, 2005). Meanwhile, given high childcare fee, such kind of support from grandparents also saves the potential cost of professional childcare service that otherwise parents have to pay for (Gray 2005).

Parents in turn are able to improve their economic situations to support their children with relatively adequate material resources. It is estimated that the grandparents helped reduce the childcare cost between 17 and 29 billion dollars in the United States (Gans and Siliverstein, 2006).

As grandchildren reach school age, grandparental involvement may shift away from the provision of childcare and towards education-related activities. A study based on a nationally representative sample of 1,569 adolescents and 40 in-depth interviews (Griggs et al., 2010) suggested a trend towards a higher level of grandparental involvement in supporting their grandchildren's education in England and Wales than in the past. Griggs and her colleagues found that it is common that grandparents engage in activities with their grandchildren including picking from school, teaching, assisting homework, advising career, and solving problems, especially when parents are unavailable. While these types of supports are shown to be more commonly associated with grandmothers, grandfathers are more inclined to help their grandchildren's education in a less formal way, for example, taking grandchildren to historical or nature trips (Griggs et al., 2010). In the UK, approximately half of families that had school-aged children (at age 8-14) used child care provided by grandparents (Woodland, et al., 2004). These activities are not only educationally meaningful, but also they indicate a substantial amount of time and resources that grandparents invest in their grandchildren. Some of the grandparent-grandchild interactions involve enjoyable companionship and confiding, which may provide adolescent grandchildren with invisible psychological support. This may explain the findings of aforementioned studies that grandchildren with socially advantaged grandparents are likely to achieve good academic performance with parental
characteristics being controlled for ${ }^{3}$. In addition, interactions may facilitate the transfer of symbolic resources that shall be discussed later.

## Financial Transfer

Transfer of financial resource to grandchildren is considered very important in improving grandchildren's education and standard of living when they are in the transition to adulthood and at the beginning of their career. In some way, 'money is something quantifiable that can be used to measure love' (Aldous, 1995, p.115). British grandparents regularly provide their adolescent grandchildren with monetary assistance (Tan, et al., 2010), particularly if grandparents are homeowners (Beach, 2013). Grandparents with higher income and educational qualification are more likely to contribute financially and be active in recreating with their grandchildren as they possess better resources to do so (Silverstein and Marenco, 2001; Attias-Donfut, Ogg, and Wolff, 2005; Mueller and Elder, 2003; Beach, 2013). In England, grandchildren received from grandparents approximately $£ 333.8$ million (excluding via Child Trust Funds) in 2010, which is equivalent to the tuition fee for more than 100,000 undergraduate placements (Beach, 2013). While older grandparents may be

[^2]less physically capable of babysitting, they may have accumulated more financial resource to transfer to their grandchildren. Silverstein and Marenco (2001) reported that as grandparents grow old, they are more likely to provide their grandchildren with cash gifts, despite the fact that they are less likely to engage in recreational activities with their grandchildren or serve as caregivers.

Alternatively, grandchildren could benefit from bequests or inter-vivos transfers that their grandparents pass on to their parents. In general the elderly are more likely to support financially their own children than their grandchildren (Attias-Donfut, Ogg, and Wolff, 2000; Hoff, 2007), but financial transfers from elderly grandparents to parents, whether in the form of inheritance or that of cash gift, are likely to be further passed on to the next generation, the generation of grandchildren. Individuals typically receive the bequest from their parents at their 50s or 60s. In this life stage, they usually have achieved occupational maturity, and their social class is less likely to be qualitatively changed by inheritance. At the same time, their children may be in strong economic needs since they may face educational tuition fee, housing cost, the beginning of their career, or even have their own babies to take care of. A recent British report found that the middle generation who received benefits from their elderly parents tend to pass on economic assistance to their own children (Royal London, 2017).

Grandparents are found to prefer to transfer financial resources to parents bearing children than to those without children. Albertini, Kohli, and Vogel (2007) observed that while financial transfers and social supports flew from the older generation to the younger generation in European countries, having grandchildren significantly increased the likelihood of grandparents supporting the parental generation. The
similar tendency is also identified in U.S. families (Hogan, Eggebeen, and Clogg, 1993; Suitor, et al., 2011). Grandparents' economic support may also affect grandchildren in some implicit ways. For example, children may benefit from a secure and stable environment, such as living in a catchment area with good schools, that grandparents contribute financially (Hagestad, 2006; Ferguson and Ready, 2011).

The effects of the factors at the macro level are clearly demonstrated in financial family transfers. 'Material transfers are not only an important part of the intergenerational linkages in the family; they are also the most appropriate field for studying how the family and the welfare state interact' (Kohli, 1999, p.84). The evidence on financial transfers shows that at least for the less affluent old people, the provision of financial assistance depends on the availability of retirement pensions that flow from public welfare system; and through family transfers, public pensions are re-distributed back to the young generations (Kohli, 1999). Public transfers may not 'crowd out' private support but may strengthen intergenerational family solidarities. The institutional influences on intergenerational family transfer may be controversial and open to further empirical exploration. Of significance is the fact that these investigations provide insights into institutional influences on intergenerational family transfers and the interplay between public and private transfers.

## Symbolic influences

One of the important ways in which grandparents affect grandchildren's attainment is through transferring their knowledge, attitudes, and values accruing from their
socio-economic positions and life-long experiences (Portes et al, 2009). Such attitudes and values may shape grandchildren's aspiration and attainment in education and career. King and Elder (1998) using longitudinal surveys of White rural families in the Iowa, the United States explained the association between grandparental education and the modes of their interactions with their adolescent grandchildren (aged 12-17). They reported that college-educated grandparents were more inclined to play a mentorship role, discuss the problems the grandchildren face and help to make plans for the future, while grandparents with lower educational qualification were more likely to develop 'friendship' with their grandchildren and maintain more frequent contacts and closer emotional bonding. King and Elder (1998) argued that education of grandparents was not related to more or less involvement in grandparenting, but instead, it explained the difference in types of roles that grandparents take. The role that grandparents play in grandchildren's life was shaped by grandparents' class-related values and work experiences ${ }^{4}$ (King and Elder, 1998).

Grandparents may function as a source of wisdom and information when helping their grandchildren to make important decisions (Griggs et al., 2010). Educational

[^3]and occupational advantages accord grandparental authority to their grandchildren and therefore facilitate the transfers of information, attitudes, and values that encourage the development of their descendants in academic and career areas. While grandparents, regardless of their social positions, tend to consider their supports influential for the academic performance of their grandchildren, college-educated young people are more convinced by the mentorship offered by their grandparents with high status in career and education (Crosnoe and Elder, 2002).

Grandparent effects may also operate as role models that affect grandchildren's educational and occupational aspirations (Denham and Smith, 1989). By referring to the appropriate role models, grandchildren are able to assess correctly the link between educational qualification and rewards such as income and privilege. In contrast, the lack of such right models may mislead the individual's educational choice and earnings expectation (Loury, 2006). Loury (2006) speculated that grandparents, together with other extended families members, may contribute to forming family circumstance, which encourages or discourage educational choices grandchildren make.

Grandparents' social positions may shape the reference frame guiding grandchildren's mobility decisions (Hertel and Groh-Samberg, 2014), and this process does not necessarily have to require any active contribution from grandparents. Family traditions that are recognized to the offspring play a crucial role in shaping their decision-making. Grandparents' social positions as an important constituent of family tradition may deliver grandchildren a sense of belonging and affect their aspiration. From a three-generational perspective, it may well explain the pattern of counter-mobility, a 'back to root' scenario (Hertel and Groh-Samberg,

2014; Chan and Boliver, 2013). For instance, parents who failed to maintain family privilege and moved downward may use grandparents' high achievement as the reference frame and encourage their children to aim high and stay with family origin. The study on three-generational mobility in Britain by Chan and Boliver (2013) reported that having advantaged grandparents is directly associated with grandchildren's upward mobility. Those parents who moved upward from the bottom may have a sense of belonging and may not reject strongly their children's class destination in working-class. This mechanism of grandparental influences operates regardless of whether grandparents are deceased or alive (Hertel and GrohSamberg, 2014; Pfeffer, 2014).

Glass and Bengtson (1986) in their research on three-generation families challenged the theory of the transfer of attitudes and values. They argued that the continuity of attitudes is not solely due to the processes of socialization and individual psychological effects but also derived from the inheritance of social status between two generations, which accounts a substantial part of the observed attitude similarities. Although the independent influence of grandparents on grandchildren is understudied, their work might reveal an important alternative pathway to the understanding of the link between the transmission of attitudes and values and the mobility of social status.

### 1.5.3 Discussion: The nature of grandparental influences

In general grandchildren in British society experience a high level of multidimensional grandparental involvement (Tan et al., 2010; Griggs, et al., 2010). The rewards and styles of grandparent-grandchild relationship are sensitive to the
transition of life course positions of both generations (Arrondel and Masson, 2001; Dunifon and Bajracharya, 2012; Pruchno and Johnson, 1996). While grandparental influences are diverse in their functions, these influences may evolve as life course stages change. The understanding of the mechanisms of grandparenting may provide explanations for my findings in grandparental effects on grandchildren's education and class attainment at different life stages.

For families with infants and pre-school children, grandparental involvement usually takes a form of childcare service, especially when the parent(s) is out to work. By providing complementary childcare work, grandparents fill the parenting gap and directly protect the well-being of their grandchildren. Such complementary childcare service by grandparents helps parent(s) stay in employment, work longer, earn more wages to support the household, and at the same time, save the potential cost of formal child care that the parent(s) otherwise has to pay. As grandchildren turn school age and the need for childcare declines, grandparents get more involved in grandchildren's education; they may enact grandparenting as homework assistant, educator, confidant, companion, mentor, career adviser, or problem solver. In this stage, the influences of grandparents are not limited to providing practical supports but also manifested in transfers of attitudes and values to the young offspring. The transfer of attitudes and values, which are closely related to the educational and occupational standing of grandparents, may encourage or discourage their grandchildren to raise educational and professional aspirations. For older grandchildren, grandparents are likely to provide financial assistance to pay for tuition fee, housing cost, or help to improve the standard of living. Alternatively, financial transfers from grandparents to their grandchildren may take an indirect form with parents being a mediator. That is, after receiving financial gifts from the
grandparent, the parents tend to pass on a part of or entire transfers to the grandchildren. As grandchildren grow older, the frequency of contact with their grandparents may drop, but it does not necessarily indicate the decline of quality of the relationship or less resilient influences of grandparental involvement (Barranti, 1985). Instead, the characteristics of the grandparent-grandchild relationship change to meet better the needs of mature grandchildren. The grandchildren who do not benefit from their grandparents may have to make extra efforts to achieve the same social positions as those with advantaged grandparents.

Grandparental influences on their grandchildren should not be taken as a simple issue about greater or lesser contribution; instead, while grandparents have been motivated to support their descendants in general, they possess the different amount of resources and play different roles in multi-dimensions of grandparenting. This is directed to the argument that only certain aspects of grandparent-grandchild relationship may affect grandchildren's behaviours and well-being, while some aspects may not make essential differences. For example, many aforementioned studies report that educational levels of grandparents have a positive association with their grandchildren's cognitive skills and academic performance, but it is also observed that emotional closeness of the relationship between grandparents and grandchildren does not have important influence on grandchildren's certain behaviours such as risky and sexual conduct (Dunifon and Bajracharya, 2012). In looking at the mixed findings that different studies present, one should bear in mind the heterogeneity and multidimensionality of grandparental role and take account of the fact that grandparents influence their offspring through different mechanisms. Grandparental influences, whether operating directly or indirectly, instrumentally or
symbolically, are important drivers for grandchildren's educational and occupational successes.

### 1.6 Causal Inference

A key challenge in the study of multigenerational inequalities is the question of whether the grandparents-grandchild associations observed in quantitative empirical studies represent causal influences of grandparents' resources or just spurious relations that arise due to the failure to control for relevant parental characteristics. This section will discuss the issue of causal inference and review the analytic approaches that previous studies used.

Studies of multigenerational mobility may follow the established approach that analyzes how grandchildren's social attainments are associated with characteristics of parents and grandparents and other extended family members. To establish the direct grandparents-grandchildren associations that are indeed net of parental characteristics, the models need to capture correctly relevant parental characteristics (without measurement error) that are affected by grandparents and that matters to grandchildren's attainments (Pfeffer, 2014).

Multigenerational studies use measures of parental characteristics that were available in the data and appropriate to the statistical modelling techniques they apply. Log-linear modelling, as a common method in social mobility studies, provides clear descriptive pictures of the multigenerational associations in terms of class positions (Beck, 1983; Chan and Boliver, 2013; Erola and Moisio, 2007; Hertel and Groh-Samberg, 2014). Log-linear modelling tests associations between
categorical variables in contingency tables; its details shall be discussed in the Chapter 2 Data and Methods. An advantage of the application of log-linear modelling is its ability to measure relative social mobility rates while separating the effects of occupational structure. The issue that raises concerns is that log-linear models allow only very few categorical variables and thus may become vulnerable to the critique of 'omitted variables' (Kelley, 1990). Log-linear modelling can do a good job of describing the associations of three-generation but may be not the best option to estimate grandparental effects net of parental characteristics. Instead, many studies of multigenerational mobility choose linear regression or logistic regression models in which researchers are able to incorporate a reasonable amount of explanatory variables to measure parental backgrounds (e.g., Bol and Kalmijn, 2016; Chan and Boliver, 2013; Chiang and Park, 2014; Erola and Moisio, 2007; Deindl and Tieben, 2017; Hancock, et.al., 2016; Loury, 2006; Jæger, 2012; Møllegaard and Jæger, 2015; Warren and Hasue, 1997; Zeng and Xie, 2014). Using log-linear modelling, Chan and Boliver (2013) found the evidence of net effects of grandparental class on grandchildren's class; and their findings are robust when they introduced a comprehensive range of parental characteristics including social class, education, and economic resources into their ordinal logistic regression models. A few of studies that use a similarly rich set of parental controls with regression methods also reported direct associations between grandparents and grandchildren's mobility outcomes (e.g., Jæger, 2012; Møllegaard and Jæger, 2015; Zeng and Xie, 2014). However, some studies found that while taking into account a relatively wide range of measures of parental characteristics, the grandparental effects did not exist (Warren and Hauser, 1997; Bol and Kalmijn, 2016).

Given the numerous pathways through which parents may affect their children's achievement visibly and invisibly, one can easily speculate the unspecified variable bias (Mare, 2014; Zeng and Xie, 2014). This argument can be particularly relevant when the quantitative survey data contain only a limited number of indicators of parental resources and when the heritability of some resources is not directly estimable (Pfeffer, 2014; Stuhler, 2014). Pfeffer compared this methodological challenge to 'an uphill battle' (Pfeffer, 2014, p.4).

However, this does not diminish the contributions of multigenerational studies. Although it may be technically challenging to measure pure causal relationships, it may be possible to identify some mechanisms of grandparental influences on grandchildren's outcome. Zeng and Xie (2014) found that multigenerational influences are conditional on living arrangement in rural China. The effects of coresident grandparents' education were almost as large as those of parental education on grandchildren's education, whereas the education of grandparents who did not live with grandchildren did not matter. Apart from suggesting that co-resident grandparents served a parent-like role in helping grandchildren's education, Zeng and Xie (2014) argued that if the effects of co-resident grandparents were caused by any unspecified parental control or by measurement error of grandparents' education, the bias would have also affected the measures of deceased and non-coresident grandparental effects. The finding that the magnitudes of deceased and noncoresident grandparental effects were small confirmed that the associations between co-resident grandparents and grandchildren's outcomes were actual existence. These insightful comments also methodologically support other studies that reported interaction effects between grandparental effects and parental positions.

Furthermore, even though observed grandparental effects arose purely due to omitted variable bias or measurement errors, it still contributes to the understanding of inequalities related to family origins. In the case in which observed grandparental effects did not work through any mechanism of transfer to grandchildren but picked up the effects of unspecified parental characteristics, grandparental effects can work and also be understood as a proxy of family origins, contributing to the explanatory power of modelling. A multigenerational analysis by Ferrie, Massy, and Rothbaum (2016) found a small yet statistically significant effect of grandparents on grandchildren's education in the U.S. Ferrie and his colleagues doubted whether the estimated grandparental effects may be a true causal relationship or due to spurious measurement. Regardless of their doubt, without considering grandparental effects, the two-generational modelling underestimated the inequality persistence by 20 per cent (Ferrie, Massy, and Rothbaum, 2016). Taking grandparental effects into account may thus develop the knowledge about the inequality of opportunity and rigidity of inequalities (Mare, 2014).

Finally, well-executed studies of multigenerational associations are valuable in their own right and should not be disregarded as descriptive evidence in favour of a statistical focus on causal inference (Mare, 2014). Many of the studies of twogenerational social mobility are not exempted from the challenge of 'omitted variable bias' as multigenerational studies, although in some different ways. For example, Bukodi and Goldthorpe (2013) point out that studies using parental class as the only indicator of family origins would underestimate the effects of family origins but overestimate the effect of parental class. In other words, for two-generational studies, failure to specify relevant variables would also bias the estimation of causal impacts. However, the description of the two-generational associations provides
pictures of social fact, of significance to social justice and questions about the durability of inequalities, stratification process, and transformation from ascriptive to achievement selection. The descriptive multigenerational studies based on reasonable hypotheses and sound analysis also develop the understanding of these questions and should be credited with similar value

### 1.7 Research motives

This thesis aims to examine the persistence of inequalities in education and class attainment over three generations and to appraise the existence of independent effects of grandparental class.

Increasing life expectancy and lower fertility rates than in past generations result in the growth of so-called 'beanpole family' type (Bengston et al., 2001), which represents vertical instead of horizontal intergenerational structure. In this type of family structure, the number of family members per generation reduced but the number of generations within the same family network increased. The Office of National Statistics estimates that in 2010, over two-thirds of the population in England over the age 50 were grandparents, which is equal to approximately 12.2 million people (Beach, 2013). As a result of changes in demographic structure, grandparents in the UK spend more time with their grandchildren; the statistic shows that grandparents are able to spend 25 years on average with grandchildren (Hoff, 2015). Grandparents in general are also younger, with the average age of 68 , and more educated than before (Glaser, et al., 2013). All of these social facts suggest that grandparents likely to contribute additional resources to their grandchildren's wellbeing and social achievement in the UK.

Research on multigenerational inequalities is still at its blooming stage. The established studies are mainly concentrated in the U.S. (Beck, 1983; Warren and Hauser, 1997; Hertel and Groh-Samberg, 2014; Wightman and Danziger, 2014; Loury, 2006; Jæger, 2012; Sharkey and Elwert, 2011; Ferguson and Ready, 2011), and other European countries (Erola and Moisio, 2007 ; Hertel and Groh-Samberg, 2014; Deindl and Tieben, 2017; Modin, Erikson and Vagero, 2013; Bol and Kalmijn, 2016; Møllegaard and Jæger, 2015); in contrast, the topic of multigenerational inequalities in the UK is an underdeveloped research area.

The thesis will focus on the multigenerational inequalities in the UK. Previous research on multigenerational inequalities in the UK has overwhelmingly devoted its efforts to investigating the inequalities in class and class-related outcomes (Chan and Boliver; 2013; Moulton, et al., 2017). Yet it gives little or no attention to education, which is a crucial determinant of social mobility and social justice. Research on multigenerational inequalities in education has been dominated by focusing on the contexts of European countries and the U.S. The thesis will explore the research questions of whether grandparental effects on grandchildren's education and class attainment exist independent of parental characteristics.

While a number of studies found the evidence of the existence of grandparental influences, one needs to ask where these grandparental influences come from, and how grandparents affect grandchildren's attainments over and above parental impacts. Social scientists have explained various mechanisms through which how family advantages or disadvantages are passed on over generations; however, these mechanisms have hardly been empirically tested in studies on multigenerational influences (for notable exceptions, see Knigge, 2016; Zeng and Xie, 2014). In order
to understand multigenerational influences, it is crucial to test empirically the mechanisms researchers proposed. This thesis will proceed to address the research questions regarding the mechanisms through which grandparental effects operate on grandchildren's education.

The present thesis, to my knowledge, is the first piece of research that focuses on grandparental effects on education in the UK and also the first piece of research that provides a holistic picture of multigenerational inequalities in the UK while taking into account social class and education together. This thesis also makes substantial progress in gaining insights into the mechanisms through which grandparental effects operate on grandchildren's education. Overall, this thesis seeks to develop upon previous studies to contribute to the understanding of the persistence of inequalities over generations. I use appropriate statistical techniques to provide evidence for whether intergenerational mobility in the UK follows a first-order Markovian chain or grandparents have effects on grandchildren's education and class over and above parental effects.

Drawing on the data from British Household Panel Survey (BHPS) and the UK Household Longitudinal Survey (UKHLS), I construct the three-generational family lineages, from grandparents to parents and then to grandchildren. A number of previous studies used incomplete family lineages, either only paternal grandparents (Hertel and Groh-Samberg, 2014), or only maternal grandparents (Loury, 2006; Chan and Boliver, 2013), or only one set of grandparents that are chosen randomly (Chiang and Park, 2015; Bol and Kalmijn, 2016; Møllegaard and Jæger, 2015). Using the sample of incomplete family lineages may result in underestimation of the effects of grandparents. My data contain the records of both paternal and maternal
grandparents and thus provide a complete picture of family lineages. This allows me to conduct accurate estimation of multigenerational inequalities.

### 1.8 Thesis structure

The remainder of the thesis is set out as follows. Chapter 2 describes the data and methods that the thesis uses. It provides a detailed description of the datasets of three-generational family lineages drawn from British Household Panel Survey and The UK Household Longitudinal Study, and the process of how I construct threegenerational family lineages. The chapter explains the statistical methods and why they are the most appropriate to my research interests and to the data. It also reports the measurements for explanatory variables related to grandparents and parents and outcome variables including grandchildren's education and class.

In terms of absolute mobility, is grandchildren's class attainment related to grandparental class? Chapter 3, as the first empirical chapter, addresses the absolute mobility of social class over three generations. The chapter provides the preliminary descriptive evidence of the grandparents-grandchild outflow mobility rates while taking into account parental class. This chapter serves as an opening of the discussion of grandparental role in social mobility.

Does grandparental class have a direct effect on grandchildren's education independent of parental resources? Chapter 4 explores the direct effects of grandparental class on grandchildren's education. The chapter shall first address the research questions of whether the effects of grandparental class on grandchildren's education exist net of parental characteristics. Using ordinal logistic modelling for
grandparental effects, the findings are able to control for parents' social class, education, household income, and property ownership, together with grandchildren's demographic information. By including a wide range of parental characteristics, I expect that the estimation of grandparental effects is statistically sound with the minimum chance that estimated effects of grandparents pick up unobserved effects of parental resources.

This chapter will make a substantial contribution to the understanding of the operation of grandparental effects. Using a subsample drawn from the UKHLS, I investigate the questions of whether grandparental effects on the chance of grandchildren attaining higher education are contingent on the living status of grandparents and on grandparent contact.

The chapter will then carry on testing the research questions of whether grandparental effects are evenly distributed or concentrated at the top or the bottom of social stratification. A few of studies that support the augment hypothesis suggest that advantaged parents have the capacity of making efficient use of grandparents' resources, and as a result, grandparental effects are notably stronger on grandchildren with advantaged parents than on those with disadvantaged parents (e.g., Chiang and Park, 2015). In contrast, some studies found the evidence supporting the compensation hypothesis that grandparents compensate for lacking resources in disadvantaged families, and as a result, grandparental effects are stronger on grandchildren with disadvantaged parents than on those with advantaged parents (e.g., Jæger, 2012). I use the methods of latent factor analysis and predicted marginal effects to test these two competing hypotheses.

What role did grandparental class play in the context of the 1990s Higher Education Expansion? Chapter 5 investigates grandparental effects on grandchildren's education during the 1990s educational expansion. Higher education in the UK has undergone dramatic expansion in recent decades, and such expansion is considered to be related to more equal access to higher education. The chapter will examine the questions of whether inequalities have persisted or improved over the period of educational expansion, and of how incorporating grandparental class contributes to an adequate understanding of the effects of family origins on multigenerational inequalities.

Does grandparental class have significant impacts on grandchildren's class outcomes? Chapter 6 comes back to grandparental effects on grandchildren's class attainment. First, the chapter will investigate the research questions of whether grandparents' class is directly associated with grandchildren's class attainment net of parents' class, education, and economic resources. Second, the chapter will explore the research questions of whether grandparental effects on grandchildren's class still exist after introducing grandchildren's own education. Using the path analysis with latent factors method, the findings are able to estimate the direct and indirect effects of grandparental effects on grandchildren's class attainments.

Chapter 7 summarises the main findings in relation to the grandparental effects. It reflects on the thesis's main contributions in research and policy-making. The chapter will also review limitations of the present research, as well as on the opportunities for research in the future.

## Chapter 2 Data and Methods

This chapter will discuss the data and methods employed to address the research questions in each of the empirical chapters that follow. This thesis uses nationally representative survey data to explore three-generational social mobility in contemporary British society. The chapter will start with data description, and explain how I construct three-generational family lineages. The chapter then moves to describe the key measures used in this study. Next, I will explain the methods and why these methods are appropriate (and why some alternative methods seem plausible but are not practical) for this study.

### 2.1 Data

### 2.1.1 Datasets

The British Household Panel Survey (the BHPS), funded and carried out by the ESRC UK Longitudinal Studies Centre and the Institute for Social and Economic Research, is an annual panel survey of a nationally representative sample that yielded 8,167 addresses, identified 13,840 persons at those addresses (Lynn, 2006). The BHPS was designed to collect information of all adult members (aged 16 or over) within the selected household in successive waves, and if the members move out from the original household to a new one, then all adult members of the new
household would also be interviewed ${ }^{5}$. New entrants to the selected households would also become eligible for interview. Children in selected households are interviewed once they reach the age of 16 . The selection of the original household samples was stratified by region and socio-demographic characteristics using the Postcode Address File for Great Britain as the sampling framework. The sample is broadly representative of British population as it changed through the 1990s. The Scottish and Welsh extension samples of 1500 respondent households in each country were integrated at wave 9 , and then a new sample of 1,979 households across Northern Ireland was included in wave 11. Aiming at developing the understanding of social and economic changes in Britain, the BHPS collected rich data on household relationships, performance in the labour market, income and wealth and conventional measures of socio-demographic characteristics. So far the design of the BHPS ensures a balanced representation stratified by geographical and socio-demographic attributes with reduced sampling error.

The UK Household Longitudinal Study (the UKHLS) that began in 2009, also known as Understanding Society, is a valuable survey that collects rich data annually based on a panel sample of 40,000 UK households. The UK Household

[^4]Longitudinal Study builds on the success of the BHPS and provides the information on the changes in socioeconomic circumstances and on how households and individuals respond to these changes. The general population sample is a stratified, clustered sample of households with a design of equal probability sampling throughout the UK. The field work of a single wave is scheduled over two years. Using a similar approach of following household members to that in the BHPS, the survey conducts interviews with the adult members of selected households and follows them in successive waves; if these adult members split out from the original households, they would be followed and interviewed, together with other adult residents in the new households. The following rules used by both BHPS and UKHLS are designed to imitate the demographic processes of population reproduction such as birth and death, emigration, and cohabitation/marriage formation and cessation, representing the evolving pattern of households and families in the UK (Buck and McFall, 2012). The UK Household Longitudinal Study incorporates a sample from the BHPS since Wave 2 during the period between 2010 and 2011. In addition, for the most of the variables involved in this study, the wording of the questions asked is largely consistent between the two datasets.

### 2.1.2 Construction of Three-generational Lineages

In order to build up family lineages of three generations, first I need to identify twogenerational associations between parents and children. A parent-child association is


#### Abstract

identified when the household reference person ${ }^{6}$ has ever had at least one child living with him or her in the households across the survey waves that he or she attended. When a child, including a natural child, adopted child, foster child, stepchild, and partner's child, is identified in a household, the household reference person and the household reference person's lawful spouse or live-in partner would be identified as the parent(s) to this child. In three-generational lineages, there is at least one respondent identified as a parent and one respondent as a child. Siblings who have the same parents would be identified as in separate lineages.


[^5]Table 2.1 Summary of measures of education and class of three generations

|  | Grandchildren | Parents | Grandparents |
| :---: | :---: | :---: | :---: |
| Education | Highest educational qualifications that grandchildren ever achieved | Highest educational qualifications parents have ever achieved. | Questions that are asked to parents: 'Thinking about your father's educational qualifications, please look at this card and tell me which best describes the type of qualifications your father gained.' |
| Class | Current or most recent class positions that grandchildren achieved | 1. Questions that are asked to grandchildren: 'Thinking back to when you were 14 , what job was your father/mother doing at that time?' <br> 2. Occupations that parents took when grandchildren were aged 14 or closest to the age of 14 . | Questions that are asked to parents: 'Thinking back to when you were 14 , what job was your father/mother doing at that time?' |

I acquire the information on grandparents by using the records on family origins that are provided by the individual respondents identified as 'parents'. The questions of 'Thinking back to when you were 14 years old, what job was your father/mother doing at that time' was asked to every eligible household member, and the responses that the members identified as 'parent' provided would be used as occupational information on grandparents. A three-generational lineage is identified when the grandparent information is available in a two-generational association between parents and children. While 'parents' and 'child' are the actual respondents of the BHPS or UKHLS, 'grandparents' are not surveyed respondents but exist only in the records on family backgrounds that 'parents' provided (see Table 2.1). For the ease
of presentation, respondents who were identified as 'child' (to the 'parents') in three-generational lineages would be referred to as 'grandchild(ren)'.

One of the major advantages of this method of lineage construction is that it is designed not to locate natural child-parent(s) lineages; rather it seeks to capture actual household member relationships which is deemed to be more indicative of social origins and thus may have more substantial influences on individuals' achievement in educational levels and the labour market than do biological childparent(s) bonding. In the three-generational lineages constructed, while the grandchild could be biologically or non-biologically related to 'the parent' defined, the point is that this child and this parent were living together so that this child could benefit from or be constrained by socioeconomic positions of his or her 'parent' defined ${ }^{7}$. In the present data drawn from the BHPS and UKHLS, non-biological relationships take up 9-10 per cent of the paternal lineages and less than 2 per cent of the maternal lineages.

[^6]
### 2.1.3 Sample structures

I construct two samples of three-generational lineages. In the first sample, each grandchild who had available information on grandparents is taken as one observation. Every grandchild is observed once in the dataset, whether the grandchild has grandparental information available from only one side (either paternal or maternal) or from both paternal and maternal sides. By including the paternal and maternal grandparents simultaneously, this sample provides the records of the full grandparent pedigrees.

Using this sample, I incorporate grandparents from paternal and maternal lineages as explanatory variables into the model and estimate their influences. This sample is mainly used in path analysis (see Chapter 6, Section 6.4), which highlights the pathways of how family advantages are transferred over generations. While I have no intention to focus on the comparison between the influences of paternal grandparents and maternal grandparents, the first sample is not appropriate to estimate combined impacts of paternal and maternal grandparents.

I build up the second sample to examine grandparental effects without distinguishing paternal or maternal lineages. In the second set of samples (see Figure 2.1), a grandchild who has grandparental information available from only one side, either paternal or maternal, would be taken as one observation; a grandchild who has grandparental information available at the both paternal and maternal sides would be observed twice. In the case of a grandchild with full information on grandparents from both paternal and maternal sides, the first observation for grandparents is his or her paternal grandparents, and the second observation is his or her maternal grandparents. The personal identifiers of grandchildren are not unique in the second
sample since the unit of analysis is the family lineages rather than individuals. A similar approach is also adopted by Erola and Moisio (2007) ${ }^{8}$.

An important advantage of this approach compared to using the two sets of grandparents simultaneously in one model is that it captures the full picture of multigenerational inequalities that serves the purpose of the present thesis. Very few studies have demonstrated the full effects of grandparents (Bol and Kalmijn, 2016); most have tested either the maternal grandparents or paternal grandparents, or randomly selected one set of grandparent pedigree. While some studies that tested the two sets of grandparent lineages aimed at comparing the strength of paternal and maternal grandparents (e.g., Modin, Erikson, and Vågerö, 2013; Moulton, et al., 2017), this is beyond the major goal of the present thesis. Instead, the thesis strives to examine all the potential effects of grandparents. The present thesis provides a rare opportunity to investigate the influences of multigenerational lineages across maternal and paternal sides on adult grandchildren's educational and class attainments. The sample that does not differentiate paternal and maternal lineages is used for the major analyses on education and class. By doing so, the analyses utilise a relatively large sample which are more statistically powerful. The distribution of grandparental class is not essentially different from that in the sample where each grandchild is observed once (and the two sets of grandparents are present simultaneously) (see Table A2.1, Appendix 2).

[^7]Figure 2.1 Illustration of the data structure in which the grandchildren who had available information on both paternal and maternal grandparents appear twice


Notes: The grandchild ID 100001 has the information on paternal and maternal grandparents available and appears twice in the data (two observation items). The grandchild ID 100002 has the available information only on maternal grandparents and appears once in the data.

### 2.2 Measurement

### 2.2.1 Class measures

Class positions are coded into the National Statistics Socio-economic Classification (NS-SEC). The NS-SEC, which originated from the Goldthorpe scheme, is based on employment relations and occupations ${ }^{9}$. Occupational groupings are considered to be characterised by different employment relationships that entail different positions in labour market and production units, in which locations can be distinguished in class stratification.

In applying the British National Statistic Socio-Economic Classification (NS-SEC), Goldthorpe and McKnight (2006) empirically demonstrate that contrasts stand out in the experiences of incumbents of different classes in terms of economic security, economic stability, and economic prospects. Goldthorpe and McKnight postulate that class position measured by the NS-SEC scheme can be seen not only as determining educational and occupational choices that individuals make, but also as

[^8]constraining or enabling their life-chances, particularly regarding social mobility patterns.

The NE-SEC scheme has eight analytic classes, but occupational records collected in the BHPS are coded in the seven-class scheme from which Class 8 (Never worked and long-term unemployed) is omitted. Depending on the sample required for particular analysis, it is collapsed into the five- and three- class versions (see Table 2.2).

In deriving class origins and class attainment of grandchildren, the sample takes into account three categories for all respondents: full-time students, retirement, and unemployment. For the respondent who was a full-time student in a given wave, his or her employment status is marked as missing in that wave. Full-time students' part-time jobs are expected to be different from the occupational positions they will take after the students have completed their education. If respondents are marked as retirement or unemployment in the last known wave but they have occupational information available in earlier waves, occupational information that is collected before they enter retirement or unemployment would be marked as occupational status. The reason for this treatment is that for individuals who are retired or unemployed, their life chances and living standards are largely determined by the previous occupational positions they took. By so doing, it is expected to provide a full picture of class positions that individuals hold.

Table 2.2 Eight-, five- and three- level versions of the NS-SEC schemes

| Eight classes | Five classes | Three classes |
| :--- | :--- | :--- |
| 1. Higher managerial, <br> administrative and <br> professional occupations |  |  |
| 1.1 Large employers and <br> higher managerial and <br> administrative occupations | 1. Higher and lower <br> managerial, administrative <br> and professional occupations | 1. Higher and lower <br> managerial, administrative <br> and professional occupations |
| 1.2 Higher professional <br> occupations |  |  |
| 2. Lower managerial, <br> administrative and <br> professional occupations |  | 2. Intermediate occupations |
| 3. Intermediate occupations | 2. Intermediate occupations |  |
| 4. Small employers and own <br> account workers | 3. Small employers and own <br> account workers | 2. |
| 5. Lower supervisory and <br> technical occupations | 4. Lower supervisory and <br> technical occupations | 3. Routine and manual |
| 6. Semi-routine occupations 5. Semi-routine and routine <br> occupations | N.A |  |
| 7. Routine occupations | 8. Never worked and long- <br> term unemployed | N.A |

The analysis of class attainment excludes the respondents who have been inactive or unemployed in the labour market throughout the survey periods. This treatment follows the conventional process of how the NS-SEC schema is used in social mobility research (Fry, Al-Hamad and White, 2012). When a respondent had a fulltime job and then was unemployed at the later wave, the record of social class would be derived from the last full-time job the respondent had. While the discussion of unemployment could be a promising line of future research in multigenerational inequality, it is beyond the scope of the present thesis. Although the present thesis does not intend to focus on unemployment, it is worth noting that employees in working-class positions (i.e., semi-routine and routine occupations) have a relatively high risk of recurrent or long-term unemployment (Goldthorpe, 2016a).

Instead of using grandfathers as the head of the household, I adopt a 'dominance approach' (Erikson, 1984) by allocating the class origins to the class positions of the grandfathers or grandmothers whoever had the higher position. The dominance approach is applied either within paternal lineages or within maternal lineages. The adoption of the dominance approach that brings in grandmother's status by referring the higher class between both grandparents to as the grandparental class fits well the conceptual stance of the present thesis. The dominance approach, based on information about the class positions of those family members who take economic responsibility of the household, is used to indicate the resources that grandparents hold. It reflects the everyday observation of the contribution of grandparents ${ }^{10}$ since it is within households that grandfathers and grandmothers tend to support each other. Take the combination of salariat grandfather and working-class grandmother for example: the grandmother may have more frequent interaction than the grandfather with grandchildren, but the financial support from the grandmother to grandchildren is largely determined by the material resources of the grandparents as a whole, rather than the grandmother alone. In addition, and concomitantly, using this method has reduced the amount of missing data on the grandparental class variable ( Li and Devine, 2011) by addressing the issues related to single parents and house wives.

[^9]In the same vein, this approach is also used to measure parental class to arrive at a single variable. The application of the dominance approach is expected to be able to capture accurately class origins of respondents than using father's position, given the rising number of female headed family and dual-earner households in the British labour market (Heath and Payne, 2000).

The pattern of absolute upward mobility that arises because of the expansion of the salariat group equally benefits men and women, or even more favours women in some aspects (Goldthorpe and Jackson, 2007; Li and Devine, 2011). A cohort study by Paterson and Iannelli (2007) shows that the proportion of households in which class positions of mothers are higher than those of fathers has risen from $14 \%$ to $29 \%$ across four cohorts (1937-46, 1947-56, 1957-66 and 1967-76). Similarly, Li and Devine (2011) also found that this number has increased from $17.9 \%$ in 1991 to nearly a quarter (23.5\%) in 2005. Applying the dominance approach to the five-class version of NS-SEC, the results show that among grandchildren who have information available on both father's and mother's occupations, 26 per cent had mother who took higher class positions than did father; 38 per cent had father occupying higher positions and 36 per cent had father and mother being found in the same class. Using the dominance approach, I am also able to avoid data attrition bias. Using grandfather or using grandfather and grandmothers together (as two separate variables) would have omitted parents originating from a single-parent family. Omitting parents from single grandparent household would exclude those adults who were raised in lone-parent family and likely to have lower education and occupational achievements as compared to their counterparts from two-parent family (Ermisch and Francesconi, 2001; Müeller and Cooper, 1986). The sample sizes of three-generational lineages are reported in Table 2.3.

Table 2.3 Data records of three-generational family lineages
BHPS: Total 43,189; grandchildren, 15,383

|  | All grandchildren | Grandchildren 25-65 |
| :--- | :---: | :---: |
| Grandchildren | 15,383 | 4,165 |
| Father | 13,342 | 3,405 |
| Mother | 15,118 | 4,012 |
| Father's class | 12,715 | 3,595 |
| Mother's class | 13,998 | 3,792 |
| Parents' class | 14,973 | 4,082 |
| Paternal grandfather | 9,732 | 2,547 |
| Paternal grandmother | 5,329 | 1,077 |
| Maternal grandfather | 11,509 | 3,233 |
| Maternal grandmother | 6,942 | 1,594 |
| Paternal grandparents | 10,190 | 2,669 |
| Maternal grandparents | 12,290 | 3,403 |

UKHLS: Total 104,814; grandchildren, 38,270

|  | All grandchildren | Grandchildren 25-65 |
| :--- | :---: | :---: |
| Grandchildren | 38,270 | 5,422 |
| Father | 29,301 | 3,556 |
| Mother | 37,276 | 5,039 |
| Father's class | 26,880 | 3,698 |
| Mother's class | 29,911 | 3,716 |
| Parents' class | 34,986 | 4,612 |
| Paternal grandfather | 15,879 | 1,846 |
| Paternal grandmother | 9,858 | 901 |
| Maternal grandfather | 22,118 | 2,726 |
| Maternal grandmother | 15,280 | 1,508 |
| Paternal grandparents | 17,226 | 1,973 |
| Maternal grandparents | 24,596 | 2,970 |

### 2.2.2 Education measures

I use educational qualifications as the indicator of parental education and grandchildren's own educational attainment. Grandchildren's educational attainment
is measured by the highest qualifications that they have achieved ${ }^{11}$. Regarding parental education, I decide to use both father's and mother's education, as a number of studies indicate that father's and mother's education may operate in different ways in shaping their offspring's education (Korupp, et al., 2002; Reay, 1998; Reay, 2000). In the sample, 34 per cent of grandchildren were born to the families in which father had higher education than the mother; 25 per cent were born to the families in which mother had higher education than father; 41 per cent had the parents who obtain the same qualifications.

The education classifications are hierarchically ranked in both the BHPS and UKHLS. For the present purpose, I collapse the 'higher degree' and 'degree' categories in the BHPS as 'degree', which is equivalent to the level of 'degree' in the UKHLS. They refer to undergraduate degrees and postgraduate degrees. The category 'sub-degree' refers to vocational higher education qualifications, including teaching and nursing higher qualifications. The category of the primary education is combined with 'no qualification' as 'primary or no qualifications'. Table 2.4 gives details of the original classifications in the surveys and those used in the present analyses after collapses.

[^10]Table 2.4 Matching and collapse of educational qualifications

| BHPS | UKHLS | The Present Analyses |
| :--- | :--- | :--- |
| Higher Degree <br> 1st Degree | Degree | Degree |
| HND, HNC, Teaching | Other higher degree | Sub-degree |
| A Level | A-level etc | A Level |
| O Level | GCSE etc | O Level \& GCSE |
| CSE <br> None of These | Other qualification | Primary or no qualification |

Grandparental education is measured on the basis of the response of the parental generation to the question 'which (the following options) best describes the type of qualifications your father/mother gained'. This question was only asked once (at the thirteenth wave) over the eighteen waves of the BHPS, resulting in a large number of missing values by design. Furthermore, rather than using the fairly detailed classifications as in parents' and grandchildren's education, grandparents' education is measured by five categories which appear to be relatively rough, ranging from 'got a university degree or higher degree' to 'never went to school'. The lowest two categories 'never went to school' and 'left school without qualifications' are combined as 'no qualification'. The missing values of grandparental education is included in the data as an 'unknown' category. The variable representing grandparental education is used in a complementary analysis in Chapter 4.

### 2.2.3 Parental wealth

Parental wealth is measured by two indicators, monthly household income and household ownership. Incomes are computed at the household level using the total personal incomes of all household members, which include both labour incomes and non-labour incomes. The BHPS and UKHLS collect the information on incomes
from (self) employment and income from saving, investment, and benefits in the past 12 months, and then this amount is then converted pro-rata to a monthly equivalent figure (Jenkins, 2011; McFall, et al., 2013). To maintain the consistency between the two surveys, I used gross monthly household incomes instead of net incomes. The monthly household incomes are transformed using logarithm function and enter the models as a continuous variable ${ }^{12}$. Household ownership refers to whether the residents owned the household or not. Parents who own their households are more likely to be able to provide financial supports for their children. Housing is regarded as one of the most important components of social mobility mechanism (Blanden and Machin, 2017). The indicator of household ownership is recoded in binary form. The record would be coded as 1 if the residents owned the property outright or with a mortgage at the waves in which they were interviewed, and as 0 if the residents rented the property.

### 2.2.4 Grandparent contact

To approximate the measures of grandparents' involvements via direct contact, I use three indicators for the extent to which grandparents and grandchildren were in contact. The UKHLS asked parents three types of questions related to family networks: (1) 'Can you tell me if your father/stepfather/mother/stepmother is alive at the moment?' (2) 'Can you tell me how often you see your father/stepfather/mother/stepmother?' (3) 'How often do you have contact by telephone, email

[^11]or letter with your father/stepfather/mother/stepmother?' (The University of Essex, et al., 2016). Research shows that the strength of relationships between grandparents and parents is a substantial predictor of frequency of grandparent contact with their grandchildren (Uhlenberg and Hammill, 1998). It can be assumed that the closer the grandparents-parent relationship, the greater the likelihood that grandparents had direct involvements in grandchildren's life. These questions were asked separately for each of the paternal and maternal grandfathers and grandmothers. The information related to family contact is not available in BHPS, and the empirical analyses are based on a subsample from the UKHLS.

For the living status of grandparents, when only one grandparent was alive at the time of survey, regardless of grandfather or grandmother, the living status of grandparents would be marked as 1 ; when none of the grandparents were alive, the living status would be marked as 0 ; when both of grandfathers and grandmothers were alive, the living status would be marked as 2 . For the indicator of family contact, the dominance approach is employed, in which the family contact is determined based on the most frequent contact reported with grandfathers and grandmothers.

I created a fourth variable to capture actual involvement of grandparents in grandchildren's life. If grandparental effects on grandchildren's attainments are assumed to operate through the contacts between them in any forms but not necessarily through face-to-face interactions, the two original survey variables can be misleading on their own. The dominance approach is then adopted to derive a fourth variable based on the most frequent contacts in any form, regardless of whether the contact was by face-to-face interaction or by email, telephone or letter.

For example, in the case in which grandparents live far away from parents and grandchildren, grandparents would not be able to visit the family frequently; but if they call each other every day, I would identify this as frequent daily contact despite the lack of face-to-face interaction. In the case in which grandparents see parents and grandchildren every day, and therefore would not need to contact them frequently by telephone, email, or letter, I would identify this as frequent contact as well despite the absence of long-distance communication. In the case where neither frequent face-to-face interactions nor long-distance communication is present, I would identify this as the absence of family contact. In addition, I add another level 'deceased' for all three indicators (two original, one derived), if grandparents passed away. The variables related to grandparent contact are used in Chapter 4.

### 2.2.5 Demographics

Grandchildren's demographic information, including gender, age, birth cohort, regions, and race, is controlled for in all the regression analyses presented in the following chapters. The gender variable is in binary form, with male serving as the reference category.

Birth cohorts are coded as a categorical variable using three distinctive groups: people born in the (1) pre-1970s, (2) 1970s, and (3) 1980s and 1990s. Due to the upgrading of the structure of the educational system and the labour market, grandchildren born at different cohorts may have different possibilities of attaining certain qualifications and occupations.

Age and Age-squared enter the regression models as continuous variables. Age variables are centred within birth cohorts. For regression models on grandchildren's
educational and class attainments, the sample is confined to the grandchildren aged between 25 and 65 years. For log-linear models on grandchildren's class attainment in which the continuous age variables are not allowed to enter as control variables, the sample excludes the grandchildren younger than 30 years old in order to capture the occupational maturity of grandchildren.

Race is represented as a binary variable to account for ethnicities because the sample sizes for detailed ethnic minority groups are small. Regions also enter the models as a control variable. Regions are measured in four categories: England, Wales, Scotland, and Northern Ireland, with England serving as the reference category.

### 2.3 Methods

This section outlines the methods employed in the thesis. Section 2.3.1 gives a detailed discussion of log-linear modelling. Log-linear modelling is an important method in class mobility studies, particularly in studies in cross-national comparison and trends over time. However, I argue that log-linear modelling should be not taken as the default research method without any questioning. It is important to examine the advantages and disadvantages of log-linear modelling in investigating threegenerational mobility. This section also justifies the decision for why log-linear modelling, as a common practice in the study of social mobility, has limitations in addressing three-generational mobility, and therefore it is not the most appropriate method to the research questions. Section 2.3.2 discusses the basic rationale of binomial logistic regression and ordinal logistic regression. Section 2.3.4 describes some key features of path analysis modelling. Section 2.3.5 focuses on the
application of clustered errors. Section 2.3.6 discusses some alternative approaches and the reasons why the current models are favoured over these approaches.

### 2.3.1 Discussion of Log-linear modelling

Log-linear modelling has been a common practice in social mobility research and has also been utilised as an important method in previous research on threegenerational mobility (i.e., Beck, 1983; Chan and Boliver, 2013; Hertel and GrohSamberg, 2014; Erola and Moisio, 2007). For this reason, this section devotes a detailed discussion to the characteristics of log-linear modelling.

## Advantages

Log-linear modelling measures the association between family backgrounds and mobility outcomes such as education and class attainments in terms of odds ratios. From the 1970s onwards, the application of log-linear modelling has become an integral part of social mobility study. One of the greatest strengths of the application of log-linear modelling, as articulated by its advocates, lies in its ability to measure relative social mobility rates while separating the effects of occupational structure (or marginal effects) (Kelley, 1990). It is a real advantage, especially for crossnational comparative studies or studies investigating the changes in social mobility over time, as the structure of labour markets may vary in different contexts. Across industrialised societies or during different time periods, (absolute) mobility rates may have shown substantial variation; but this variation is likely to arise to a large degree from the changes of occupational structures rather than from the changes of relative chances of individuals originating from different family background (e.g.,

Breen, 2004; Goldthorpe, 1987; Goldthorpe, 2000). Regarding three-generational class mobility, log-linear modelling is particularly useful to estimate the relative mobility chances of grandchildren since class structures have undergone remarkable changes over the three generations.

The second advantage of log-linear modelling is its ability to assess the associations among all covariates simultaneously without distinguishing explanatory variables and outcome variables. This advantage is particularly relevant to the topic of threegenerational mobility pattern in that the simultaneous tests of log-linear modelling enable researchers to describe adjacent two-generational relationships. The null hypothesis that implies the non-existence of net grandparental effects describes a Markovian-chain mobility pattern: it would contain only adjacent two-generational associations between grandparents and parents and between parents and grandchildren. In contrast, the alternative hypothesis suggesting existences of net grandparental effects would add the skipped-generational association between grandparents and grandchildren together with those adjacent two-generational associations. The log-linear models testing these two competing hypotheses are compared in terms of model fit (the formulas and assumptions for these models are discussed in Appendix 2.1).

## Disadvantages

However, the limitations in log-linear modelling have weakened its statistical power and made it less statistically apt to handle the current research questions on threegenerational mobility. Due to its basis on contingency tables, log-linear modelling can cope with only a small number of categorical variables with limited categories.

The analysis of contingency tables requires a reasonable sample size in each cell. For example, if following the conventional log-linear analysis one attempts to measure three-generational class mobility with five-level categorical variables, separately by surveys and gender, then it would generate 500 cells ( $5 \times 5 \times 5 \times 2$ $\times 2$ ). The bottom line of log-linear analysis is no empty cell in the multi-way contingency tables. Since it is expected that individuals are not uniformly distributed over all the cells, log-linear modelling has a strict requirement for sample size. Empty cells can be distinguished in two types: structural zeros and sampling zeros (Agresti and Kateri, 2011). Structural zero cells exist because these cells are impossible to be observed in social reality, such as the number of male with ovarian cancer. Sampling zero refers to the situation in which it is theoretically possible to have observations if the sample size is large enough; in other words, it is because of sparse data that some specific cells appear to be empty. Sampling zero is a severe problem when applying the five-fold version of NS-SEC scheme in studying threegenerational class mobility using the BHPS and UKHLS. These sampling zeros exist because of limited sample size. Some combinations of class positions of grandparents, parents and grandchildren have very low frequencies so that they appear to be zero in the multiway cross-tabulation tables, but these combinations do exist in the real world. In this sense, one may say that if the sample size was large enough, the cells that are currently zero would have had relatively low counts. The methods that I attempted to address sampling zeros are discussed in Appendix 2.2.

The limitation of empty cells results in two serious measurement issues which Kelley (1990) explained in his critique of the application of log-linear diagram in social mobility research: conceptual confounding and the necessity of crude measurement. The limitation that log-linear models can handle only a small number
of categorical variables results in a loss in the estimation of parental socioeconomic backgrounds which in turn may inflate the estimated effects of grandparental class. As only one categorical variable measuring parental characteristic is allowed to enter into the model using the current data set, this variable would become the single proxy of parental backgrounds. Class positions, education, and economic resources involve different mechanisms in social mobility and they should be identified separately on both theoretical and methodological grounds. If both parental education and parental class as categorical variables are introduced into log-linear models, it would add another dimension to the contingency table, leading to even more serious problems related to empty cells. With respect to economic resources, since the log-linear model does not handle continuous variables, monthly household income as a continuous variable would have to be excluded from the model. Even though parental economic resources can enter into the model as a categorical variable by using income quantiles or by using binary property ownership, it would also intensify the issues of empty cells.

Ignoring the variety of parental resources that come to play distinctive roles in their children's attainment entails a substantial cost to the statistical power of the present three-generational mobility research. Regarding the parental generation, it would underestimate the effects of parental resources as a whole on individual attainment and overestimate the effects of the single indicator of parental backgrounds. When it comes to grandparental effects, the upshot is that the grandparental effects that are estimated in models using a single variable for the parental social position are very likely to pick up unmeasured parental influences. Thus it is crucial for the present research to utilize a rich range of indicators of parental resources in order to avoid the measurement issues of grandparental effects.

The third reason why the log-linear model is not the most appropriate method in the present research context lies in its inability to deal with the current clustered data structure ${ }^{13}$. Clustered data structure refers to the structure in which grandchildren living in the same households are more likely to be similar to each other in terms of social attainment as compared to grandchildren selected randomly in the population. Ignoring within-cluster error correlation may result in misleadingly small standard errors, and consequently large t -statistics and low p -values.

Chapter 6 on grandchildren's class attainment briefly reports the results of log-linear modelling using five- and three-fold versions of class schemes (Section 6.2). It compares a range of model fit indexes, including the Pearson chi-square, Dissimilarity Index, and BIC, to test the existence of net grandparental class effects.

### 2.3.2 Logistic regression modelling

I prefer ordinal and binary logistic regression to log-linear modelling as the major statistical methods in examining three-generational social mobility. The defining difference between log-linear modelling and logistic regression is that while the former analyses the strength of association underlying the contingency tables, the

[^12]latter models the sizes of the effects of explanatory variables at the individual level on specified outcome variables. As compared with log-linear modelling, logistic regression is more flexible in analysing a mixed set of categorical and continuous variables. As discussed earlier, one of the key methodological challenges is measurement confounding that estimated grandparental effects may pick up some unmeasured parental effects; and therefore it is crucial to employ as many sociologically meaningful indicators of parental resources as the data provide. The features of regression modelling that it provides coefficients and standard errors for the independent influences of each explanatory variables on an outcome variable allow to control for a relatively wide range of parental characteristics while estimating grandparental effects. By so doing, the model is able to minimise the measurement confounding issue that arises in log-linear modelling. In addition, the ability of regression analysis to accommodate clustered errors also makes it more appropriate than log-linear modelling to the data structure.

A choice between log-linear modelling and logistic regression is a trade-off between control and flexibility (Tansey, et al., 1996). Overall, I consider binary and ordinal logistic regressions more flexible and powerful than log-linear modelling in dealing with the three-generational social mobility research questions (see the explanation of binary and ordinal logistic regressions in Appendix A2.3, the parallel assumption of the ordinal logistic regression in Appendix A2.4).

### 2.3.3 Path analysis modelling

The Chapter 6 on class attainment employs path analysis to describe the mobility paths of how family advantages are passed on over three generations ${ }^{14}$. Considering gender differences in mobility pattern, I use multiple group analysis to generate a simplified model by allowing the coefficients of paths towards grandchildren to be free across genders and constraining those of the paths between grandparents and parents to be equal (Muthén and Muthén, 2012).

Mplus estimates ordered categorical variables such as educational qualifications and class positions with their latent continuous variables if they are endogenous variables ${ }^{15}$. Ordered categorical variables that are introduced as exogenous variables ${ }^{16}$ enter the model as dummy variables. I apply a robust weighted least squares approach with a diagonal weight matrix (WLSMV) as Mplus recommends when outcome variables (i.e., grandchildren's educational and class attainments) enter the model as ordinal categorical variables. Theta- parameterisation is considered to be appropriate for WLSMV estimation and categorical outcome variables in multiple group analysis (Muthén and Muthén, 2012) ${ }^{17}$. With WLSMV, Mplus estimates the path coefficients using ordinal probit regression method.

[^13]The overall model fit of the path analysis model is determined by the Chi-square statistics which tests the difference between the proposed model and the independence model in which variables or constructs are assumed to be unrelated. This index is known to be affected by large sample sizes. Along with chi-square test, Mplus also provides reliable model fit indexes such as Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Comparative Fit Index (CFI) is based on the comparison between the proposed model and the null model of zero correlations (Hooper, Coughlan, and Mullen, 2008). An advantage over Chisquare test is that Comparative Fit Index (CFI) is relatively insensitive to the sample size. CFI varies from 0 to 1 , and values greater than 0.90 are considered to indicate an acceptable model fit between the model and data. RMSEA has become one of the most popular model fit indicators (Hooper, Coughlan, and Mullen, 2008). RMSEA is also independent of sample size, but it is sensitive to the number of estimated parameters in the models. In other words, it favours parsimonious models. A RMSEA in the range of 0.05 to 0.10 is considered an indication of acceptable fit, and values between 0.00 and 0.05 indicate good model fit. The comparison between nested models is tested by Chi-square statistics.

### 2.3.4 Weighting adjustment

All the descriptive statistics presented in this thesis use weighted data to accommodate the complex surveys designs and sampling attrition, while sample counts are unweighted unless specified. I use cross-sectional adult interview and proxy weights at the last wave in which respondents provided the information on
their social class ${ }^{18}$. For the respondents who had available records of education but missing records of social class, I used cross-sectional adult interview and proxy weights at the last wave in which respondents attended. The weighting is multiplied by 0.5 for all the grandchildren who appeared twice in the data and the weights for grandchildren who appeared once remain the same.

Using three methods that statisticians recommend (Winship and Radbill, 1994), I run all the regression models presented in this thesis with unweighted as well as weighted data and did not find any essential differences in the results. I first compared the unweighted and weighted parameter estimates using F-test (Winship and Radbill, 1994) and did not find significant differences. I then introduced the weighting as an independent variable into models (Gelman, 2007) and the weighting variable showed no significant effects or model improvement. In the last method, I added the weighting variable and the interaction between the weighting variable and each independent variable to the models (Winship and Radbill, 1994), and found that these interaction effects had no significant effects in the F-test. The results show that the application of weighting adjustment did not yield substantial bias in the research questions of interests.

I prefer to present the model results using unweighted data because when the estimated parameters are essentially similar between weighted regression and unweighted regressions, the unweighted regression would be more efficient and provide smaller and correct standard errors as compared to weighted regression (Winship and Radbill, 1994). This is particularly true, as I have taken into account the cluster structure of the data.

[^14]
### 2.3.5 Clustered errors

In the regression analyses on this sample, I adjust standard errors for clustering of grandchildren within families. The data include siblings in the grandchild generation as the survey interviews were conducted at the household level. As a result, observed family characteristics as regressors are perfectly correlated within families and the error terms are likely to be positively correlated within families as well (Cameron and Miller, 2015). Using plain standard error would downward bias the p-values, resulting in incorrect statistical inferences. The clustered error approach is also employed by previous multigenerational studies (Hällsten and Pfeffer, 2016; Modin, Erikson, and Vågerö, 2013; Møllegaard and Jæger, 2015). Intraclass correlation is another important reason for clustering standard error ${ }^{19}$ (Rogers, 1993). Despite a fairly comprehensive range of measures of family origins being taken into consideration, there are unavoidably unmeasured influences of family background in shaping grandchildren's chance in education and class attainment. Because of these unobserved family influences, grandchildren living in the same households are likely to be similar as compared to those living in the different ones. Ideally, errors are independently and identically distributed, but obviously, this assumption is violated in the models. Controlling for clustered errors takes into account the unknown correlations between observations within a household.

According to the follow-up rules of the BHPS and the UKHLS, interviewers would follow the respondents who were marked as the original sample members (OSMs)

[^15]when the respondents move into a new household (Taylor et al., 2010; McFall, et al., 2013). In practice, the identifier of the earliest households in which the grandchild lived is used as the cluster variable.

The need for controlling clustered errors is decided by three factors: the strength of the within-cluster correlation, the strength of within-cluster correlation of explanatory variables used in modelling, and the number of the observation within each cluster (Cameron and Miller, 2015). Despite the low number of observations within each cluster, the within-cluster correlations of the outcome variables and explanatory variables are strong, and the measures of parental characteristics have the same values for the observations within the clusters.

The presence of clustered error does not affect the estimated coefficients; instead, it corrects the estimation of standard errors, which is fundamental to statistical inference. Comparing the models with clustered standard errors to those with plain standard errors, the results show that without considering clustered errors, t -statistics are notably larger, and p -values are lower. Moreover, the changes made by the implementation of clustered errors do cross over the threshold levels of statistical significance of some regressors. In other words, controlling for clustered errors corrects the otherwise misleading statistical significance of explanatory variables.

### 2.3.6 Alternative Approaches: Survey sampling and multilevel modelling

 Survey sampling is another approach that is commonly used to deal with clustered data. The clustering unit is referred to as a primary sampling unit (or PSU) which indicate the primary level of sampling. In the current data, the survey sampling approach assumes that the households are sampled first and then the individualswithin households, and as a result, individuals within a household are more likely to share similar characteristics than individuals between households. Using Stata, Cheah (2009) suggested that the standard errors estimated by the survey sampling approach are equivalent to the results by the clustered error method. This finding is confirmed in the models; the results by survey sampling methods are the same as those by cluster errors.

I also considered using multilevel modelling to handle the clustered data structure. Multilevel modelling, although it has many advantages and become popular in social sciences, is not an approach which is theoretically appropriate and practically applicable to the research questions of interest. In multilevel modelling, grandchildren with family origins characteristics are treated as level 1 units and households as level 2 units. Similarly to the clustered error approach, the multilevel modelling method also assumes that grandchildren within the same household tend to be more similar than grandchildren selected randomly from the population at large.

Multilevel modelling and regression with clustered errors adjusted are employed to address different research questions. Multilevel modelling is particularly useful to answer research questions that have substantial interests in group effects, such as the extents of grouping in individual-level outcomes and the effects of group-level predictors. Multilevel modelling allows researchers to estimate residual components at each level in clustered data. In the case in which multilevel modelling technique is employed in the current data, this two-level model which takes into account grouping of grandchildren outcomes within households would estimate residuals at the grandchildren level with family origins characteristics and the household level. The residual variance is therefore partitioned into a between-household component
and a within-school component. Multilevel modelling can show whether the explanatory power of the models lies mainly at the group level or at the individual level. These processes enable the researchers to estimate how much each level of analysis contributes to explanation in the model, and how much each level contributes to the errors. In this light, one may say that the multilevel modelling approach intends to analyse a process adequately; in contrast, adjusting clustered errors does not add much complexity raised in partitioning variance components; rather, it serves to correct statistical inferences (Primo, et al., 2007).

As the research questions concern the direct contribution of grandparents to their grandchildren's attainment, the thesis intends to focus on coefficients, standard errors, and therefore p-values, rather than estimating the grouping in grandchildren in households and variances at different levels. In practice, multilevel modelling does not perform well with the data. A key practical reason that makes the current data inappropriate to multilevel modelling is that the number of observations in each household is too low and also unbalanced. With households as the prime sampling unit, I selected only over 25 years old grandchildren who had available information on grandparents, parents and their own education and class attainment; as a result, the data appear to be considerably sparse.

Putting grandsons and granddaughters together, I found that in a model with education outcome variable, the average group size is very small (with a mean 2.4, ranging from 1 to 10). With multi-level modelling on other key outcome variables, the group size is also found very small and unbalanced. The conventional general rule is that for multilevel modelling the minimum group size is $10-15$, which is far higher than the current data. Clarke (2008) and McNeish (2014) argue that the
multilevel modelling method still estimates valid regression coefficients and standard errors with as low as two observations per group, given that the number of groups (i.e., level 2 units) is sufficient. They found, however, that the model estimation might be compromised when both small group sizes and unbalanced data structure are present at the same time ${ }^{20}$. I attempted to run multilevel ordinal logistical regression models with grandsons' and granddaughters' educational and class attainments. After several attempts, the most of my multilevel models failed to converge ${ }^{21}$.

Being aware of different methods in dealing with clustered data, I prefer the clustered error approach to multilevel modelling in addressing research questions. Both clustered errors and multilevel modelling can be used to obtain correct inferences which otherwise would have been biased in plain ordinal logistic regressions that fail to consider clustered structure. The clustered error approach, however, is more theoretically informed and also practically applicable to the data.

[^16]
## Chapter 3 Absolute Mobility of Three Generations

### 3.1 Introduction

This chapter intends to serve as a brief opening of the empirical analysis. This chapter describes absolute class mobility over three generations, and in particular, addresses the research questions of whether grandparental class is directly related to grandchildren's class after parental class is taken into account. Absolute mobility as a conventional method of social mobility refers to observed mobility; it describes the proportions of individuals who attain social class that are different from or similar to their family origins. In other words, they measure whether and to what extent individuals are better off, or worse off, relative to their family origins. The absolute mobility rates can be examined from a cross-tabulation of family origins against grandchildren's class attainments.

Numerous studies on social inequalities in class from a perspective of absolute mobility have demonstrated that children's attainments are strongly related to their parental social characteristics (e.g., Blanden and Machin 2010; Breen, 2004; Goldthorpe 1987; Li and Devine, 2013). Parents transmit family advantages or disadvantages to their offspring's social attainment, and intergenerational inheritance of family advantages/disadvantages is found to be very strong in Britain. However, these conclusions focus on only the associations between parents and children, and there are only a handful of studies that discuss absolute class mobility over three generations. Erola and Moisio (2007) used the method of crosstabulations with categorical measures of social class and found clear relations
between grandparental class and grandchildren's class; however, without any attempt to isolate the parental influences, they emphasised that it reflects structural changes in Finnish class structure over time. Chan and Boliver (2013) used the similar cross-tabulation method but controlled for the mediating role of parental characteristics. They found that outflow mobility rates from service class parents to grandchildren's class depended on grandparental class in Britain. A recent comparative study on three-generational mobility in U.S. and Germany (Hertel and Groh-Samberg, 2014) presents outflow mobility tables from fathers to sons separated by grandparents' class. Hertel and Groh-Samberg argued that while grandparental influences on sons' outflow rates were rather limited, immobility across three-generations was most frequent in the service class.

This chapter will use two strategies. First, I will outline the outflow tables between parents and grandchildren and between grandparents and grandchildren. By doing so, I expect to describe the gross amounts of the grandparents-grandchild mobility. Second, I will estimate the outflow mobility rates between grandparents' class and grandchildren's class separated by parental class. I argue that the association between grandparents and grandchildren by certain types of parents manifests the patterns of how grandparents affect grandchildren's absolute mobility outcome net of parental influences.

### 3.1.1 Chapter structure

The remainder of this section reports research questions and core findings. Section 3.2 reports the data and measure that the analysis uses. Section 3.3 presents the
findings of absolute class mobility. Section 3.4 summarises the main findings of the chapter.

### 3.1.2 Core findings

A few of essential prior conditions will be identified before running analysis of absolute mobility of three generations that the upgrading of the occupational structure in the labour market affects absolute mobility, and that grandchildren's class attainment is related to parents' class. Once these basic assumptions have been confirmed, I will move to examine grandparental role in absolute class mobility. This chapter will address the following research questions

1. Do grandparents-grandchild associations in absolute mobility exist without parental class being taken into account?
2. Do grandparents-grandchild associations in absolute mobility still exist after parental class is taken into account?

- Do grandchildren of salariat grandparents have a higher proportion of attaining salariat class than did those of working-class grandparents after the parental class has been controlled?

This chapter will show that grandchildren's absolute class mobility outcomes are related to their grandparents' class and that these close relations between grandparental class and grandchildren's attainment still exist with parental class being taken into account. The chapter will further examine that for absolute class mobility outcomes, the patterns of such associations vary across parental class. The results suggest that for grandchildren with salariat parents, those of salariat
grandparents have substantially higher proportions of attaining salariat than do those of working-class grandparents and that for grandchildren with working-class parents, those of salariat grandparents and small-employer grandparents have substantially higher proportions of reaching salariat positions than do those of working-class grandparents.

As a result of sex segregation and women's career interruption, men dominate the top of the class stratification, and the majority of women face some obstacles hindering the career advancement and are found in the middle and lower positions (Li, Devine and Heath, 2008). From that point forward, research based on Britain and international contexts suggested that men and women follow different trajectories of mobility (i.e., Breen and Jonsson 2005; Li, Devine and Heath, 2008) and that the trends in absolute mobility between parents and children over time are also different for men and women (Li and Devine, 2011). While previous studies on absolute class mobility over three generations did not highlight gender differentials in the pattern of grandparents-grandchild associations, I will discuss the question as to whether grandsons' and granddaughters' attainments are related to their grandparents' class in different ways.

- Do the associations between grandparental class and grandchildren's class differ according to grandchildren's gender?

First, for both grandsons and granddaughters with salariat parents, having advantaged grandparents was related to high chances of attaining advantaged classes. Second, regarding grandchildren born to working-class parents, grandsons of salariat grandparents had a high proportion of moving back to salariat class, whereas it was
granddaughters of small-employer grandparents who took up the best chance of enjoying salariat class positions.

### 3.2 Data and measures

This chapter uses data from BHPS and UKHLS. I use the two-way cross-tabulation as the major method to measure absolute mobility rates of class attainment. Grandparental class is used as an indicator of grandparents' social position. The application of two-way cross-tabulation constrains the measure of parental resources to a single categorical indicator. Parental class is used to represent parental resources. In regression modelling on grandchildren's class attainment in later chapters, the parental class is found to be the most influential factor as compared with other parental measures. For parental class, I use the dominant approach to arrive at a single indicator. That is, parental class are determined jointly by fathers' or mothers' attainments (whichever is higher).

This chapter reports the weighted results. I run all the analyses using weighted and unweighted data and found that the results were highly similar and the differences, if any, were small. The conclusions drawn from the following discussion are robust whether or not the data are weighted.

### 3.3 Absolute class mobility

Table 3.1 shows class distributions of grandparents, parents, and grandchildren. In order to reduce the age effect on the mobility from family origins to present class
attainment, I confined the analysis to grandchildren over 25 years old at the last wave of the BHPS and UKHLS where his or her class positions were reported. Britain has undergone a substantial upward shift in class structure since the late $20^{\text {th }}$ century. The data are arranged by generations instead of by cohorts or by time periods, and therefore the changes revealed in the discussion may be somewhat different from what is shown in cohort data or cross-sectional surveys. The data, however, does reflect that class structure has updated over time.

Table 3.1 Class distributions of three generations

|  | Grand- <br> parents | Father | Mother | Parents | Grand- <br> sons | Grand- <br> daughters |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Higher \& lower salariat | 20.8 | 32.0 | 24.6 | 39.1 | 34.8 | 41.3 |
| Intermediate occupations | 10.2 | 8.4 | 20.4 | 15.5 | 11.7 | 21.7 |
| Small employers \& own | 16.4 | 15.0 | 6.1 | 10.8 | 10.9 | 5.1 |
| account workers |  |  |  |  |  |  |
| Lower supervisor \& | 16.3 | 16.2 | 4.8 | 11.0 | 11.6 | 5.3 |
| technicians | 36.2 | 28.5 | 44.2 | 23.6 | 31.0 | 26.7 |
| Semi-routine \& routine | 9,708 | 9,588 | 9,439 | 10,347 | 5,527 | 4,421 |
| N |  |  |  |  |  |  |

Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Working class accounted for over one-third of the grandparental generation and its proportion decreased to 24 per cent in the parental generation. Regarding salariat class, the size nearly doubled from 21 per cent in the grandparental generation to the nearly 40 per cent in the parental generation. At the grandchildren generation, 35 per
cent of grandsons and 41 per cent of granddaughters are found in salariat class ${ }^{22}$. Turning to classes at the middle range, I find that the composition of the intermediate classes undergone noticeable changes. The proportions of both lowlevel supervisors and technicians and small employers have shrunk over generations, from 16 per cent at the grandparental generation to 11 per cent at the parental generation. In contrast, the proportion of the intermediate occupations that cover positions in clerical, sales, services and intermediate technical occupations (without involving planning or supervisory powers) has increased, especially among granddaughters. Gender segregation was clearly shown in the composition of the intermediate classes. Whereas as compared with grandsons, granddaughters were much more likely to be employed in the intermediate occupations, they were less likely to have a business of their own or to become low-level supervisors and technicians.

[^17]Table 3.2 Absolute mobility rates between three generations

|  | G-P | P-C |  | G-C |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  |  | Grandsons | Granddaughters | Grandsons | Granddaughters |
| Immobility | 31.3 | 36.8 | 34.8 | 28.5 | 25.9 |
|  |  |  |  |  |  |
| Total Mobility | 68.7 | 63.2 | 65.2 | 71.5 | 74.1 |
|  |  |  |  |  |  |
| Upward | 41.7 | 24.6 | 27.0 | 38.5 | 42.5 |
| Downward | 17.1 | 31.2 | 30.3 | 23.9 | 22.3 |
| Horizontal | 9.9 | 7.4 | 7.9 | 9.1 | 9.4 |

Notes: G-P denotes the movement between grandparents to parents;
P-C denotes the movement between parents and grandchildren;
G-C denotes the movement between grandparents and grandchildren.
Source: BHPS and UKHLS; grandchildren age between age and 65 years.

Table 3.2 presents the absolute mobility rates between three generations in which absolute mobilities are disaggregated into immobility, upward and downward mobility and horizontal mobility. This provides a general picture of absolute mobility in different inter-generational associations. In this table, I treat immobility as grandchildren attaining the same class positions as their parents or grandparents based on the five-class classification scheme. Upward and downward mobilities refer to grandchildren attaining class positions that are higher or lower than their parents/ grandparents did, respectively. Mobilities that occur within the middle range of class structure are referred to as horizontal mobility. According to the rationale of the NS-SEC scheme, classes at the middle range, that is, of the intermediate occupations, small employers and own account workers (which shall be shortened as small employers) and lower supervisors and technicians, are neither hierarchically structured, nor better than one another, as they have distinctive life chances and commands over various kinds of resources.

The first impression one may have is that for both grandsons and granddaughter, total mobility rates in the grandparents-grandchildren associations are higher than those adjacent two-generational associations between parents and grandchildren and between grandparents and parents. Over seven of ten grandchildren left the class positions that their grandparents held. These figures are approximately 10 percentage points higher than parents-grandchild associations. This finding is hardly surprising in that the longer time span in generational-skipping associations gives individuals more opportunities to experience class mobility, whether out of family origins or via work-life advancement.

With regard to upward mobility, there are two notable findings in Table 3.2. First, upward mobility rates accounted for a substantial proportion of total mobilities in the grandparents-parent and grandparents-grandchild associations, whereas it is downward mobility rates that represented a large segment of the parents-grandchild mobility. If upward mobility was driven by the massive upgrading of the occupational structure as previous social mobility studies suggest, what seems apparent is that while such upgrading prevailed in the work life of the parental generation, it appeared to be levelling off in the grandchildren generation. Upward movements from grandparents' class to their grandchildren's class were likely to be driven by the expansion of upward mobility chances that occurred in the parental generation.

Another possible explanation of the downward mobility in parents-grandchildren associations is related to age. As the grandchild generation were typically younger than the parent generation at the time of the survey, the grandchildren might have not reached the occupational maturity. If this analysis had included only
grandchildren who have reached occupational destination, say, grandchildren older than 35 (Goldthorpe and McKnight, 2006), the table would have shown lower amounts of downward mobility in parents-grandchild associations. As the sample size of grandchildren over 35 is too small, I ran the same analysis using a sample of grandchildren over 30 and found that the findings remain largely unchanged (see the results in Appendix, Table A3-1).

Second, in both grandparents-grandchild and parents-grandchild associations, upward movements seemed to be more accessible to granddaughters than to grandsons. There is a significantly higher proportion of granddaughters than that of grandsons being found to follow the upward mobility trend in these associations ${ }^{23}$. This result is largely consistent with previous studies (e.g., Li and Devine, 2011), which found that the upward mobility trend is more favourable to women than to men. On the other hand, as downward mobility rates rose in parents-grandchild associations, granddaughters appeared to be less likely to experience downward mobility than did grandsons, although this difference was not shown to reach a statistically significant level.

### 3.3.1 Outflow mobility

This section reports noticeable features of grandparents-grandchildren motilities (and immobilities) in outflow rates as compared to parents-grandchildren associations. The outflow rates from parents to grandchildren and from grandparents to grandchildren are shown in Table 3.3 and Table 3.4, for grandsons and

[^18]granddaughters, respectively. The figures in cells represent the percentages of row margins, indicating the amount and patterns of class mobility that grandchildren of different family origins experienced.

Viewing the grandparents-grandchildren outflow tables, I find that the immobility rate in salariat class in grandparents-grandchild associations appeared to be similar to that in parents-grandchild associations. Nearly half of the grandchildren of the salariat grandparents attained the same class positions as their grandparents. The situation in which both grandparents and grandchildren belonged to the salariat class accounted for the largest proportions in the row percentage table. This result is in line with the findings by Erola and Moisio (2007). In the outflow tables structured by the seven-class CASMIN version of the Erikson-Goldthorpe classification, Erola and Moisio (2007) found that the immobility rates between grandparents and grandchildren in the service class and routine non-manual class and lower salary service class came close to those between parents and grandchildren in the Finnish society. Regarding other classes, immobilities occurred less frequently in the grandparents-grandchild table than did those in the parents-grandchildren outflow table. The immobility rates of immediate occupations, small employers and lower supervisors and technicians between grandparents and grandchildren were from 4 to 9 percentage points lower than were those between parents and grandchildren.

A remarkable feature is the relatively low level of the reproduction of working-class in the grandparents-grandchildren outflow table as compared to the parentsgrandchildren table. There has been a sizeable decline in grandsons who had working-class grandparents and also stayed in working class ( 36 per cent) as compared to those who had working-class parents and took working-class
occupations themselves (48 per cent). The similar pattern was also found among granddaughters ( 31 per cent vs 41 per cent).

Table 3.3 Outflow mobility rates from grandparents and parents to grandsons

|  | Grandsons' Class |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Salariat | Intermediate occupation | Smallemployers | Lower supervisor \& technicians | Working Class |
| Parents' class |  |  |  |  |  |
| Salariat | 46.7 | 13.1 | 9.4 | 9.8 | 21.1 |
| Intermediate occupation | 34.9 | 16.9 | 11.6 | 9.5 | 27.1 |
| Small-employers | 30.7 | 9.3 | 20.4 | 12.9 | 26.8 |
| Lower supervisor \& technicians | 30.3 | 8.1 | 8.6 | 19.9 | 33.3 |
| Working Class | 20.7 | 9.1 | 10.1 | 11.9 | 48.2 |
| $\mathrm{N}=5,455$ |  |  |  |  |  |
| Grandparents' class |  |  |  |  |  |
| Salariat | 46.4 | 14.0 | 9.4 | 9.1 | 21.1 |
| Intermediate occupation | 39.0 | 12.4 | 10.0 | 11.0 | 27.6 |
| Small-employers | 31.2 | 10.4 | 16.0 | 10.4 | 32.1 |
| Lower supervisor \& technicians | 36.8 | 11.6 | 10.4 | 10.7 | 30.5 |
| Working Class | 28.6 | 10.8 | 9.9 | 14.2 | 36.4 |
| $\mathrm{N}=5,119$ |  |  |  |  |  |
| Immobility |  | ward ity | Upwar | d mobility | rizontal bility |

This finding is hardly surprising if the grandparents-parents outflow table (see Appendix, Table A3.2) is brought into the picture. It can be readily seen that of parents with the working-class grandparents, around one-third stayed in working class and more than two-thirds took better occupations. These parents in turn passed on family advantages and prevented their children from sliding back to the bottom of
the class structure. That said, the stability of the working class still represented a large proportion in row percentages tables of grandparents-grandchildren associations. This indicates the convincing evidence of the reproduction of working class over the three generations, albeit not as strong as what was found in the salariat class.

Table 3.4 Outflow mobility rates from grandparents and parents to granddaughters

|  | Granddaughters' Class |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Salariat | Intermediate occupation | Smallemployers | Lower supervisor \& technicians | Working Class |
| Parents' class |  |  |  |  |  |
| Salariat | 52.4 | 20.9 | 5.4 | 4.0 | 17.3 |
| Intermediate occupation | 41.4 | 21.8 | 5.8 | 5.8 | 25.2 |
| Small-employers | 34.0 | 23.6 | 5.6 | 6.0 | 30.8 |
| Lower supervisor \& technicians | 36.0 | 20.9 | 3.6 | 7.3 | 32.2 |
| Working Class | 26.8 | 22.2 | 4.6 | 5.8 | 40.8 |
| $\mathrm{N}=4,394$ |  |  |  |  |  |
| Grandparents' class |  |  |  |  |  |
| Salariat | 49.3 | 21.0 | 3.8 | 4.5 | 21.4 |
| Intermediate occupation | 43.3 | 20.3 | 5.9 | 3.6 | 27.0 |
| Small-employers | 44.3 | 21.1 | 6.2 | 4.3 | 24.1 |
| Lower supervisor \& technicians | 41.9 | 22.3 | 4.7 | 5.6 | 26.0 |
| Working Class | 33.6 | 23.4 | 5.8 | 6.1 | 31.1 |
| $\mathrm{N}=4,117$ |  |  |  |  |  |
| Immobility |  | ward ity | Upwa | d mobility $\quad{ }^{\text {a }}$ | izontal ility |

Notes: Values refer to row percentages.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Second, the amount of upward mobilities was larger in the grandparents-grandchild table than in the parents-grandchildren table. While upward mobility rates into intermediate classes was slightly higher in the grandparents-grandchild mobility than
in the parents-grandchild mobility, the differences appeared to be more pronounced in the long-range mobility into the salariat positions. So far as the long-range upward mobility into salariat class is concerned, around 30 per cent of the grandchildren of working-class grandparents achieved the salariat position, which is 8 percentage points higher for grandsons and 7 percentage points higher for granddaughters than what is shown in the parents-grandchildren tables. This is not really a surprise given that the share of the salariat occupations has expanded greatly in Britain over generations.

Last, turning to the downward mobility into the working class, I find the long-range downward mobility rates from the salariat class to the working class between grandparents and grandchildren did not display substantial differences from those rates over two generations.

In order to explore grandparents-grandchild absolute mobility experiences after parents' class has been controlled for, Figure 3.1 reports net outflow mobility rates from grandparents to grandchildren, which address research questions 2 and its subquestions (for 95\% confidence intervals, see Figure A3.2, Appendix 3). In Figure 3.1, all of the grandchildren in Panel A were born to salariat parents, and those illustrated in Panel B were born to working-class parents. Each bar represents grandparents' class and each block represents grandchildren' class. Referring to these figures, I will examine the differences in outflow mobility patterns among grandchildren whose parents were in similar class positions, but grandparents were in different classes. As can be seen from the appropriate rows of Figure 3.1, grandparental effects on class attainment were quite evident, and the patterns of the grandparentsgrandchild associations varied by parental class. The graphs describing
grandchildren originating from intermediate class parents are not presented here. The numbers of overly small cell sizes increased in the analyses for grandsons and granddaughters originating from intermediate class parents, and the patterns of the grandparents-grandchild associations appeared to be less clear for grandchildren originated from intermediate class parents.

For the present concern, what is striking is the class retentiveness in the salariat class (see Panel A, Figure 3.1): of grandchildren whose grandparents and parents both were in salariat class, more than half has secured their salariat membership. To a slightly less extent, reproduction over three generations was also marked in workingclass: for those grandchildren with working-class grandparents and parents, 51 per cent of grandsons and 44 per cent of granddaughters stayed in working class (see Panel B, Figure 3.1). Comparing the outflow mobility rates outlined from conventional parent-child associations with those outlined from three generational associations, I find that restricting class mobility to two-generational associations may have underestimated the long roots of intergenerational immobility. For example, of grandsons originating from salariat parents, 47 per cent secured salariat jobs (see Table 3.3); taking a three-generational view, I find 53 per cent of grandsons whose grandparents and parents both were in salariat class stayed in the same position (see Panel A, Figure 3.1). This gap of 7 percentage points is also observed among granddaughters from advantaged families. The similar findings of class reproduction are shown in class reproduction in working class as well although to a lesser extent.

Figure 3.1 Grandchildren's outflow mobility rates by grandparental class
Panel A: When grandchildren had salariat parents


Panel B: When grandchildren had working-class parents
Grandparents Grandsons



| Salariat | Intermediate occupations | Small employers |
| :---: | :---: | :---: |
| Lower supervisor and technician | Working class |  |

Notes: Values refer to row percentages; in Panel A, for grandsons, $\mathrm{N}=1,995$; for granddaughters, $\mathrm{N}=1,710$; in Panel B , for grandsons, $\mathrm{N}=1,213$; for granddaughters, $\mathrm{N}=868$
Source: BHPS and UKHLS; grandchildren over 25

Second, for grandchildren who were born to salariat parents, having socially advantaged grandparents may help those grandchildren maintain salariat positions (see Panel A, Figure 3.1). Of grandsons of salariat and intermediate grandparents, over half have attained salariat occupations as compared with only around one-third of grandsons of working-class grandparents who did the same. This pattern also emerges among granddaughters. While the proportions of attaining salariat occupations of granddaughters of non-working-class grandparents were not dramatically different, granddaughters who had salariat grandparents claimed the highest proportion (58 per cent). In contrast, granddaughters of working-class grandparents had the lowest proportion of working in salariat positions (42 per cent). In this sense, one may say that grandchildren who have socially disadvantaged grandparents had lower proportions of attaining salariat position than those of advantaged grandparents even though they were born to salariat parents.

Viewing the data in Panel B, Figure 3.1, I find that the associations between grandparents and grandchildren born to working-class parents were evident but in different patterns. For grandsons born to working-class parents, 36 per cent of grandsons of salariat grandparents moved upward to salariat class, as compared to 17 per cent of grandsons of working-class grandparents and 14 per cent of those of intermediate occupation grandparents. Having small-employer and low-level supervisor and technician grandparents appeared to bring some advantages to grandsons; grandsons who had grandparents working in these occupations had sizeable proportions of moving to the top position of the class structure.

Among grandsons born to working-class parents, those of salariat grandparents had the lowest proportion of inheriting their parents' working-class status and relatively
high proportions of moving upward away from parental class as compared with those of other class grandparents. Only one-third of grandsons who had workingclass parents but salariat grandparents were found to stay in the category of workingclass as compared with over half of grandsons who had both working-class grandparents and parents and did the same.

For granddaughters from working-class parental backgrounds, having smallemployer grandparents appears to help to move upward. It is granddaughters of small-employer grandparents who had the highest proportion, 34 per cent, of climbing to salariat class; in contrast, only 23 per cent of those of working-class grandparents achieved the same. Granddaughters whose grandparents worked as salariat and lower supervisor and technicians also had higher proportions of moving upward to salariat than those of working-class grandparents.

Both of the two figures reveal the inequalities among grandchildren of different class grandparents after parental background is taken into consideration. The patterns of grandparents-grandchild class mobility seem to differ across gender and parental class. For grandchildren who were lucky enough to be born to salariat parents, having salariat grandparents appeared to increase their chance of attaining salariat positions which were already high. Among granddaughter born to working-class parents, those of small-employers and intermediate class grandparents held fairly high proportions of reaching salariat. The grandparental class is also related to the proportion of grandchildren falling into working-class occupations. I conducted additional analyses of outflow mobility from parents to grandchildren separated by grandparents' class (see Figure A3.1, in Appendix) and found evidence of marked grandparental influences on grandchildren's outflow mobility. Overall, the above
discussion provides evidence that even after parental class is taken into account, grandchildren's absolute mobility experiences as represented in outflow mobility rates are related to their grandparents' class.

### 3.4 Conclusion

The analyses in this chapter have largely confirmed my expectation on absolute class mobility patterns over three generations and also shed light on somewhat unexpected roles of grandparental class.

Using data available in the BHPS and UKHLS, the findings indicate that the close associations between family origins and class attainment coexist alongside the increased space in the 'room at the top'. The British labour market has experienced structural shifts towards non-manual labour occupations and increased the space at the top of class stratification. Such increase in 'room at the top' did not in itself guarantee greater equality in opportunities to get there. I observed first that the grandchildren who were born to advantaged class parents had far higher proportions to stay in favourable class position than did those from disadvantaged parental backgrounds, and second that the amount of long-ranged mobility as shown in the proportion of grandchildren who had the least advantaged parents and climbed up to the most advantaged positions along the social ladder was very low. These findings are in line with previous research in parent-child social mobility in different industrialised societies (e.g., Erikson, and Goldthorpe, 1992; Breen, 2004).

What is more relevant to the present discussion on the grandparental role in absolute mobility rates is the incorporation of the variables of grandparental class into the
parents-grandchild associations in absolute mobility. I found that grandchildren's class attainments are related to grandparental class, but to a lesser extent than parents-grandchildren associations. In other words, as compared with the parentsgrandchild associations, more grandchildren were found to move away from grandparents' class, and fewer grandchildren were found to stay in the same positions as grandparents. Looking at the gross associations between generations, I found a higher proportion of granddaughters than grandsons retaining family privilege and a higher proportion of grandsons than granddaughters staying in working-class.

This chapter set out research questions as to whether grandparental class affects grandchildren's absolute class mobility while taking into account parental backgrounds. The outflow mobility graphs Figure 3.1 and Figure 3.2 described the associations between grandparental class and class of grandchildren originated from given parental backgrounds. By so doing, I expected to examine these associations in absolute mobility while controlling for parental backgrounds.

To respond to the research questions, I summarise the findings as follows. First, the grandparental class did make differences to grandchildren's absolute class mobility outcomes even after the relevant parental class was considered. For grandchildren originating from salariat parents and working-class parents, their class attainments were related to grandparental class.

Second, the patterns of the grandparents-grandchild associations varied across parental characteristics. On the one hand, among grandchildren born to salariat parents, those of salariat grandparents had substantially higher proportions of attaining salariat class positions than did those of working-class grandparents.

Having salariat grandparents appeared to be like 'icing on the cake'; it benefited the grandsons and granddaughters with advantaged parents in attaining good positions whereas these grandchildren already had high proportions in these positions due to parental advantages.

On the other hand, having grandparents also appeared to be a 'life-saver' for grandsons, in that of grandsons born to working-class parents, the proportion of being found in advantaged class position was remarkably higher if they had salariat grandparents. Meanwhile, small-employer grandparents appeared to provide substantial support to granddaughters born to working-class parental backgrounds. For granddaughters who had working-class parents and small-employer grandparents, the proportions of attaining advantaged class positions were higher than were those of granddaughters who had grandparents of other classes

It needs to be noted that these results paint a fairly broad picture of social mobility defined by five-fold class classification. A refined account would require an extended version of social class schema and a larger sample of three-generational lineages. For example, the current category of salariat class combined higher and lower salariat together, and as a result, it may have concealed additional class mobility differentials. As many two-generational social mobility studies using seven-fold class classification indicated, the chance of working-class children moving upward to higher salariat was lower than the chance of the transition from working class and lower salariat (Marshall, Swift and Roberts, 1997). Was I able to distinguish higher and lower salariat class using a large sample, I might have well found greater inequalities of class attainment across the different family origins and more impermeable boundaries of salariat class.

Measurement issue raised another concern. Previous studies of grandparental effects on grandchildren's mobility have reported mixed findings, partially because they applied different measurements for individual positions in social stratification. For example, the studies on three-generational social mobility which were mentioned in the introduction of this chapter used different measurement for social class. Hertel and Groh-Samberg (2014) used four-fold EGP scheme (Erikson-GoldthorpePortocarero, 1979); Erola and Moisio 2007) used seven-class CASMIN version of the Erikson-Goldthorpe classification (e.g. Breen, 2004); Chan and Boliver (2013) measured social class by the UK Register General (RG) class scheme and collapsed it into four categories (without including small-employers as an independent group). There were also a few studies that used continuous measurement (e.g., Warren and Hauser, 1997). One of the reasons, as wells as advantages, of using categorical instead of continuous measurement is that the application of categorical measures can reveal potentially nonlinear associations between grandparents and grandchildren. This chapter found that regarding absolute class mobility grandparental class had a particularly strong effect on the reproduction of salariat class, and that small employer grandparents had a special influence on grandchildren born to disadvantaged parenthood. Such nonlinear association would have been concealed if a less refined three-fold NS-SEC classification or continuous measurements was employed.

To conclude, the analyses provide a reasonably accurate assessment of grandparental role in absolute class mobility and thus fulfil the purpose of the present chapter. The evidence was that absolute mobility rates were far from equal with the proportion of grandchildren from persistently privileged family background being more likely to obtain salariat class jobs than were those whose family origins were in deeply-rooted
disadvantaged families. Differences in the class attainments appear to persist across three generations. Given the observed associations between grandparents and grandchildren with the parental class being controlled for, can one reasonably claim that grandparental effects on grandchildren's class attainment exist net of parental characteristics?

Not yet. The analyses presented in this chapter tell little about the nature of grandparental effects that are observed. This chapter addressed three-generational social mobility measured in absolute rates. The main weakness of absolute mobility as a measure of mobility rate is that it confounds mobility rates due to changes in the composition of the relevant social structure with relative mobility chances (Marshall, Swift and Roberts, 1997). The cross-tabulation of grandchildren's class attainment by parental class and grandparental class did not differentiate the mobility rates caused by the growth of salariat class and the shrinking of working class from the amount of relative mobility chance independent of the structural upgrading. Furthermore, as the absolute mobility analyses used a single measure for parental backgrounds, it is entirely plausible to argue that the observed grandparentsgrandchild associations reflected the influences of unobserved characteristics of parents, which may play important roles in determining grandchildren's class attainment. Regarding class attainment, it is also likely that some people climb up through career development as they grow older. The absolute mobility analyses in this chapter included grandchildren aged between 25 and 65 and did not further take into account grandchildren's age; as a result, they may have concealed some potential age-related influences. In order to test whether the results were sensitive to age, I ran the analysis of the gross grandparents-grandchild associations without controlling for parents' class using a sample of grandchildren over 30 and did not
find substantial difference. The sample size of grandchildren over 30 did not allow for the analysis of the grandparents-grandchild associations by parents' class due to cell size consideration.

This chapter on absolute mobility is an opening of the empirical analyses in the thesis. Discussion of relative mobility would answer the question of how grandparental class affects the inequality of grandchildren's opportunities regarding educational and class attainment. The chapters that follow address these issues.

# Chapter 4 Grandparental Effects on Educational Attainment 

### 4.1 Introduction

This chapter seeks to investigate grandparental influences on their grandchildren's education and determine whether these influences exist independent of parental influences. Better education leads to better opportunities for attaining advantaged class positions in later life stages. Education is therefore considered as a key element in driving social mobility. Only if educational opportunities are accessible equally regardless of what family a person comes from, then education may reach the goal of improving social mobility in a sense that the more able people have better chances to hold advantaged occupations. The effects of family origins on educational attainment have been well examined by social scientists using the two-generational approach in which resources are transmitted from parents to their children (e.g., Blanden and Gregg, 2004; Breen and Jonsson, 2005; Bukodi and Goldthorpe, 2013; Devine and Li, 2013; DiMaggio, 1982; Goldthorpe, 2014; Jæger and Holm, 2007; Lareau, 1987; Paterson and Iannelli, 2007; Raftery and Hout, 1993; Reay, 2000; Shavit and Blossfeld, 1993). Research consistently shows that children of advantaged parents are more likely to pursue further educational qualifications than their counterparts of disadvantaged parents.

Following Mare's (2011) argument of multigenerational effects on inequalities, several empirical studies report significant influences of grandparents on grandchildren's educational performance while parental backgrounds are being
controlled for. Research shows that grandparents' cultural capital (Møllegaard and Jæger, 2015) or income (Lindahl, et al., 2012) directly affected their grandchildren's academic success and cognitive ability in Sweden (Modin and Fritzell, 2009); in other social contexts, grandparental effects were found to exist in the interaction with parental characteristics (Chiang and Park, 2015; Jæger, 2012) or co-residential arrangement (Zeng and Xie, 2014). Meanwhile, Bol and Kalmijn (2016) provided counter-evidence; they found no significant effects of grandparental resources on grandchildren's schooling. While the grandparental effects, as well as the effects of family origins, on education vary across social contexts and time, none of these studies, to my knowledge, are based on British society, and grandparental effects on education in Britain remain unrevealed so far. In this chapter, grandparental influences are to be examined as an additional mechanism that may exacerbate the inequalities raised by family origins at the parental level.

This chapter uses data from the British Household Panel Survey (BHPS) and the UK Household Longitudinal Survey (UKHLS) from wave 1 to wave 5, which has a similar sampling design to that of the BHPS. As the analyses are concerned with educational qualification attainment, the grandchildren generation is restricted to the group over 25 . Driven by the findings of previous research on family origins effects on education, I selected the indicators to represent characteristics of family origins that are both theoretically essential and practically available in data.

### 4.1.1 Chapter Structure

Section 4.1.2 and Section 4.1.3 discusses potential mechanisms through which grandparents directly affect grandchildren's education. The rest of Section 4.1
highlights core findings and research questions. Section 4.2 illustrates the selection and construction of the outcome variables and explanatory variables. Section 4.3 test basic assumptions over adjacent two-generation associations with descriptive analyses. Section 4.4 discusses findings of the statistical modelling on grandparental effects, gender differentials, as well as potential mechanisms. Section 4.5 concludes the main results of the chapter.

### 4.1.2 Potential mechanisms 1

Whilst numerous studies have reported grandparents' effects on grandchildren's attainment net of parental influences, questions arise as to what kind of resources possessed by grandparents are transmitted to grandchildren and how effective they are in promoting grandchildren's educational and social advancement. One of the mechanisms identified posits a need-directed relationship (Silverstein and Marenco, 2001), which operates at different life stages of both grandparents and grandchildren.

Compared to the relationship between parents and children that is guided strongly by natural affection and social norms, grandparenthood is generally not governed by legal and institutional obligations (Pruchno and Johnson, 1996). Such lack of explicit and specific norms results in flexibility and heterogeneity of grandparenting. Nevertheless, the traditional view of family as a source of support at any age persists (Kemp, 2004). For both the old and the young generations, a taken-for-granted expectation of grandparental support appears to remain in the practice of familial relations, especially in situations where such support is needed and desired (Griggs et al., 2010; Kemp, 2004; Hagestad, 2006). Grandchildren, whether at young ages or in adulthood, also feel obliged to spend time with their grandparents and expect to
receive support from them in times of need (Hagestad, 2006). The closeness and supportiveness of the interaction between grandparents and grandchildren are generally valued and manifested across cultures.

Providing baby-sitting and childcare is a common way in which grandparents directly involve in pre-teen grandchildren's life. Grandparents were the most commonly used childcare resources in the UK: 58 per cent of families had been helped by a grandparent with childcare in the previous year (Woodland, et al., 2004). Twenty-seven per cent of grandmothers and 19 per cent of grandfathers helped to look after their grandchildren (Murphy and Grundy, 2003). Grandparents were also considered the most satisfactory caregivers compared to other kinds of help (Meltzer, 1990). It is worth mentioning that a study (Gray, 2005) using the British Household Panel Study (BHPS) identified an increase in the provision of childcare by grandparents between 1991 and 2000. The childcare provided by grandparents certainly involves direct face-to-face interactions between grandparents and grandchildren, and also relieve parents of childcare duties, allowing parents to work more and earn more salaries (Gray, 2005; Wheelock and Jones, 2002).

As grandchildren reach school age, grandparental involvement may move to education-related activities. Griggs and her colleagues (2010) suggested a trend towards a higher level of grandparental involvement in supporting their grandchildren's education in England and Wales than in the past. British grandparents may get involved in activities including picking grandchildren from school, assisting them with homework, giving career advice, solving sundry problems (Griggs, et al, 2010), and visiting museums and art galleries (Beaumont and Sterry, 2005), especially when parents are unavailable. In the UK, approximately half of the families with school-aged children (at age 8-14) use
childcare provided by grandparents (Woodland, et al., 2004). A positive relation between grandparents' active involvement and grandchildren's psychological wellbeing has also been found in the U.S. (Ruiz and Silverstein, 2007). These activities are not just educationally relevant but also indicate a substantial amount of time and resource dedicated, a highly valuable investment made by grandparents in their grandchildren's development. The grandparent-grandchild interactions also involve joyful companionship and confiding, which may facilitate the transfer of symbolic resources as well, as I shall discuss later. These factors may explain the frequent findings that grandchildren with socially advantaged grandparents tend to achieve better academic performance even when parental characteristics are taken into account.

Transfer of financial resources to grandchildren is another important channel for enhancing their educational attainment and improving their standard of living during their transition to adulthood and at the start of their career. 'Money is something quantifiable that can be used to measure love' (Aldous, 1995, p.115). British grandparents may help their adolescent grandchildren with financial resources (Tan, et al., 2010), particularly if grandparents own properties (Beach, 2013). In England, grandchildren received from grandparents an accumulative sum of approximately $£ 333.8$ million (excluding via Child Trust Funds) in 2010, which is equivalent to the undergraduate tuition fee for more than 100,000 placements (Beach, 2013). While grandparents are getting too old to help with babysitting, they may have accumulated considerable wealth to transfer to their grandchildren (Attias-Donfut, Ogg and Wolff, 2005; Beach, 2013; Mueller and Elder, 2003; Silverstein and Marenco, 2001). Using a nationally representative s data of grandparents in the continental U.S., Silverstein and Marenco (2001) found that as grandparents grow
old, they are more likely to pass on their grandchildren with cash gifts, although they are less likely to involve in childcare or entertaining activities. Hoff (2007), using a longitudinal data source, found a trend of increasing financial transfers from grandparents to grandchildren in Germany.

Alternatively, grandchildren may benefit from bequests or inter-vivos transfers that grandparents pass on to parents. Individuals typically inherit from their parents in their 50s. At this life stage they usually have achieved occupational maturity and their social positions may not be much changed by inheritance, but their children may have economic needs since they have to pay tuition fees, housing costs, job searches, and many will also have their own babies to take care of. A recent British report found that the middle generation who inherit from their elderly parents tend to pass on economic assistance to their own children (Royal London, 2017). In European countries, grandparents are also found to prefer to pass on financial resources to parents who have children rather than to those without children (Albertini, Kohli and Vogel, 2007). Grandparents' financial transfer may also affect grandchildren in directly. For example, children may benefit from a safe and stable neighbourhood, which grandparents contribute financially to securing (Hagestad, 2006; Ferguson and Ready, 2011).

In addition, grandparents may function as a source of wisdom and information to British adolescents when making important decisions (Griggs et al., 2010). A U.S. study shows that college-educated grandchildren are more convinced by the mentorship, opinion and guidance from their well-educated grandparents (Crosnoe and Elder, 2002). Whereas grandparents with primary educational qualification tend to emphasise 'friendship' and emotional bonding shared with their grandchildren,
grandparents with degrees are likely to act as an advisor, counsellor, or a mentor to the grandchildren (King and Elder, 1998).

Grandparental effects may also be taken as role models that guide grandchildren's educational and occupational aspirations (Denham and Smith, 1989). By referring to the appropriate role models, grandchildren are able to form a more informed assessment of the link between educational qualifications and labour market rewards. In contrast, the lack of such role models may hamper the individual's educational choices and earnings expectations. Loury (2006) argued that grandparents, together with other kin from extended families, may form a family network which may encourage or inhibit educational choices grandchildren make.

The third mechanism refers to the role of grandparents as a reference frame in shaping grandchildren's educational decisions. In the process of educational decision-making, individuals are driven to minimise the risk of downward mobility relative to their parents' position (Breen and Goldthorpe, 1997; Goldthorpe, 1998). Following this explanation, I suggest that a three-generational diagram can outline long-lasting family norms or traditions where grandparents serve as an important component. In other words, in deciding educational transitions, not only parents' positions but also grandparents' positions are likely to be viewed as the reference points for grandchildren. In the case where both grandparents and parents had successful career, the reference frame serves to strengthen the expectation of maintaining family privilege. Where parents are found in disadvantaged positions, a reference frame characterised by highly accomplished grandparents may inspire grandchildren to move up back to their grandparental origins, promoting upward mobility. This mechanism may also explain the reproduction of the disadvantaged
group (Hertel and Groh-Samberg, 2014). Parents who moved upward from the bottom of the social hierarchy may hold a sense of belonging to the lower-class origins ${ }^{24}$, and may not strongly object the possibility that grandchildren move 'back to the root'.

Grandchildren in Britain tend to experience a high level of multi-dimensional grandparental involvement (Tan et al., 2010). While grandparental influences are diverse in their functions, they may evolve as the life course stages of grandparents and grandchildren change (Arrondel and Masson, 2001; Dunifon and Bajracharya, 2012; Pruchno and Johnson, 1996). Grandparental influences, whether operating directly or indirectly, instrumentally or symbolically, are important drivers for grandchildren's educational and occupational successes.

Unlike the mechanisms of socialisation, economic transfer and the reference frame do not necessarily require physical involvement of grandparents in grandchildren's life; they would still affect grandchildren's education even though grandparents have passed away. Previous research has found that grandparental effects on education exist regardless of whether grandparents were alive or not (Modin, Erikson and Vågerö, 2013) and regardless of temporal distance and geographical distance (Knigge, 2016). Great wealth and family norms in family lineages outlive individuals.

[^19]
### 4.1.3 Potential mechanisms 2

So far, the theoretical model of three-generational mobility assumes that the grandparents-grandchild associations are independent of parental characteristics. In other words, grandparents' social positions have equal effects on grandchildren across different parental backgrounds. I argue that this pattern is subject to empirical tests. As Mare posits, 'the usual models of two-generation association may apply to families in the middle of the socioeconomic distribution, but at the extremes, an individual's fortunes may depend on the actions and experiences of a more distant ancestor who was lucky or unlucky enough to achieve great wealth or abject poverty' (Mare, 2011. p.7).

Augmentation hypothesis expects that grandparental effects are particularly strong on grandchildren originating from advantaged parents. According to augmentation hypothesis, parents who are well educated and successful in their career are able to maximise the effects of the advantages of grandparents as compared to those parents at the bottom of social stratification (Chiang and Park, 2015). These advantaged parents may have better knowledge, information or social network in supporting grandchildren's education, and therefore they are able to activate and make good use resources of grandparents. Furthermore, when receiving support from grandparents, affluent parents are more likely to invest in grandchildren's education, whereas deprived parents may face pressure to use it to improve living qualities or take care of immediate needs. On the other hand, this mechanism may operate through family norms even if grandparents have passed away. Accomplished grandparents strengthen family norms that motivate grandchildren to achieve favourable credentials if parents are also in advantaged positions. For example, family tradition would be stronger for grandchildren whose grandparents and parents both are
accomplished than for their counterparts whose grandparents were advantaged, but parents are disadvantaged. Evidence supporting this mechanism has been found in Taiwan (Chiang and Park, 2015) and Sweden (Hällsten, 2014).

According to the compensation hypothesis, grandparents are particularly likely to compensate the consequence of a lack of parental resources on grandchildren's education. The resources in the extended family network can be mobilised in times of need or during the family crisis (Jæger, 2012). The compensation hypothesis expects that grandparental effects are stronger on grandchildren born to disadvantaged parents than on those born to advantaged parents. For example, wealthy grandparents may contribute to the cost of tuition fee of private schools or universities if parents are unable to afford the cost. In addition, grandparents who had successful career may serve as role models, and the effect of role model may be particular prominent if grandchildren originated from disadvantaged parents. Evidence supporting this mechanism has been found in the effects of grandparents and other extended family members such as aunts and uncles (Jæger, 2012; Prix and Pfeffer, 2017). I will test these two mechanisms in Section 4.4.4.

### 4.1.4 Core Findings

The chapter will show that serious educational inequalities exist between individuals of different socioeconomic backgrounds and that these inequalities have persisted over three generations.

It has been widely acknowledged that families transfer various forms of resources to support their offspring's education, and family backgrounds, therefore, have become one of the most important determinants of educational attainment. Before
proceeding with the key research questions of grandparental effects, a series of essential initial conditions related to adjacent intergenerational effects need to be discussed: (1) grandparents' social class affects parental socioeconomic resources; (2) parental resources affect grandchildren's education. These prior assumptions will be confirmed in Section 4.3 descriptive analysis. I then turn to explore the direct effects of grandparents on their grandchildren's education.

This chapter will address the following research questions:

1. Does grandparental class have significant impacts on grandchildren's education independent of the effects of parental resources?

The findings of the present chapter will provide a good understanding of inequality reproduction in the context of contemporary British society by discovering the effects on educational inequality that originate not only from parental socioeconomic backgrounds but also from grandparents' class positions. Using ordered logit models and marginal effects methods, the chapter will demonstrate that grandparents exert significant effects on their adult grandchildren's educational attainment net of parents' social class, education and economic resources, indicating long-lasting class-based educational inequalities that stretch over three generations.
2. Are grandsons and granddaughters affected equally by grandparental effects? Is there any gender differential regarding the grandparental effects?

The offspring's gender is often included as an important demographic factor in determining educational attainments-a practice that has been widely (although not invariably) followed in the area of intergenerational mobility over two generations.

Some research, while using father's class as the only proxy of family origins, suggests that the relative mobility chance of women was indistinguishable from that of men and that the forces that determine associations between family origins and class destinations seemed to be sex-blind (Erikson and Goldthorpe, 1992; Marshall, Swift and Roberts, 1997). In contrast, by incorporating a rich range of family characteristics, a number of studies reveal that men and women are influenced by family backgrounds in different manners. Bukodi and Goldthorpe (2013) found that in contemporary Britain, while the impacts of parental education and status did not vary by sex, parents' class effects appeared to be rather regular on daughters' educational qualifications and less so on sons. Mensah and Kiernan reported that adverse life conditions, such as living poor neighbourhoods and lack of welleducated parents, have less negative effects on school performance of daughters than sons (Mensah and Kiernan, 2010).

The socialization path to education and career expectation may partially explain the sex-linked differences in family influences. For example, for male college students, emotional support from parents had significant influences on career-planning maturity, whereas for the degree to which parents had fostered autonomy had more influences on female students' career planning (Kenny, 1987). Role modelling and socialisation theories suggest that the offspring are more likely to model themselves on the same-sex parent than on the opposite-sex parent (Miller and Hayes, 1990); education and occupation of mothers may have greater effects on the occupation of daughters than on sons, and education and occupation of fathers may have greater effects on the occupation of sons than daughters (Marini, 1980). From a perspective of family inheritance, findings consistently indicate that sons of small employers are expected to take over family business instead of aiming for higher education and
salariat education; in contrast, daughters are less likely to inherit and more emphasis is likely to be placed on education to improve their chances in the labour and marriage markets (Bukodi and Goldthorpe, 2013; Erikson and Goldthorpe, 1992; Ishida, Müller and Ridge, 1995; Matthews and Moser, 1996).

In the light of earlier research that documents gender-related differentials in parentschild associations, it is therefore reasonable to explore further potential gender differences in the grandparental influences. In particular, among a limited amount of existing studies on grandparental effects, some used data covering only grandsons instead of both genders (Ridge, 1973; Beck, 1983; Hertel and Groh-Samberg, 2014). This is encouraging further interests in examining gender-based differences. In order to address this question, I introduce interactions between family generational origins and gender in ordinal logit models and find that as compared to grandsons, granddaughters appeared to receive additional benefit from small-employer grandparents.
3. Do grandparental effects depend on contacts between grandparents and grandchildren? If yes, do grandparental effects exist only in the case of face-to-face interactions? Do grandparental effects disappear if grandparents have passed away?

The empirical analyses will test the mechanisms through which grandparental effects operate. Section 4.1.3 discusses the plausible mechanisms through which grandparental effects on grandchildren's social attainments work. No matter how theoretically reasonable these mechanisms may be, they have barely been empirically tested in quantitative research (for notable exceptions, see Zeng and Xie,

2014; Knigge, 2016). Using a subsample drawn from the UKHLS, this study is expected to make substantial headway in testing the associations between grandparental effects and grandparents-grandchild contacts that take in different forms.

The model results will show that grandparental effects remained regardless of whether grandparents were alive or deceased and that grandparental effects were significantly reduced if grandparents lost regular contact with the offspring. Regarding contact, the findings will report that while face-to-face interaction itself did not make differences in grandparental effects, contact that did affect grandparental effects took many forms such as the face-to face, telephone, email, and letter. These findings will suggest that the aforementioned mechanisms were at work.
4. Does grandparental class have equal effects on grandchildren's educational outcome regardless of whether grandchildren originated from advantaged parents or disadvantaged parents? Does grandparental effect follow the augmentation hypothesis, compensation hypothesis, or both?

To response the discussion of the augmentation hypothesis and compensation hypothesis, I adopt latent factor analysis to derive a latent factor capturing a wide range of parental characteristics and fit logistic models with an interaction between the latent factor and grandparental class. The findings will demonstrate that grandparental effects were particularly concentrated at the top of social stratification. That is, grandparental effects are stronger on grandchildren with advantaged parents
than on those with disadvantaged parents. The persistence of family advantages is evident in the data.

### 4.2 Measures

## Educational Attainment

Grandchildren's educational attainment, as the dependent variable in the present analyses, is measured by the highest educational qualification levels that grandchildren have achieved. Grandchildren's education, as well as parental education, is measured by a five-level classification: degree, sub-degree, highersecondary, lower-secondary, and primary (see Table 4.1). Since the levels educational qualifications can be considered as hierarchical, grandchildren's education is treated as ordinal categorical variables. Because previous studies show that both fathers' and mothers' educational levels are important to children's educational experience (i.e., Reay, 2000), both fathers' and mothers' education qualifications are employed as the independent variables in the models.

Grandparental education is derived from the response of the parental generation to the question 'which (the following options) best describes the type of qualifications your father gained'. In the BHPS this question was only asked once (at the thirteenth wave), resulting in a large number of missing values by design. The missing values of grandparental education are coded into an 'unknown' category.

Table 4.1 Educational qualifications of grandparents, parents and grandchildren

|  | Analytic sample |  | Whole sample |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Grandsons | Granddaughters | Grandsons | Granddaughters |
| Degree | 23.7 | 32.5 | 23.7 | 31.9 |
| Sub-degree | 7.1 | 7.9 | 6.9 | 8.6 |
| Higher-secondary | 28.3 | 27.3 | 26.7 | 25.0 |
| Lower-secondary | 28.3 | 23.8 | 26.4 | 23.6 |
| Primary | 15.3 | 8.6 | 16.3 | 11.0 |
| N | 3,850 | 3,192 | 5,677 | 4,627 |
|  |  |  |  |  |
|  | Fathers | Mothers | Fathers | Mothers |
| Degree | 14.6 | 11.6 | 14.7 | 10.6 |
| Sub-degree | 8.9 | 10.2 | 8.3 | 9.2 |
| Higher-secondary | 19.0 | 13.4 | 17.6 | 12.2 |
| Lower-secondary | 19.9 | 25.2 | 18.8 | 23.0 |
| Primary | 37.7 | 39.8 | 40.6 | 45.1 |
| N | 7,042 | 7,042 | 8,791 | 9.976 |
|  | Grandparents |  |  | Grandparents |
| Higher Education | 4.6 | 3.4 | 4.7 | 3.2 |
| Post-school qualification | 24.0 | 17.9 | 22.1 | 14.9 |
| Some qualification | 17.4 | 13.0 | 17.0 | 11.5 |
| No qualification | 54.0 | 40.3 | 56.2 | 37.9 |
| Missing |  | 25.4 |  | 32.5 |
| N | 5,256 | 7,042 | 7,104 | 10,528 |

Notes: The analytic sample refers to the sample that is used in the statistical modelling in this chapter; the whole sample refers to the sample of three-generational lineages.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

## Social Class

This chapter employs the five-level NSSEC as the measure of social class of grandparents and parents. Parental class and grandparental class are determined by the dominance approach (Erikson, 1984) by choosing the higher class between fathers and mothers in the family. The compositions of the grandparental and parental class are presented in Table 4.2.

Table 4.2 Social class of parents and grandparents

|  | Analytic sample | Whole sample |
| :--- | :---: | :---: |
| Father |  |  |
| Salariat | 34.2 | 31.5 |
| Intermediate occupations | 8.2 | 8.1 |
| Small employers \& own account workers | 15.6 | 15.8 |
| Lower supervisor \& technician | 15.5 | 15.4 |
| Working class | 26.5 | 29.3 |
| N | 7,042 | 9,637 |
|  |  |  |
| Mother |  |  |
| Salariat | 26.4 | 24.9 |
| Intermediate occupations | 21.1 | 20.2 |
| Small employers \& own account workers | 6.2 | 6.0 |
| Lower supervisor \& technician | 4.1 | 4.2 |
| Working class | 42.2 | 44.7 |
| N | 7,042 | 9,489 |
|  |  |  |
| Grandparents |  |  |
| Salariat | 20.7 | 19.4 |
| Intermediate occupations | 9.6 | 9.6 |
| Small employers \& own account workers | 15.7 | 17.5 |
| Lower supervisor \& technician | 17.0 | 15.8 |
| Working class | 37.0 | 37.7 |
| N | 7,042 | 9,759 |
| Notes: The analytic sample refers to the sample that is used in the statistical modelling in |  |  |

Notes: The analytic sample refers to the sample that is used in the statistical modelling in this chapter; the whole sample refers to the sample of three-generational lineages. Source: BHPS and UKHLS, grandchildren over 25.

## Parental economic resources

I measure parental economic resources using their property ownership and monthly income. Property ownership is treated as a binary variable: whether parents owned or rented the household they lived ${ }^{25}$. Monthly income is calculated at the household level, and its $\log$ transformation enters the models as a continuous variable.

[^20]Table 4.3 Demographic compositions of grandchildren's education and data sources

|  | Degrees | Sub- <br> degree | A level |  <br> GCSE | Primary \& no <br> qualification | Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Sex | 23.7 | 7.1 | 28.3 | 25.6 | 15.3 | 53.6 |
| Male | 32.5 | 7.9 | 27.3 | 23.8 | 8.6 | 45.3 |
| Female |  |  |  |  |  |  |
| Cohorts |  |  |  |  |  |  |
| pre-1970s | 14.5 | 6.7 | 24.7 | 31.7 | 22.5 | 11.9 |
| 1970s | 25.6 | 8.8 | 28.9 | 24.2 | 12.5 | 35.7 |
| 1980s | 32.1 | 6.8 | 27.8 | 23.6 | 9.7 | 52.4 |
|  |  |  |  |  |  |  |
| Race |  |  |  |  |  |  |
| Non-white | 56.0 | 10.1 | 19.2 | 9.9 | 4.9 | 7.5 |
| White | 25.4 | 7.3 | 28.5 | 26.0 | 12.8 | 92.5 |
|  |  |  |  |  |  |  |
| Region | 28.9 | 6.8 | 27.5 | 25.0 | 11.8 | 72.2 |
| England | 20.4 | 6.2 | 30.2 | 25.9 | 17.3 | 9.9 |
| Wales | 23.2 | 14.0 | 32.3 | 19.9 | 10.6 | 10.3 |
| Scotland | 23.2 | 21.8 | 28.2 | 11.8 | 7.6 |  |
| NI | 31.3 | 6.9 |  |  |  |  |
| Survey |  |  |  |  |  |  |
| BHPS | 23.4 | 6.4 | 23.4 | 26.4 | 15.4 | 64.3 |
| UKHLS | 35.3 | 9.5 | 26.8 | 21.7 | 6.5 | 35.6 |
| Total | 27.7 | 7.5 | 27.8 | 24.8 | 12.2 |  |

Notes: Values refer to row percentages; analytic sample is used; $\mathrm{N}=7,042$.
Source: BHPS and UKHLS, grandchildren over 25.

## Grandparent contact

I will test three indicators of grandparents-grandchild contact. The UKHLS asked parents to answer three types of questions related to family networks: (1) living status of their own parents; (2) frequency of seeing their own parents; and (3) frequency of contact by telephone, email or letter with their own parents. Research suggests that the strength of grandparent-parent bonding is a substantial predictor of grandparent-grandchild contact (Uhlenberg and Hammill, 1998). I will use the contact between grandparents and parents as the proxy for grandparent contact with grandchildren.

Regarding the living status of grandparents, there are three situations: the value ' 0 ' denotes that neither grandfather nor grandmother was alive at the moment of survey; the value ' 1 ' denotes that only one grandparent was alive, regardless of grandfather or grandmother; the value ' 2 ' denotes that both grandfather and grandmother were alive.

I derived a fourth variable to capture actual involvement of grandparents in grandchildren's life. If grandparental effects on grandchildren's attainments operate through the contacts in any forms, using only face-to-face contacts and long-distance communication on their own may be misleading. The derived variable is created based on the most frequent contact in any form, regardless of by face-to-face interaction or by email, telephone or letter. For example, if grandparents live in a different city, grandparents would not be able to see parents and grandparents frequently; however, if they call each other every day, the variable would identify it as daily contact despite lack of face-to-face interaction. In the case in which grandparents live nearby and see parents and grandchildren every day, and they would not need to contact them frequently by telephone, email, or letter, the variable would identify it as frequent contact as well despite infrequent long-distance communication. In the case where neither frequent face-to-face interactions nor long-distance communication is present, the variable would identify it as the absence of family contact. In addition, I add the category 'deceased' into the indicators of grandparental contact if grandparents passed away.

## Demographic information

The main analytic sample is confined to grandchildren between 25 and 65 (with a mean of 31.6). Age variables used in the models are centred within birth cohort.

Over the half of grandchildren were born in the 1980s, making it the largest cohort in the dataset. Those born in the 1970s claimed the second largest group, representing 35 per cent of grandchildren. The group who were born in the 1960s or earlier account for 12 per cent of the grandchildren generation. The details are reported in Table 4.3 (see the details of the whole sample of three-generational lineages in Appendix, Table A4.1). Regarding race, non-white grandchildren were found to outperform white grandchildren in education attainment, which is in line with studies in ethnic inequalities in higher education (Connor, et al., 2004; Heath, 2016; Lessard-Philipps and Li, 2017). The binary race variable is admittedly a rather crude measure. Due to sample size limitation, the data does not allow for the analyses with refined ethnicity groups.

### 4.3 Descriptive analyses

## Class and education

This section reports the outcomes of bivariate analyses on the associations between grandchildren's education and their family origins. I find clear positive gradients between grandchildren's education and family backgrounds (see Table 4.4). The dominance approach is adopted to derive the highest social class and education between father and mother. For ease of discussion, this section will focus on the distribution of the highest and the lowest categories, that is, higher education and primary or no qualifications.

First, the data in the Table 4.4 show that grandchildren's educational qualifications are strongly associated with both parents' and grandparents' class (for cumulative percentages of grandchildren's education by parents' and grandparents' class, see

Table A4.2, Appendix 4). Of grandchildren with salariat parents, 38 per cent attained university-level education, compared to just 14 per cent of those with working-class parents. Meanwhile, of the grandchildren with salariat parents, only 6 per cent held the primary or no qualifications, compared to 21 per cent of those with workingclass parents. In general, I find that grandchildren from salariat class parental backgrounds had higher proportions of acquiring desirable educational qualification than those with lower class parents.

Grandchildren of salariat grandparents were also educated better than those of working-class grandparents. Approximately 41 per cent of grandchildren of salariat grandparents earned university degrees, and 7 per cent ended up with the primary or no qualifications. In contrast, only 14 per cent of grandchildren of working-class grandparents attended university, and as high as 21 per cent had the primary-level or no qualification. Comparing the adjacent two-generational associations to the skipped-generational associations, I observe that the gradient of having salariat grandparents on grandchildren's education seems to be similar to that in the parentsgrandchildren associations. The class-based inequalities in education, which have been well documented in two-generational education research, are evident in the associations between grandparents and grandchildren.

Second, I find evident inequalities in grandchildren's educational attainment in relation to parental education (see Table 4.4; for cumulative percentages of grandchildren's education by parental education, see Table A4.2, Appendix 4). Of grandchildren whose parents held university-level qualifications, more than half achieved the same level as their parents, and only 4 per cent held the primary -level qualifications or no qualifications. The proportions of grandchildren attaining higher
educational qualification by parents' educational levels significantly differ from its adjacent categories. Particularly, grandchildren with parents who had primary-level or no qualifications were clearly in disadvantages as compared with those with university-educated parents; grandchildren with poorly educated parents had the lowest proportion of attaining university qualification (10 per cent) and the highest proportion of holding the least desirable qualifications ( 25 per cent).

Table 4.4 Grandchildren's education by grandparental, parental class, and parental education

|  | Grandchildren's education |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | Degrees Sub-degree | A-level |  <br> GCSE | Primary \& no <br> qualification |  |
| Grandparents' class |  |  |  |  | 7.1 |
| Salariat | 41.3 | 7.0 | 26.7 | 17.9 | 6.6 |
| Intermediate occupations | 34.4 | 8.0 | 26.8 | 24.2 | 10.2 |
| Small employers | 30.8 | 8.8 | 27.4 | 22.8 | 12.7 |
| Lo supervisor \& technician | 24.8 | 6.6 | 29.4 | 26.5 | 17.2 |
| Working class | 18.4 | 7.5 | 28.2 | 28.8 |  |
| Parental class |  |  |  |  |  |
| Salariat | 38.4 | 7.0 | 28.2 | 20.0 | 6.5 |
| Intermediate occupations | 26.9 | 10.2 | 29.5 | 23.3 | 10.2 |
| Small employers | 18.7 | 6.4 | 26.7 | 29.7 | 18.5 |
| Lo supervisor \& technician | 16.1 | 7.6 | 29.4 | 28.3 | 18.7 |
| Working class | 13.9 | 7.1 | 25.4 | 32.9 | 20.8 |
|  |  |  |  |  |  |
| Parental education | 52.0 | 7.2 | 25.3 | 12.0 | 3.6 |
| Degree | 37.6 | 9.0 | 28.2 | 19.1 | 6.2 |
| Sub-degrees | 25.4 | 7.3 | 33.4 | 24.2 | 9.7 |
| A-level | 19.3 | 8.0 | 28.0 | 31.3 | 13.4 |
| GCSE \& O-level | 9.9 | 6.7 | 24.1 | 34.1 | 25.2 |
| Primary \& no qualifications |  |  |  |  |  |
| Total | 27.7 | 7.5 | 27.8 | 24.8 | 12.2 |

Notes: Values refer to row percentages; analytic sample applies; $\mathrm{N}=7,042$;
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table 4.5 Household monthly income by grandparental and parental class and by parental education

| Grandparental <br> class |  | Parental class |  | Parental <br> education |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Salariat | 4039 | Salariat <br> Intermediate | 3951 | Intermediate <br> occupations | 3350 |

Notes: Figures are presented in GBP; analytic sample applies.
Source: BHPS and UKHLS; grandchildren between 25 and 65 years.

## Parental wealth

Parents' economic resource is measured by monthly household income and household property ownership. Parental income is measured by the natural logarithm of monthly household income. In order to make the descriptive statistic more intuitive, raw parental household incomes and by quintiles are reported in the descriptive analyses.

Parental income was apparently of close association with grandparental class, parental class, and parental education. Mean incomes were highest for those parents who have salariat family origins, good education, and desirable occupations in the labour market (See Table 4.5).

Figure 4.1 Grandchildren's educational qualifications by the quartiles of parents' income and house ownership


Notes: Analytic sample applies; $\mathrm{N}=7,042$.
Source: BHPS and UKHLS; grandchildren between 25 and 65 years.

## Grandparental contacts

Table 4.6 provides descriptive information of grandparents-parents contact and the associations between contact and grandparental class in the UKHLS sample.

Grandparents who worked as salariat and intermediate had high proportions of being alive at the time of the survey, relative to grandparents of other classes. In terms of face-to-face interaction, there is no clear pattern related to grandparental class. It is of interest to see clear gradients of grandparental class regarding long-distance communications and contact in any forms (see the third and fourth panels of Table 4.6). I find that grandparents who worked in salariat and intermediate occupations had higher proportions of keeping frequent contacts with parents (and grandchildren) than did small-employer and working-class grandparents.

The effects of family wealth on children's education has been well documented in previous studies on intergenerational mobility (e.g., Blanden and Gregg, 2004; Blanden and Macmillan, 2013; Blanden and Machin, 2017). To put it simply, affluent economic resource allows parents to invest more money in their children's education; in contrast, parents with disadvantaged economic resources are subject to the pressure of education costs. The link between parents' economic resources and grandchildren's education is also evident in the data (see Figure 4.1). Grandchildren with parents who earned the top income quintile had the highest proportion of having higher educational qualification. More than one-third of grandchildren from the top income quartile families attained university degrees, whereas only 15 per cent of those grandchildren from the bottom quartile families did the same. A clear association can also be observed between house ownership and grandchildren's education.

Table 4.6 The grandparents-parent contacts by grandparental class

|  | Number of alive grandparents |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| Grandparents' class | 0 | 1 | 2 |  |
|  |  |  | 24.4 |  |
| Salariat | 43.0 | 32.6 | 22.1 |  |
| Intermediate occupation | 39.4 | 38.5 | 17.1 |  |
| Small employers | 53.8 | 29.1 | 19.7 |  |
| Lo supervisor \& technician | 51.0 | 29.3 | 17.3 |  |
| Working class | 53.8 | 28.9 | 19.6 |  |
| Total |  |  |  |  |
|  | 49.4 | 31.0 | Face-to-face contact |  |
|  |  |  | once per | several times per |
|  |  | deceased |  |  |
| Grandparents' class | daily/once per |  | year/none |  |
|  | week |  | 16.3 | 43.0 |
| Salariat | 31.3 | 9.4 | 13.8 | 39.4 |
| Intermediate occupation | 35.9 | 10.9 | 14.6 | 53.8 |
| Small employers | 24.8 | 6.8 | 12.4 | 51.0 |
| Lo supervisor \& technician | 29.3 | 7.2 | 8.9 | 53.8 |
| Working class | 31.2 | 6.1 |  |  |
| Total | 30.4 | 7.7 | 12.5 | 49.4 |


|  | Contact via telephone, call, and letter |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Grandparents' class | daily/once per week | once per month | several times per year/none | deceased |
| Salariat | 45.7 | 6.3 | 5.0 | 43.0 |
| Intermediate occupation | 50.0 | 3.9 | 6.8 | 39.4 |
| Small employers | 38.7 | 2.7 | 4.7 | 53.8 |
| Lo supervisor \& technician | 35.5 | 5.5 | 7.9 | 51.0 |
| Working class | 36.0 | 3.2 | 7.1 | 53.8 |
| Total | 40.2 | 4.1 | 6.3 | 49.4 |
| Contact in any form |  |  |  |  |
| Grandparents' class | daily/once per week | once per month | several times per year/none | deceased |
| Salariat | 48.8 | 5.2 | 3.1 | 43.0 |
| Intermediate occupation | 53.2 | 3.9 | 3.5 | 39.4 |
| Small employers | 41.2 | 2.0 | 2.9 | 53.8 |
| Lo supervisor \& technician | 39.7 | 5.2 | 4.1 | 51.0 |
| Working class | 40.2 | 3.6 | 2.4 | 53.8 |
| Total | 43.7 | 3.9 | 3.0 | 49.4 |

Notes: Values refer to row percentage; analytic sample applies; $\mathrm{N}=2,485$.
Source: UKHLS; grandchildren between 25 and 65 years.

### 4.4 Model results

### 4.4.1 Grandparental effects on educational qualifications

The first research question is concerned with the impacts of family origins on grandchildren's educational qualifications and whether there exist gradients of grandparents' positions independent of parents' resources. The influences of grandparental and parental characteristics are assessed with a full model. This full model considers, along with grandparents' social class, parents' social class, education, material resources measured by monthly household incomes, property ownership, and controls of data sources, age, age-squared, birth cohorts, sex, race, and regions. In order to demonstrate the existence of the net grandparental influences, I expect the overall effects of indicators associated with grandparents to reach statistical significance at the 5 per cent level.

Table 4.7 reports the results of the ordinal logistic regression models on educational qualifications grandchildren have attained. The estimates presented in Table 4.7 shows the chances of grandchildren from certain family origins attaining higher instead of lower educational qualifications.

Model M4-1 represents an incomplete test of the first research question as it does not include the step of the transmission from parents to grandchildren. Model M4-1 contains only grandparents' class positions and demographic characteristics of grandchildren; it measures the total effects of grandparents on their grandchildren.

As expected, grandparents' class positions are positively associated with grandchildren's education attainments.

Model M4-2 introduces parents' class as independent variables on the basis of Model M4-1. By so doing, I separate the direct effects of grandparents on
grandchildren's educational attainment from the indirect effects of grandparents channelled through parents' class. Whereas the statistical significance and the direction of grandparental class effects remain unchanged, the magnitudes of these effects drop remarkably due to the inclusion of parents' class ${ }^{26}$.

Model M4-3 that progressively includes the indicators of parents' class, parents’ educations, and parents' economic resources represents the complete empirical test of the theoretical framework of the first research question. Model M4-3 is referred to as the full model. After a wide range of the indicators capturing the parental characteristics are added, grandparental class' positive effects on grandchildren's education remained to be statistically significant at the overall level.

[^21]Table 4.7 Ordered logit regressions predicting grandchildren's educational qualifications

|  | $\mathbf{M 4 - 1}$ | $\mathbf{M 4 - 2}$ | M4-3 |
| :--- | :--- | :--- | :--- |
| Grandparents' class |  |  |  |
| Salariat | $2.758^{* * *}$ | $1.817^{* * *}$ | $1.435^{* * *}$ |
| Intermediate occupations | $2.012^{* * *}$ | $1.475^{* * *}$ | $1.308^{* *}$ |
| Small employers | $1.641^{* * *}$ | $1.484^{* * *}$ | $1.386^{* * *}$ |
| Lower supervisor and technician | $1.497^{* * *}$ | $1.300^{* * *}$ | $1.241^{* *}$ |
|  |  |  |  |
| Father's class |  | $2.196^{* * *}$ | $1.227^{*}$ |
| Salariat |  | $2.038^{* * *}$ | $1.314^{*}$ |
| Intermediate occupations |  | $1.251^{* *}$ | 1.012 |
| Small employers |  |  | 1.080 |
| Lower supervisor and technician |  | $2.572^{* * *}$ |  |
|  |  | $1.697^{* * *}$ | $1.515^{* * *}$ |
| Mother's class |  | $1.466^{* *}$ | $1.310^{* *}$ |
| Salariat |  | 0.912 | 0.237 |
| Intermediate occupations |  |  |  |
| Small employers |  |  |  |

## Father's education

| Degree | $2.388^{* * *}$ |
| :--- | :--- |
| Sub- degree | $1.720^{* * *}$ |
| Higher-secondary | $1.530^{* * *}$ |
| Lower-secondary | $1.465^{* * *}$ |

Mother's education

| Degree | $2.668^{* * *}$ |
| :--- | :--- |
| Sub- degree | $2.371^{* * *}$ |
| Higher-secondary | $1.713^{* * *}$ |
| Lower-secondary | $1.406^{* * *}$ |


| House ownership | $1.936^{* * *}$ |
| :--- | :--- |
| Monthly income | $1.221^{* *}$ |

Control variables:

| Age | 0.994 | 0.995 | 0.998 |
| :--- | :--- | :--- | :--- |
| Age-squared | 1.000 | $1.000^{* * *}$ | 1.000 |
| 1970s (1960s as base) | $1.992^{* * *}$ | $1.988^{* * *}$ | $1.861^{* * *}$ |
| 1980s | $1.768^{* *}$ | $1.630^{* *}$ | $1.390^{* *}$ |
| Female | $1.562^{* * *}$ | $1.613^{* * *}$ | $1.671^{* * *}$ |
| White | $0.337^{* * *}$ | $0.298^{* * *}$ | $0.288^{* * *}$ |
| Wales (England as base) | $0.901^{* * *}$ | $1.061^{* * *}$ | 0.987 |
| Scotland | $1.410^{* * *}$ | $1.432^{* * *}$ | $1.369^{* *}$ |
| Northern Ireland | $1.262^{* * *}$ | $1.391^{* *}$ | $1.363^{* *}$ |
| UKHLS | $1.752^{* * *}$ | $1.817^{* * *}$ | $1.339^{* * *}$ |
| Observations | 7042 | 7042 | 7042 |
| BIC | 20489 | 19926 | 19477 |

Notes: The lowest levels used as reference categories; figures provided as odds ratios; age is centred within birth cohorts; ${ }^{+} p<0.10,{ }^{*} \mathrm{p}<0.05,{ }^{* *} \mathrm{p}<0.01,{ }^{* * *} \mathrm{p}<0.001$
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

As can be seen in Model M4-3 in Table 4.7, parents' class, education, and economic resources, in fact, had independent effects on the grandchildren's educational attainment. The odds ratios of parental characteristics are larger than one, suggesting that grandchildren whose parents worked in higher class positions, attained better qualification, and had better economic resources had more favourable chances to achieve higher (and avoid lower) educational qualifications. In particular, fathers' and mothers' educational levels appeared to have the strongest influences on grandchildren's education chance. Grandchildren with university-educated mothers were 2.7 times more likely to attain higher instead of lower education than those whose mothers had only primary or no qualifications. These results are consistent with the findings from the studies on parents-children mobility that different types of parental resources had independent impacts and should not be treated as 'essentially interchangeable’ (Bukodi and Goldthorpe, 2013, p.7; also see Jæger and Holm, 2007).

With regard to the main interest, Model M4-3 shows that grandparents' class position was important even after having taken into account the effects of parents' and grandchildren's characteristics. Grandchildren of salariat grandparents have been marked by high level of education, with the probability being around 44 per cent higher than that of working-class grandparents. The influences of the grandparental social class were not confined only to the contrast between the grandchildren who were fortunate to have top-class grandparents and those of working-class grandparents; instead, the influences seem to be regular and farreaching. Grandparents who were situated somewhere higher than working-class helped their grandchildren to advance their education to varying extents.

It is worth noting that the indicator of grandparental class was considerably influential for their grandchildren's education outcomes. While parents' characteristics have been accounted for, the effect size of grandparental class was similar to that of the effect of parents' class. This seemingly counter-intuitive finding may result partially from the model specification that parental effects are measured by a wide range of parental characteristics, and that grandparental effects are measured only by grandparental class. This means that the effects of grandparental class may pick up the effects of other grandparental resources that are unobserved but relevant to grandchildren's education.

In additional analyses, I incorporate grandparental education in Model M4-4 on the basis of Model M4-3 (see Table A4.3, Appendix 4). The non-missing grandparental education appeared to have positive effects on grandchildren's education; however, these effects did not reach statistical significance at the 5 per cent level and grandparental class continued to be significant. After adding grandparental education, neither the magnitudes of the effects of other indicators nor the BIC index was substantially changed. In the following analyses, grandparents' education would not be used as the key variable of grandparental resources. Regarding grandparental education's missing data, the effect seemed to be significantly weaker than having low-educated grandparents. As can be seen in the cross-tabulations (see Table A4.4, Appendix 4), having the missing information of grandparents' education may indicate a disadvantaged family background.

I also conducted additional analyses to estimate simultaneously the effects maternal and paternal grandparents (see Table A4.5, Appendix 4) and did not find essential differences from the major models discussed above. Both maternal and paternal
grandparents' class positions were significantly associated with grandchildren's education net of parental characteristics.

As can be seen in the lower part of Table 4.7, educational attainment has improved over birth cohorts, which is also shown in the UKHLS as compared to the BHPS data. Women and ethnic minority group are found to fare better than men and white British, as do the Scots and Northern Irish over the rest of the population.

### 4.4.2 Gender differentials

As the results reveal that granddaughters did better than grandsons in education, a question arises as to whether there was any gender-based differential in terms of the effects of family origins from a multigenerational perspective. Interactions, therefore, are introduced in a full model (M4-3) between gender and the measures of family origins. The full model with the gender interactions is reported (Model M4-5) (see Table 4.8).

First, whereas both grandsons and granddaughters were able to take advantages of grandparental resources, having small-employer grandparents was more beneficial for granddaughters than for grandsons. The impact of having small-employer instead of working-class grandparents on granddaughters was 1.3 times higher than that on grandsons. This finding may be explained by the discussion in Section 4.1.5; small employers tend to place great emphasis on female offspring's education and on male offspring's career planning.

Table 4.8 Ordinal logit regressions predicting educational qualifications with gender interactions for grandchildren

|  | M4-5 |  |
| :---: | :---: | :---: |
| Female | 0.508 |  |
| Grandparental class |  | x Female |
| Salariat | $1.378^{* *}$ | 1.105 |
| Intermediate occupations | 1.260 | 1.089 |
| Small employers | 1.209 | $1.337 *$ |
| Lower supervisor and technician | $1.227^{*}$ | 1.031 |
| Working class(Base) |  |  |
| Father's class |  | x Female |
| Salariat | 1.371* | 0.797 |
| Intermediate occupations | 1.485* | 0.747 |
| Small employers | 0.979 | 1.072 |
| Lower supervisor and technician | 1.062 | 1.035 |
| Working class (Base) |  |  |
| Mother's class |  |  |
| Salariat | 1.308* | 1.353 |
| Intermediate occupations | 1.239 | 1.121 |
| Small employers | 1.114 | 1.218 |
| Lower supervisor and technician | 0.750 | 1.196 |
| Working class (Base) |  |  |
| Father's education |  | x Female |
| Degree | $2.831^{* * * *}$ | 0.696 |
| Sub- degree | $1.851^{* * *}$ | 0.868 |
| Higher-secondary | $1.773^{* * *}$ | 0.719 |
| Lower-secondary | $1.466^{* *}$ | 1.007 |
| Primary or no qualification (Base) |  |  |
| Mother's education |  | x Female |
| Degree | $2.625^{* * *}$ | 1.005 |
| Sub- degree | 2.507*** | 0.878 |
| Higher-secondary | $1.441^{* * *}$ | 1.434 |
| Lower-secondary | $1.532 * * *$ | 0.841 |
| Primary or no qualification (Base) |  |  |
| Parental wealth |  | x Female |
| House ownership | 1.942*** | 1.017 |
| Monthly income | 1.149 | 1.164 |
| Observations | 7042 |  |

Notes: Figures refer to odds ratios; age is centred within birth cohorts; ${ }^{+} p<0.10,{ }^{*} p<0.05$, ${ }^{* *} p<0.01,{ }^{* * *} p<0.001$; Control variables are included in modelling but not shown in the table.
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Second, I find only slight gender differences in the impacts of parental characteristics, and these differences were not statistically significant. In other words, contrary to the previous studies (for example, Bukodi and Goldthorpe, 2013), gender differentials are not shown in the effects of parental characteristics. When the interactions between gender and family origins are introduced, the main gender effects disappeared, suggesting that family origins seemed to be enough for grandsons to catch up with their female counterparts.

### 4.4.3 Grandparent contact

Since Section 4.4.1 has found the evidence that grandparental class has significant impacts on grandchildren's education independent of parental influences, one may wonder the questions of how grandparental effects operate - that is, whether such grandparental effects rely on grandparents-grandchild contact and living status of grandparents. In order to establish at least a partial understanding of the observed grandparental effects, I conduct a series of binary logistic regressions with the interactions between grandparental class and the indicators of grandparent contact. Because the BHPS does not have related variables, the models use only the UKHLS data. The models here, as in the previous analyses, take into consideration parental characteristics including father's class, mother's class, father's education, mother's education, household income, and property ownership as well as grandchildren's information. Table 4.9 reports the results of grandparental class and the interactions with grandparental involvement (see the complete model results in Table A4.6, Appendix 4).

Model M4-6 provides the results of interaction analyses where the grandparental class interacts with the living status of grandparents. If the assumption that grandparental class effects operate only in the presence of alive grandparents was correct, grandparental effects would have been significantly reduced while none of grandparent was alive at the time of the survey. Model M4-6 does not support this assumption; it shows no significant changes related to the living status of grandparents.

Model M4-7 presents the results where the grandparental class interacts with face-to-face contact. If the assumption that grandparental class effects relied only on face-to-face contacts was correct, grandparental class effects would have been significantly reduced as the frequency of face-to-face contact dropped, and the effects would not have existed while all of the grandparents passed away. Model M4-7 shows that the interactions did not reach statistical significance. In other words, there is no evidence that grandparental effects depended solely on face-to-face contacts.

Table 4.9 Binary logistic regressions predicting chance of grandchildren attaining higher education, including interactions with the indicators of family networks

|  | M4-6 | M4-7 | M4-8 |
| :--- | :---: | :---: | :---: |
| Grandparental class (working-class as base) |  |  |  |
| Salariat | $1.873^{*}$ | 1.316 | $1.814^{* *}$ |
| Intermediate occupations | $2.102^{*}$ | 1.494 | $1.619^{+}$ |
| Small employers | 1.755 | 1.231 | $1.498^{+}$ |
| Lower supervisor and technician | $1.992^{+}$ | 1.135 | 1.303 |

Number of alive grandparents ( 2 as base) 0

Interaction with number of alive grandparents
0 X Salariat
1.074

0 X Intermediate occupations
0 X Small employers
0 X Lower supervisor and technician
0.844

0 X Working class (base)
1.000

1 X Salariat
0.764

1 X Intermediate occupations
0.578

1 X Small employers
0.691

1 X Lower supervisor and technician
0.518

1 X Working class (base)

## Contact (daily/once per week as base)

once per month
several times per year/less often/never deceased

## Interaction with contact

once per month $X$ Salariat
once per month $X$ Intermediate occupations
once per month X Small employers
once per month X Lower supervisor and technician
once per month X Working class
several times /never X Salariat
several times /never X Intermediate occupations several times /never X Small employers several times /never X Lower supervisor and technician several times /never X Working class (base)
deceased X Salariat
deceased X Intermediate occupations
deceased X Small employers
deceased X Lower supervisor and technician

| deceased X Working class |  | 1.000 | 1.000 |
| :--- | :---: | :---: | :---: |
| Observation | 2485 | 2485 | 2485 |

Notes: Figures refer to odds ratios; ${ }^{+} p<0.10,{ }^{*} p<0.05,{ }^{n} p<0.01,{ }^{* *} p<0.001$
Source: UKHLS; grandchildren between 25 and 65 .

The most interesting observation is the result of Model M4-8 that includes the interaction terms between grandparental class and contact in any forms. The result highlights two important findings. First, the strength of grandparental effects was significantly weaker on grandchildren who were likely to have infrequent contact with their grandparents than on those who were likely to keep in intensive contact with their grandparents. Second, grandchildren whose grandparents deceased at the time of survey benefited equally from having advantaged grandparents as those who had grandparents alive and kept in close touch. When it comes to family network, neither the living records of grandparents nor the frequency of face-to-face interaction made significant differences; what mattered was whether grandparents who were alive had close contact with their offspring.

The results provide the evidence for the assumptions that there are multiple mechanisms through which grandparental effects work as a complicated social process. First, if the grandparents were alive and kept in intensive touch with parents and grandchildren, then knowledge, financial resources, family traditions, and aspirations may be directly passed on to the grandchildren (Bengtson, 2001). These kinds of support rely on intensive interactions, and these interactions may take many forms. The ways that grandparents and grandchildren interact, whether face-to-face or long-distance communication, do not matter in itself. Although the current models do not include information on the geographical distance between grandparents and grandchildren, the results suggest that geographical distance may not matter to the associations between grandparents and grandchildren if they kept in close contact.

Second, grandparental effects may still exist even though grandparents were deceased. Financial resources that grandparents amassed can be beneficial to grandchildren without the presence of grandparents (Mare, 2011). The influences of
successful grandparents as role models can also strengthen the family traditions and expectations for education attainments of grandchildren; these influences related to role models would not disappear as grandparents passed away. Similar results were reported in a study on grandparental effects on grandchildren's school marks in Sweden (Modin, Erikson and Vågerö, 2013). Modin and his colleagues identified close associations between grandparents and grandchildren in terms of school performance but found no difference in the associations according to whether grandparents were alive or not.

Third, however, the condition that grandparents were alive but did not keep in close touch with parents and grandchildren implies a lack of strong bonding between generations. When this occurred, grandchildren were much less likely to benefit from grandparents' economic resources and also less likely to take grandparents as role models. In this case, it is hardly surprising that grandparental effects disappeared when grandparents lost substantial touch with their offspring even though they were still alive.

### 4.4.4 Patterns of grandparental effects

So far, the foregoing analyses take grandparental effects on educational attainment as a simple additive manner; that is, the grandparental class had the equal effects on grandchildren regardless of parental characteristics. However, research on family relations and social stratification suggests that supports provided by grandparents may be conditional on parents' characteristics. The last research question is therefore concerned with the augmentation hypothesis and the compensation hypothesis; that is, as compared to grandchildren originating from disadvantaged parents, whether
grandchildren originating from advantaged parents benefit more or less from having salariat grandparents instead of working-class grandparents.

The strategy that addresses the question of whether grandparental effects vary with parental resources is to introduce interaction terms between grandparental class and parental resources. I construct a continuous latent factor representing father's class, mother's class, father's educational qualification, mother's educational qualification, household income, and property ownership. Latent factor analysis is a measurement model aiming to generate a latent factor that underlies the relationships between observed indicators (Hair, et al., 2005) ${ }^{27}$. It provides a parsimonious understanding of the underlying construct that logically and systematically accounts for various kinds of parental resources. The earlier findings that these parental characteristics have substantial impacts on grandchildren's education establish a strong empirical and theoretical foundation that is required by the specification of the current latent factor model.

The latent factor analysis is superior to the summation approach in which years of education of both parents, a continuous scale of parental social position and monthly household income are summed up. The summation approach does not allow for the measurement error of the generated latent factor or the different loadings to be attached to these involved parental characteristics. Instead, the summation approach simply treats these characteristics as equally weighted, which apparently does not reflect the social process of how parental backgrounds are associated with

[^22]educational attainment. The latent factor analysis is also preferred over a conventional approach of using only one variable to measure parental resources that shape the offspring's educational attainment, in that the latter approach ignores the independent roles played by various kinds of parental resources as manifested in the previous models. If the models used only a single variable to represent parental impacts, the parental effects as a whole would have been underestimated and the effects of that specific indicator would have been overestimated (Bukodi and Goldthorpe, 2013).

All the observed variables mentioned above load significantly on the latent factor of parental resources as expected. The resulting model displays good fit statistics (RMSEA=0.038, CFI=0.986) indicating that the latent factor analysis model captures the underlying parental resources quite well ${ }^{28}$ (see the model results in Appendix Table A4.7). This new factor is then used as the proxy for parental characteristics in the ordinal logistic regression on grandchildren's educational qualification. This factor has the mean of zero with positive scores representing advantaged parental resources and negative scores representing disadvantaged parental resources. The factor score is used in the present chapter and Chapter 5.

Using the method of contrasting predictive margins, the findings seek to estimate the effects of grandparental class at the different factor scores of parental resources on the chance of grandchildren attaining university degrees. The results are shown in Figure 4.2, and the details are provided in Table A4.8, Appendix 4. The lines

[^23]represent estimated marginal effects of grandparental class, that is, the changes in percentages of the educational chance of grandchildren of grandparents in different classes at the values of parental factor scores. The effects of the grandparental class are estimated as if all grandchildren had same specific scores of parental resources and left other characteristics unchanged (StataCorp, 2015).

The four coloured lines indicate the strength of grandparental class effects, and the values at the X axis represent the factor scores of parental characteristics. In the case in which grandparental class effects were evenly distributed over the families with different parent resources, the coloured lines would have been shown to be parallel to the X axis, indicating that grandparental class effects on grandchildren's chance of attaining university degrees were not conditional parents' resources.

Figure 4.2 Grandparental class effects at parental socioeconomic characteristics predicting chances of grandchildren attaining university degrees


Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Figure 4.2 shows a clear trend that as the factor score of parental resources increased, the strength of grandparental effects also increased. In other words, grandparental class effects appeared to be stronger in the households characterised by advantaged parental resources than in the disadvantaged households. The effects of having salariat instead of working-class grandparents are approximately 1 percentage points for grandchildren originating from the least advantaged parents and 13 percentage points for those originating from advantaged parents. Figure 4.2 does not display confidence intervals of each point estimate for ease of presentation. Tests show that for grandchildren whose parental factor score was higher than average, the impacts of the grandparental class were significantly stronger than on those whose factor score is at the bottom. The exception is the effects of having lower supervisory and
technical grandparents instead of working-class grandparents, which seemed to have largely equal effects on grandchildren originating from different parental backgrounds. Although the lines representing grandparental effects seemed to weaken a bit at the highest values of the parental score, the reduction was far from statistically significant, suggesting that there was no substantial difference. I conducted separate analyses for grandsons and granddaughters and found that this trend held up for both genders.

The phrase 'success breeds success' may explain the foregoing findings. Grandchildren with advantaged parents are the main beneficiaries of grandparental effects. On the one hand, thanks to their advantaged parents, they are the major group of who have salariat grandparents. Of grandchildren of university-educated parents, 40 per cent had salariat grandparents. In contrast, grandchildren with parents who attained only primary qualifications were much less likely to have salariat grandparents: of grandchildren with salariat grandparents, only 7 per cent grew with primary-educated parents. Net grandparental impacts should not be understood simply as an additional layer of family resources; rather, the strength of grandparental effects is found to be the most prominent in advantaged families and then narrow down for less advantaged families. Based on this pattern, inequalities in educational attainment appeared to be more persistent at the top of the social structure and become less rigid at the bottom. This implies that whereas individuals originating from socially disadvantaged family backgrounds might be able to take some opportunities to attain desirable educational qualifications, those from advantaged family origins were able to maintain their privileges in access to education over generations.

### 4.6. Conclusion

The aim of this chapter is to assess grandparental effects on educational inequalities in modern British Society. The study is based on a three-generational view of family origins measured by grandparental class and a comprehensive range of parental characteristics. Evidence suggests that grandparents did have their contributions on grandchildren's education attainment which are distinctive of parental influences, and the magnitude of these grandparental effects was far from negligible. I argue that the application of a three-generational model introduces a new perspective on social stratification in educational attainment.

The effects of family origins on education are striking. As compared to the benchmark that 28 per cent of grandchildren in the data obtained university or higher degrees, approximately 40 per cent of grandchildren of salariat grandparents ( 41 per cent) and of those with salariat parents ( 38 per cent) did the same (see Table 4.4). This suggests that grandchildren with salariat origins, whether at the grandparental generation or at the parental generation, were significantly over-represented in university graduates.

I estimated the total effects of grandparents on their grandchildren's education and then showed the extent to which these effects could be explained away by the introduction of parental characteristics. After the information of the parental characteristics was added, the statistical significance of grandparental class effects remained, indicating the existence of the direct effect of grandparents on grandchildren's education. When grandparental education was added, the results showed that non-missing grandparental educational levels did not have significant explanatory power independent of grandparental class. The BIC index was not
improved either. Grandparental education is no longer included in further analyses, and grandparental class is used as the only indicator of grandparental background.

As shown in the full models of three generations, parental education, parental class, and parental wealth are not essentially interchangeable dimensions of parental resources, and each plays a significant role in grandchildren's education. Parental educational qualifications are found to be the most powerful component of family origins in explaining grandchildren's educational attainment; their influences outweigh the importance of other measures of family origins. The grandparental class is found to have both direct and indirect effects; while its effect was mediated partially by parental characteristics, the grandparental class held its independent contribution to their grandchildren's education. Furthermore, while using a set of relatively comprehensive measures of parental backgrounds, the size of grandparental class effects was similar to that of parental class. The foregoing analyses, therefore, suggest that if the parental background was taken as the only measure of family origins, as seems a common practice, this would have underestimated family origins effect and overestimated mobility rates in education.

An important aim of this chapter is to gain insight into the mechanisms through grandparental effects operate. Previous studies suggest that grandparental contributions to their grandchildren's education come in various forms. First, grandparents may support their grandchildren in a tangible way with their economic resources, cultural resources or social resources. A prerequisite for this mechanism is through contact: grandparents have to be alive and get involved in their grandchildren's life. Previous research shows that grandparental effects are contingent on household co-residence (Zeng and Xie, 2014). Second, the influences
of grandparents may operate in a less tangible way that does not require the presence of grandparents. Grandparents may work as role models based on their social attainment in life and therefore foster strong educational aspirations. In particular, when it comes to educational choice, grandparents' achievement may be used as a reference frame for grandchildren, regardless of the living status grandparents (Jæger, 2012; Hertel and Groh-Samberg, 2014). It should be noted that in the case which grandparents have accumulated a large amount of economic wealth, the grandchildren may benefit from the resources, even though grandparents have passed away and thus had no physical involvement in grandchildren life.

I found evidence supporting both of the mechanisms. On the one hand, grandparental effects disappeared when grandparents barely had contacts with and grandchildren as compared to when grandparents kept in intensive contact. The forms of contact did not matter; it could be face-to-face interactions, or longdistance communications such as by telephone, emails or letter. On the other hand, grandparental effects remained regardless of whether grandparents deceased or were alive. However, when grandparents did not share strong bonding with grandchildren as indicated by grandparents being alive but in infrequent touch with grandchildren, the grandchildren may not benefit from grandparents' resources or take grandparents as a constituent of family norms that shape grandparents' aspirations. In this case, no statistically significant grandparental effect was observed.

My findings are in line with a recent study by Knigge (2016) that in Netherlands the effect of grandfather did not necessarily require contact. Knigge (2016) used temporal distance and geographical distance as the proxy indicators of grandparent contact with grandchildren and did not have information of frequency of contact. I argue that the current data allow more accurate and solid estimation. Although no
information on proximity between grandparents and grandchildren was not used in current analyses, the finding that the face-to-face interaction form in itself did not matter but actual contact that took different forms mattered implies that geographical distance is not important if family members keep frequent communication. This finding would have been hidden if geographical proximity was used as the sole indicator of family bonding.

The available data, however, do not allow for detailed exploration of causal processes or mechanisms behind grandparental effects on education. For instance, it would be helpful to investigate how wealth and family values related to different grandparental characteristics produce the patterns that have been observed in the chapter, but this is beyond reach at the moment as the data sources do not possess sufficient information in these regards. That said, with the discussion of grandparent contact, the evidence so far implies that there is more than one mechanism through which grandparental effects operate and that the observed direct grandparental effects should be understood complicated multi-dimensional social processes.

In the last part of empirical analyses, grandchildren with advantaged parental backgrounds are found to benefit significantly more than those with the disadvantaged parental background from having salariat grandparents. As compared to those with disadvantaged parents, grandchildren with advantaged parents were more likely to have salariat grandparents; in other words, they were the main possessor of salariat grandparents. Moreover, and more importantly, grandparental effects operated in a nonlinear process; the advantages of having salariat grandparents are found significantly stronger among grandchildren with advantaged parents than among those with disadvantaged parents. Having salariat grandparents
gives grandchildren from advantaged parental backgrounds further a leg-up in competing for better education. In this context, one may say that grandparental effects serve to extend the advantages of salariat family backgrounds over generations, thus significantly augmenting the persistent privileges of families at the top of social hierarchy. In contrast, multigenerational effects of family origins appear to be relatively weak at the bottom; grandchildren originating from disadvantaged parental households are shown to have some chances of access to higher education. This result may be associated partially with the massive expansion of higher education. More opportunities for access to higher education become available to the students who come from disadvantaged families without endangering the chances of those from advantaged families.

Chapter 5 will carry on examining the effects of grandparental class on grandchildren's education with a focus on the interplay between grandparental class effects and educational expansion.

# Chapter 5 Grandparental Effects on Educational Attainment: Educational Expansion 

### 5.1. Introduction

This chapter sets out to investigate the changes in three-generational mobility in educational attainments over the pre-1970s, 1970s and 1980s cohorts. It discusses whether the 1990s educational expansion contributes to the reduction of inequalities in access to tertiary education. There is a dispute as to whether equality of educational opportunities for individuals of different family origins has been improved during the twentieth century. Participation in tertiary education in Britain, as in other industrialised countries, has expanded remarkably over the postwar period and educational inequalities in relation to family backgrounds are expected to reduce. Treiman (1970) posits that as an inevitable result of industrialisation, the mass availability of educational opportunity would reduce the dependence of educational attainment upon parental status. Research has shown that with the mass expansion of education, family origins play a less important role in children's educational attainment in some societies (for Sweden and the Netherlands, Shavit and Blossfeld, 1993; for Sweden and Germany, Breen, 2010; Spain and Italy, Ballarino, et al., 2009). Yet, a number of studies find that educational inequality remained essentially unchanged (e.g., Breen, 2010; Shavit and Blossfeld, 1993) and some find that educational inequality deteriorated over time (e.g., Blanden and Machin, 2004).

Although different studies appear to have divergent findings with regard to changes over time, all the studies concur that as a result of educational reform the British
educational system has expanded substantially in the recent decades. This chapter intends to focus on the grandparental effects during the period that has been described as the mass tertiary education expansion (Halsey, 2000) between the 1990s and the 2000s. The increase in university participation could be seen as demand-led, as students react to the trends of economic expansion and upgrading of the occupational structures (Blanden and Machin, 2004). The increase in university participation provides more labour forces for jobs in professional and management that require higher educational qualifications. Breen and Goldthorpe explain that the process of decision-making to pursue university education is determined by the evaluation regarding the costs and benefits of university education (Breen and Goldthorpe, 1997). When the benefits are perceived to be higher than the costs, students would make choices in favour of the transition to higher education. Given the markedly wage gap between graduates and non-graduates (Blanden and Machin, 2004), rising economic rewards likely play an important role in such decisionmaking process at the level of the individual.

The most fundamental change in educational policy that accelerated the mass expansion of tertiary education in the early 1990s is the introduction of Further and Higher Education Act of 1992, which upgraded the former polytechnic institutions to the same funding and administration arrangements as the pre-1992 universities, leading to the abolition of the binary system. The enrolment in both less prestigious 'new' universities and more prestigious 'old' ones increased remarkably during this period (Wyness, 2010). The political commitment to educational expansion at the institutional level, together with economic incentives at the individual level, gave rise to the substantial growth in participation in tertiary education. The next phase that runs from the 2000s to the present has been referred to as 'the maturation of the
mass tertiary education phase' (Boliver, 2011, p.233). This phase is characterised by the continuing expansion of higher education, with the goal promoted by the government that the participation rate would reach the $50 \%$ by 2010 (Department for Education and Skills, 2003).

This chapter will seek to examine the effects of educational expansion on inequality in educational attainments from a multigenerational perspective. The thesis of Maximally Maintained Inequality (MMI) contends (Raftery and Hout, 1993) that educational inequalities are maintained as long as individuals from advantaged families can increase their educational participation rates as much as or more than those from disadvantaged families and that only when those in advantaged group reach saturation with regard to a certain level of education, the educational expansion would reduce the gap at that level. A number of studies have empirically tested the thesis of Maximally Maintained Inequality (MMI) using parents-child associations (e.g., Ayalon and Shavit, 2004; Boliver, 2011). In particularly, Boliver (2011) found that class inequalities in higher education have been maximally maintained in Britain where higher education has expanded massively. Given the evidence that grandparental class had significant impacts on grandchildren's education, one may expect that grandparental effects have played a role in maintaining family advantages in education during the 1990s educational expansion. This chapter will discuss the questions of whether grandparental effects have changed at different stages of the educational expansion and of how grandparental effects can be understood in terms of the thesis of Maximally Maintained Inequality.

### 5.1.1 Chapter Structure

The rest of this section will outline the core findings of how the effects of multigenerational family origins on educational attainment have changed over time. Section 5.2 reports the variables and measures to be used in the analyses. Section 5.3 presents the results of the temporal changes of the effects of grandparental class and parental characteristics on the chance of grandchildren attaining higher instead of lower educational qualifications. Section 5.4 focuses on the influence of multigenerational family origins on higher educational attainment at different phases of the 1990s educational expansion. Section 5.6 summarises the findings of this chapter.

### 5.1.2 Core Findings

While a number of studies on the trend of social mobility in education report divergent results, many measure family origins with a single indicator at the parental level, such as parental class (e.g., Ballarino, et al., 2009; Breen, et al., 2009; Paterson and Iannelli, 2007) and parental income (e.g., Blanden and Machin, 2004). Pfeffer correctly points out that the application of a single indicator of parental backgrounds is one of the major reasons for the divergent findings of educational inequalities over time (Pfeffer, 2008). One of a few notable exceptions is the research by Bukodi and Goldthorpe (2012) who decompose family origins into three components: parental class, status and education. In assessing the changes in the effects of these different components on education over time, Bukodi and Goldthorpe suggest that these components change in different patterns over time. This is an important contribution to the understanding of the mechanism through which how various kinds of family
resources shape education. However, while Bukodi and Goldthorpe (2012) focus on only the two-generational associations between parents and children, the changes of the effects of multigenerational mobility remain understudied. Research question 1 seeks to understand the temporal changes in the association between family origins and educational inequality, where family origins are conceptualised and measured in a three-generational construct with a range of relatively comprehensive parental characteristics

1. How far have grandparental effects and parental effects on educational attainment changed over time?

The chapter will demonstrate that regarding the chance of grandchildren attaining higher (and avoiding lower) qualifications, parental effects and grandparental effects, while still being evident in the context of the 1990s educational expansion, have changed in different ways for grandsons and granddaughters. Parental educational effects will be found to be stronger on the 1970s cohort grandsons who experienced the initial stage of expansion as compared with on the 1980s cohort who experienced the post-expansion stage. Regarding granddaughters, the model results will show that parental class and parental wealth had stronger effects on the 1980s cohorts than on the 1960s who went through the pre-expansion stage. Grandparental effects remained essentially unchanged for both grandsons and granddaughters.

In the context of the 1990s educational expansion, I seek to investigate the changes in the effects of family origins on degree attainment over the decades represented by the cohorts. This discussion is pursued with research question 2 .
2. In the context of the massive tertiary educational expansion, what are the combined grandparental and parental effects on the chance of grandchildren attaining higher educational qualifications?

Using the methods of Latent Factor Analysis and Predicted Marginal Effects, the chapter will show that during the 1990s higher educational expansion, although the chance of grandchildren of disadvantaged families grew steadily, it was those grandchildren from persistently advantaged families (i.e., the grandchildren who had both advantaged grandparents and advantaged parents) who took up the increments that the expansion afforded. The findings will show that educational expansion did not necessarily lead to the reduction of inequality related to family backgrounds. This confirms that the improvement of educational inequality is not a simple linear process; the gap between grandchildren of the most advantaged families and those of the least advantaged families was found to be enlarged during the expansion phase, as compared to that in the pre-expansion period. Introduction of grandparental effects will be shown to be crucial to understanding the influences of family origins on educational inequalities under the context of the 1990s educational expansion.

### 5.2. Data and Methods

The empirical analyses are based on the data from the BHPS and UKHLS. The sample includes three cohort groups, individuals who were born in the pre-1970s, 1970s and $1980 \mathrm{~s}^{29}$. Assuming that the grandchildren likely started the university

[^24]education at the age range of 18 to 20s if they enrolled, I consider that the pre-1970s cohort would reach this age range before the 1990s educational expansion began. By the same logic, I posit that the 1970s cohort would be able to benefit from the initial stage of the 1990s educational expansion, and the 1980s cohort, if they enrolled, would participate in higher education at the maturation stage of the expansion. In order to capture accurately the chance of grandchildren acquiring university degrees, the data excludes the grandchildren under 25 and over 65 at the time of the survey.

Figure 5.1 shows how educational attainments have improved at an overall level during the decades indexed by grandchildren's cohorts. The proportion of grandchildren with only primary or no qualification has declined from 30 per cent as in 1960s cohort to less than 10 per cent as in 1980s cohorts. The proportions of obtaining higher than primary education have increased. Of grandchildren who were born in the 1980s, 29 per cent obtained university degrees, as compared to 14 per cent of those who were born in 1960s and earlier. The findings of the dramatic decline in the proportion of attaining primary education and the massive growth in the proportion of attaining tertiary education manifest the social process of educational expansion that occurred since the 1990s in Britain.

Figure 5.1 Educational attainments by cohorts


Notes: Figures refer to row percentages.
Source: BHPS and UKHLS, grandchildren over 25.

In the discussion of the first question, due to consideration of cell sizes, variables related to social class and educational qualifications are collapsed into three-fold classifications. With grandparental class and parental class, I collapse the NS-SEC classes to three categories: i.e., 1-2 (salariat class including higher and lower managerial, administrative and professional occupations), 3-5 (intermediate class including intermediate occupations, small employers and own account workers, and lower supervisory and technical occupations), and 6-7 (working class, including semi-routine occupations and routine occupations) (see the three-level class measurement in Table 2.2 in Section 2.2.1). For parental education, the dominance approach (Erikson, 1984) is adopted to arrive at a single indicator by using father's or mother's education (whichever is higher). I also collapse parents' five-level educational qualifications into three categories, tertiary qualifications (higher degree,
first degree, and professional qualifications including High National Certificates, Higher National Diplomas, and teaching and nurse qualifications), secondary qualifications (A-level and GCSE or O-level), and primary qualification (Other qualifications and no qualifications) (see the three-level parental education measurement in Table 2.4 in Section 2.2.2).

I decide to use the binary variable of whether grandchildren have acquired university degrees as the outcome variable in the investigation of the first and second research questions. I am aware of the fact that the number of educational institutions that provide sub-degrees (including Higher National Certificates, Higher National Diplomas, and teaching and nurse qualifications) also increased during the higher educational expansion. I find, however, that the grandchildren with higher educational qualifications had considerably higher proportions (68 per cent) of working in salariat occupations than those with sub-degrees (42 per cent) (see Table A5.1, Appendix 5), indicating that having higher education degrees instead of subdegrees does make important differences in occupational career and life conditions.

In order to address the first research question of how far the effects of multigenerational family origins on education may have changed, and in particular, whether grandparental and parental effects may have changed in similar or in different directions and extents, following Boliver (2011) and Bukodi and Goldthorpe (2013), I apply a series of binary logistic models on the chance of grandchildren attaining degree qualifications and introduce interaction terms between cohorts and family origin indicators. The 1980s cohort that experienced the expansion maturation stage is used as the reference category. The 1980s cohort had the largest number of observations and using it as the reference category reduces the standard errors and confidence interval widths of interaction terms' coefficients.

Regarding the second question, I used latent factor measurement analysis and generated a continuous latent factor that represents parental resources including father's NS-SEC class, mother's NS-SEC class, father's educational qualifications, mother's educational qualifications, monthly household income, and property ownership. This latent factor model shows a good fit, indicating that the latent factor well captures the underlying parental characteristics (see the detailed results in Table A4.7, Appendix 4). I regard it as an improvement from the simplistic approach that uses only a single observed variable as the measure of parental resources, in that the application of latent factor measurement is able to capture detailed parental characteristics with different factor loadings.

### 5.3. Finding 1

Table 5.1 presents the results of fitting a series of binary logistic regression models on grandsons' higher education attainment. Model M5-1, as seems as common practice in research in social mobility, uses the parental class as the only indicator of family origins, and then grandsons' cohorts interact only with parental class. As expected, grandsons originating from salariat parents and intermediate class parents had significantly better chances of attaining degree qualifications than those originating from working-class parents. Regarding the changes over time, although there seemed a declining trend of parental class effects, this trend was not statistically significant.

Model M5-2 introduces a wide range of parental characteristics, including parental class, parental education, and parental wealth measured by property ownership and monthly household incomes, and adds interaction terms between these
characteristics and birth cohorts. Grandsons whose parents were in higher social class, held higher educational qualifications, and owned a greater amount of economic resources had substantially better higher educational experiences than those whose parents were in disadvantaged positions. The application of a relatively comprehensive range of parental characteristics reveals a different picture from Model M5-1. Whereas the effects of the parental class remained constant over the cohorts, parental education seemed to have significantly greater impacts on the 1970s cohort than on the 1980s cohort (the average marginal effects of parental education across birth cohorts are reported in Table A5.2, Appendix 5). Parental wealth effects were shown to be stable over time. On the basis of Model M5-2, Model M5-3 adds grandparental class and the interaction terms with birth cohorts. Model M5-3 shows that grandparental class effects remained essentially unchanged over the birth cohorts considered. Regarding parental effects, the finding of Model M5-2 on the change of parental education effects hold up.

Table 5.1 Binary logistic regressions predicting chances of grandsons attaining degree qualifications with the interaction between family origins and birth cohorts

|  | M5-1 | M5-2 | M5-3 |
| :--- | :---: | :---: | :---: |
| Grandparental class |  |  | $1.798^{* * *}$ |
| Salariat |  | 1.100 |  |
| Intermediate |  | 1.430 |  |
| pre-1970s X Salariat |  | 1.335 |  |
| pre-1970s X Intermediate |  | 0.898 |  |
| 1970s X Salariat |  | 1.356 |  |

## Parental class

| Salariat | $3.653^{* * *}$ | $1.743^{* *}$ | $1.639^{*}$ |
| :--- | :--- | :--- | :--- |
| Intermediate | $1.533^{*}$ | 1.070 | 1.072 |
| pre-1970s X Salariat | 1.400 | 1.309 | 1.350 |
| pre-1970s X Intermediate | 1.127 | 1.130 | 1.129 |
| 1970s X Salariat | 1.211 | 0.896 | 0.904 |
| 1970s X Intermediate | 0.948 | 0.920 | 0.896 |

## Parents' education

| Tertiary | $2.951^{* * *}$ | $2.674^{* * *}$ |
| :--- | :--- | :--- |
| Secondary | $1.438^{+}$ | 1.378 |
| pre-1970s X Tertiary | 1.606 | 1.392 |
| pre-1970s X Secondary | $1.676^{*}$ | 1.531 |
| 1970s X Tertiary | $2.160^{*}$ | $2.288^{*}$ |
| 1970s X Secondary | 1.474 | 1.502 |

## Parental wealth:

House ownership pre-1970s X House ownership $1.754^{* *}$
1.716**

1970s X House ownership
1.459
1.513

- X
0.935
0.981

Monthly income
1.167
1.160
pre-1970s X Monthly income
1.182
1.172

1970s X Monthly income
1.051
1.014

Cohorts: (1980s as base)

| pre-1970s | $0.398^{*}$ | 0.067 | 0.060 |
| :--- | :--- | :--- | :--- |
| 1970 s | 0.772 | 0.451 | 0.514 |

Controls:

| Age | 0.997 | 1.004 | 1.004 |
| :--- | :---: | :--- | :--- |
| Age-squared | 1.001 | $1.002^{* * *}$ | $1.002{ }^{* * *}$ |
| White | $0.278^{* * *}$ | $0.248^{* * *}$ | $0.251^{* * *}$ |
| Wales | $0.626^{*}$ | $0.571^{* *}$ | $0.577^{* *}$ |
| Scotland | 0.919 | 0.887 | 0.921 |
| Northern Ireland | 0.996 | 0.987 | 1.042 |
| UKHLS | $1.209^{+}$ | 0.945 | 0.982 |
| Constant | -2.407 | -0.737 | $-2.334^{*}$ |
| Observations | 5157 | 5157 | 5157 |

Notes: Values refer to odd ratios; age is centered within birth cohorts; ${ }^{+} p<0.10,{ }^{*} p<0.05,{ }^{* *} p$ $<0.01$, *** $p<0.001$.
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Table 5.2 Binary logistic regressions predicting chances of granddaughters attaining degree qualifications with interaction between family origins and birth cohorts

|  | M5-4 | M5-5 | M5-6 |
| :---: | :---: | :---: | :---: |
| Grandparental class |  |  |  |
| Salariat |  |  | $1.491^{* *}$ |
| Intermediate |  |  | $1.278^{*}$ |
| pre-1970s X Salariat |  |  | 0.904 |
| pre-1970s X Intermediate |  |  | 1.509 |
| 1970s X Salariat |  |  | 1.384 |
| 1970s X Intermediate |  |  | 1.265 |
| Parental class |  |  |  |
| Salariat | $3.856^{* *}$ | 1.812** | $1.771^{* *}$ |
| Intermediate | $2.104^{* * *}$ | $1.564 *$ | $1.541^{*}$ |
| pre-1970s X Salariat | $0.454^{*}$ | 0.521 | $0.449^{+}$ |
| pre-1970s X Intermediate | $0.455^{*}$ | 0.532 | $0.426{ }^{*}$ |
| 1970s X Salariat | 1.618 | 1.367 | 1.298 |
| 1970s X Intermediate | 1.337 | 1.223 | 1.179 |
| Parents' education |  |  |  |
| Tertiary |  | $3.029^{* * *}$ | $2.864^{* * *}$ |
| Secondary |  | $1.631^{*}$ | $1.636{ }^{*}$ |
| pre-1970s X Tertiary |  | 0.966 | 1.128 |
| pre-1970s X Secondary |  | 0.542 | 0.576 |
| 1970s X Tertiary |  | 1.611 | 1.473 |
| 1970s X Secondary |  | 1.176 | 1.084 |
| Parental wealth: |  |  |  |
| House ownership |  | $2.540^{* * *}$ | $2.545^{* * *}$ |
| pre-1970s X House ownership |  | $0.476{ }^{+}$ | $0.40{ }^{*}$ |
| 1970s X House ownership |  | 0.726 | 0.676 |
| Monthly income |  | 1.399** | $1.368^{* *}$ |
| pre-1970s X Monthly income |  | 0.915 | 1.138 |
| 1970s X Monthly income |  | 0.997 | 1.029 |
| Cohorts: (1980s as base) |  |  |  |
| pre-1970s | 0.823 | 3.863 | 0.776 |
| 1970s | 0.738 | 0.946 | 0.753 |
| Controls: |  |  |  |
| Age | 0.990 | 0.994 | 0.998 |
| Age-squared | 1.001 | 1.002 | 1.002 |
| White | $0.480^{* * *}$ | $0.399^{* * *}$ | $0.388^{* * *}$ |
| Wales | 1.075 | 1.044 | 1.091 |
| Scotland | 0.999 | 1.033 | 1.073 |
| Northern Ireland | $1.550^{* *}$ | $1.572^{*}$ | $1.823^{* *}$ |
| UKHLS | $1.932^{* * *}$ | $1.449^{* *}$ | $1.541^{* * *}$ |
| Constant | $-1.262^{* * *}$ | -4.574*** | -4.601*** |
| Observations | 4583 | 4559 | 4242 |
| BIC | 5298.651 | 4986.714 | 4616.386 |
| Notes: Values refer to odd ratios; age is centered within birth cohorts; ${ }^{+} p<0.10,{ }^{*} p<0.05$ ${ }^{* *} p<0.01,{ }^{* * *} p<0.001$. |  |  |  |
| Source: BHPS and UKHLS; gr | ildren aged | 25 and 65 y |  |

A different picture emerges for granddaughters (see Table 5.2). The findings of Model M5-4 report that parental class effects became significantly stronger for the 1980s cohort as compared to the pre-1970s. This result remains significant in the Model M5-6 in which grandparental effects and other parental characteristics are taken into account. I also observe similar significant trends in the change of parental wealth effects: namely, parental wealth was much more important for the 1980 cohorts than for their pre-1970s peers. That is, there seemed to have been some strengthening of parental class and parental wealth effects while comparing the oldest cohort, those who were born before 1970, and the youngest cohort, those who were born in the 1980s. The overall interaction effects also reached statistical significance according to the Wald tests (the average marginal effects of parental class and parental wealth across birth cohorts are reported in Table A5.3, Appendix 5). With respect to grandparental class effects and parental education effects, no significant changes were observed.

The findings of Table 5.1 and Table 5.2 answer the first research question. It would be difficult to view family origin effects as being other than changing over the periods of educational expansions. First, for grandsons and granddaughters alike grandparental class effects appeared to be constant over time. Second, gender differentials were evident in the changes in parental effects. For grandsons, parental education effects may have been weakened between the 1970s cohort and 1980s cohorts, while other parental characteristics did not undergo essential changes. For granddaughters, the contrasts were found between pre-1970s cohort and 1980 cohort: the effects of parental class and parental wealth appeared to be strengthened on the 1980s cohorts.

Due to data limitations, I do not have the intention to suggest that these results provide conclusive evidence of long-term trends in British society. Instead, following Bukodi and Goldthorpe (2013) in decomposing social origins, I tend to suggest that whereas the impacts of family origins on educational attainment may appear to be stronger or weaker over time, family origins measured at the multigenerational levels do not necessarily change in the same direction or share the same pattern.

### 5.4. Finding 2

The foregoing analysis intends to identify temporal changes of grandparental and parental effects as separate social forces; it looks at one component while controlling for the others. What the results indicate seems to be a theoretical discussion supported by a set of statistical tests. The second research question- pertaining to the combined effects of family origins as measured by grandparental and parental characteristics-is raised to understand family origins effects in a way that the social process operates in reality. This question is complicated by nature and I would have to carry out the analyses in a somewhat limited way.

The strategy is first to generate a continuous latent factor variable of parental backgrounds that represent the multi-dimensional parental characteristics. Next, I created a three-level categorical variable representing parental backgrounds based on the tertiles of the continuous latent variable and then combined this categorical variable with the three-fold grandparental class variable to arrive at a single variable that captures the multigenerational family origins.

By so doing, this new variable describes different combinations of family origins, ranging from Type 1 (the most advantaged family) to Type 9 (the least advantaged family) (see Table 5.3). Type 1-3 grandchildren had advantaged parents, and the difference between them lies in grandparental class. Type 1 grandchildren had advantaged grandparents and advantaged parents, and Types 2-3 grandchildren represent the combined family origins of advantaged parents and relatively disadvantaged grandparents. At the bottom of the social spectrum, Type 7-9 grandchildren had the least advantaged parents. Whereas Type 9 refers to the stable disadvantaged family origins that had disadvantaged grandparents and disadvantaged parents, Types 7-8 grandchildren had the relatively advantaged grandparents and disadvantaged parents. At the middle range, Type 4-6 grandchildren represent those born to parents in intermediate positions. By the same logic, the grandparental class defines the differences among these Type 4-6 grandchildren.

Table 5.3 Types of family origins as combined grandparental class and parental background

|  | Type | Grandparental class | Parental background | Column Percentages |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\begin{gathered} \text { pre- } \\ \text { 1970s } \\ \hline \end{gathered}$ | 1970s | 1980s | Total |
| Most advantaged | 1 | 1 | 1 | 4.6 | 9.1 | 13.4 | 10.5 |
|  | 2 | 2 | 1 | 5.0 | 10.9 | 16.4 | 12.7 |
|  | 3 | 3 | 1 | 4.3 | 6.1 | 8.9 | 7.2 |
|  | 4 | 1 | 2 | 4.7 | 6.0 | 6.1 | 5.8 |
|  | 5 | 2 | 2 | 15.6 | 17.1 | 15.0 | 15.8 |
|  | 6 | 3 | 2 | 11.0 | 12.4 | 12.5 | 12.2 |
| $\downarrow$ | 7 | 1 | 3 | 3.9 | 3.2 | 2.4 | 2.9 |
|  | 8 | 2 | 3 | 22.1 | 14.4 | 11.5 | 14.1 |
| Least advantaged | 9 | 3 | 3 | 29.0 | 20.7 | 13.9 | 18.6 |
|  | N |  |  | 911 | 3,001 | 6,105 | 11,485 |

Notes: In the columns of Grandparental class and Parental background, 1 represents the advantaged positions; 2 represents the intermediate positions; 3 represents the least advantaged positions.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

I fit binary logistic regression models on the odds of grandchildren attaining university degree qualifications. To account for potential changes in family origins effects during the higher educational expansion, I incorporate interaction terms between the nine types family origins and grandchildren's birth cohorts. Grandsons and granddaughters are analysed separately. In order to estimate the probabilities of obtaining degree qualifications for each cohort, I have relied on the counter-factual predicted margins method by treating every grandchild in the data as if the grandchild came from a certain type family origin regardless of what his or her family background actually was and leaving all other demographic characteristics as they were. The results of the analyses using the combined family origins are represented in Figure 5.2.

I intend to focus on two aspects in the following discussion. First, I investigate the empirical evidence on the changes over time in inequalities related to family origins. I am interested in the questions of whether the opportunities of grandchildren from relatively disadvantaged family backgrounds have been improved and of whether those from relatively advantaged family backgrounds have maintained their privileged access to higher education. Figure 5.2 provides a detailed description of the changes in the gaps between grandchildren from different family origins over the different phases of the educational expansion. Second and more importantly, I examine the questions of to what extent grandparental class made differences to the chance of attaining higher education for grandchildren born to similar parental backgrounds during the educational expansion. In the following discussion, the terms 'significant/significantly' and 'substantial/substantially' refer to the results
that the differences are statistically significant at the 5 per cent level according to the Wald tests of point estimates ${ }^{30}$.

Comparing those at the top and at the bottom, I find that grandsons of Type 9 combined family origins (i.e., grandsons whose grandparents and parents both were found in disadvantaged positions) had as low as 5 to 12 per cent chances of achieving university degrees during the periods considered, while those of Type 1 grandsons (i.e., those whose parents and grandparents were both found in advantaged positions) had the 46 to 52 per cent chances. While granddaughters appeared to outperform grandsons academically in general, the inequality between the two extremes was even more pronounced for granddaughters than for grandsons. The granddaughters of Type 9 had 12 to 14 per cent chances of access to higher education, as compared to the 69 to 43 per cent chances that those of Type 1 held. Looking into the Type 1-3 and Type 7-9, that is, the group from advantaged parental backgrounds and those from disadvantaged parental backgrounds, I suggest that incorporating grandparental class into the measure of family origins reveals acute social inequalities in access to higher education that would have been concealed if only two-generational associations were considered.

Grandparental effects on the grandsons with the most advantaged parents are observed based on the comparison among the Type 1-3 grandsons. Type 1-3 grandsons were born to advantaged parental backgrounds, but they had grandparents

[^25]in different social classes. Type 1-3 grandsons had highest chances of attaining university qualifications relative to those grandsons of other family types.

Grandparental effects appeared to be stronger on the cohorts who experienced the expansion (i.e., the 1970s cohort and the 1980s cohort). Looking at the 1970s cohorts, I find that Type 3 grandsons of working-class grandparents had a significantly lower chance ( 34 per cent) as compared to Type 1 grandsons of salariat grandparents (44 per cent). For the 1980s cohort, I find the significant difference in the chance of access to degree qualifications between grandsons of salariat grandparents (Type 1, 53 per cent) and those of lower class grandparents (Type 2, 36 per cent; Type 3, 37 per cent). Of the 1980s cohort, having salariat instead of lowclass grandparents significantly increased the chance of acquiring higher education by 17 percentage points ( 53 per cent -36 per cent). Overall, although the growth of the higher education chance for grandsons originating from salariat grandparents was not statistically significant, having salariat grandparents did seem to have provided remarkable advantages during the initial expansion stage and the expansion maturation stage.

Of Type 4-6 grandsons who were born to parents at the intermediate level, grandparental effects were found to be evident among the pre-70s cohort and the 1970s cohort. For Type 4-6 pre-70s cohort grandsons, having salariat grandparents significantly increased the probability of obtaining degree qualifications by 19 percentage points ( 29 per cent -10 per cent) as compared to having working-class grandparents.

Figure 5.2 The predicted marginal effects of family origins on tertiary educational attainment over the cohorts Grandsons:

The pre-70s: pre-
 expansion stage

The 70s: initial expansion stage

The 80s: maturation stage

Legend:
—— Type 1Type 2
Granddaughters:
 Type 3
$\qquad$ Type 4
Type 5
$\square$ Type 6Type 8 - Type 9

Notes: Grandchildren born in the pre-1970s, 1970s, and 1980 are split into 9 family types as showen in the legend. These family types are explained in Table $5 \cdot 3$, with Type 1 being the most advantaged (both parents and grandparents in advantaged positions) and Type 9 being the least advantaged (both parents and grandparents in disadvantaged positions). Each estimate is shown with its $95 \%$ confidence intervals a a vertical spread. Source: BHPS and UKHL; grandchildren aged between 25 and 65 years.

Among Type 4-6 grandsons, Type 6 grandsons of working-class grandparents seemed to be the only group who experienced substantial increases in the chance of achieving higher educational degrees: the chance increased from 14 per cent for the 1960s cohort to 21 per cent for the 1970s cohort. In contrast, Type 4 grandsons displayed no essential change over time. Despite the increase for Type 6 grandsons of working-class grandparents, their chance of access to higher education for the 1980s cohort (18 per cent) was still lower than that for Type 4 grandsons of salariat grandparents ( 25 per cent) in the same cohort.

All of the grandsons originating from disadvantaged parental backgrounds (Type 7-9) showed increasing trends in access to higher education during the educational expansion. Type 7 and Type 9 grandsons who had disadvantaged parents appeared not to gain much in the initial stage of educational expansion, and their trend of growth occurred at the post-expansion stage (i.e., comparing the 1970s cohort and the 1980s cohort). For example, of the Type 9 grandsons, the chance rose from only 4 per cent for the pre1970s cohort to 6 per cent for the 1970s cohort and then to 12 per cent for the 1980s cohort. Although these grandsons experienced some increases in the chance of attaining higher education, they were still at the bottom of higher education competition.

Having grandparents of different classes seemed to provide rather limited advantages for the higher educational chance of grandsons with disadvantaged parents. The chance of access to higher education for grandsons of salariat grandparents (Type 7) was not shown to be significantly higher than grandsons of other class grandparents (Type 8 and Type 9).

The stories are somewhat different for granddaughters. Looking at Type 1-3 granddaughters who had advantaged parental backgrounds, I find that granddaughters of salariat class grandparents (i.e., Type 1) were the only group who experienced substantial increases in the chance of attaining tertiary education. The chance for the 1960s cohort was 42 per cent, and then it sharply rose to as high as 68 per cent for the 1970s cohort and settled down to 56 per cent for the 1980s cohort. For granddaughters who had advantaged parents but low-class grandparents (Type 2 and Type 3), the chances were also improved; in particular, of granddaughters of working-class grandparents (Type 3), the chance rose by 14 percentage points from 26 per cent to 40 per cent. The improvements, however, did not reach statistical significance.

The differences in the educational chance among Type 1-3 1960s cohort granddaughters did not reach statistical significance at the 5 per cent level, indicating that grandparental effects might work to a very limited extent for granddaughters born to advantaged parents before the expansion. However, grandparental class certainly played an important role during the initial phase of the educational expansion and its maturation. Of the 1970s cohort, Type 1 granddaughters of salariat grandparents are estimated to have a 68 per cent chance of attaining degree qualifications, as compared to the 40 per cent chance of Type 3 granddaughters of working-class grandparents. That is, for the 1970s cohort granddaughters originating from advantaged parental backgrounds, having salariat grandparents significantly increased the chance by 28 percentage points as compared with having working-class grandparents. Among the 1980s cohort who experienced the post-expansion stage, the difference between having salariat
grandparents and having working-class grandparents remained to be significant, although it was reduced to 17 percentage points.

Similar patterns emerged among granddaughters originating from intermediate-level parents. As the chances of attaining degree qualifications have significantly improved for Type 4-6 granddaughters during the initial expansion stage, the effects of grandparental class appeared to be evident. The chance of granddaughters of salariat grandparents (Type 4) substantially increased by 32 percentage points ( 39 per cent -7 per cent), as compared to 16 percentage points for granddaughters of lower class grandparents ( 33 per cent - 17 per cent for those of intermediate class grandparents; 29 per cent - 13 per cent for those of working-class grandparents). Despite the remarkable increase for the 1970s Type 6 granddaughter of working-class grandparents, their chance was still significantly lower by 10 percentage points ( 39 per cent -29 per cent) than Type 4 granddaughters of salariat grandparents. However, the differences among granddaughters of different class grandparents diminished at the post-expansion stage.

For granddaughters originating from disadvantaged parents, the chances of access to higher education seemed to remain unchanged over time. no essential improvement in Type 7-9 granddaughters was observed, regardless of their grandparental class. This is to suggest, first, that granddaughters born to disadvantaged parents seemed not to benefit from the educational expansion, and second, that grandparental class may not have much impact on the education chances.

What can one learn from these findings? First, and most obviously, the attainment of higher educational qualification has risen remarkably during the decades captured by
the three cohorts. At first glance, the educational expansion appeared to favour grandsons from disadvantaged families. Type 7 and Type 9 grandsons originating from disadvantaged parents experienced significant growths in the educational chances. As compared to the 1960s cohort Type 7 and Type 9 grandsons, the 1980s cohort's chance of obtaining higher education has more than doubled.

However, it must be noted that the improvement for grandchildren at the bottom of social stratification is by no mean to suggest that educational expansion that occurred during the 1990s led to the narrowing of inequalities in the higher education opportunity. Instead, the findings so far have led me to argue that as compared to the pre-expansion period, inequalities driven by multigenerational family origins have become acute since the 1990s educational expansion. The reason behind this seemingly counter-intuitive argument is that despite the trend that the chance appeared to be accessible for grandchildren originated from disadvantaged parents, it was those from advantaged families who took up the most of the gains that the expansion afforded; at the same time, comparing the pre- and after- expansion cohorts, the gap between those from the top and those from the bottom did not show the evidence of narrowing.

For the other types of grandsons whose parental backgrounds were more advantaged, either the chance appeared to be fairly stable over time (such as for Type 3, Type 4 and Type 5) or the improvement did not reach the statistically significant level (such as for Type 1, Type 2, Type 6 and Type 7). With respect of granddaughters, the improvement was more widespread than that for grandsons, in a sense that the groups who significantly benefited from the expansion were more diverse. Comparing between the old cohort and young cohorts, I find that achievement of higher education has become
significantly more common to the Type 1 at the top and Type 4-6 at the middle range. Some improvement was also seen between Type 3 and Type 8 granddaughters, but not to a statistically significant extent.

While comparing the two groups at the top and the bottom of the spectrum of family origins (Type 1 and Type 9), I did not find the evidence that the educational expansion narrowed the gap. For grandsons, the gap seemed to be stable throughout the educational expansion, whereas for granddaughters, the gap has substantially widened. Of the 1960s cohort grandsons, there was a gap of 39 percentage points in the chance of acquiring university degrees between those whose grandparents and parents both were in the most advantaged positions (Type 1, 43 per cent) and those whose grandparents and parents both were in the least advantaged positions (Type 9, 4 per cent). The gap appeared to be essentially unchanged for the 1970s cohort (38 percentage points) and 1980s cohort (41 percentage points). Regarding the 1960s cohort granddaughters, the divide was 32 percentage points between the top and the bottom groups. The gap has then substantially grown to 57 percentage points for the 1970s cohort and then narrowed to 42 percentage points for the 1980s cohort. Despite the narrowing, the gap in the 1980s cohort at the expansion maturation stage was still larger than that in the 1960s cohort at the pre-expansion stage.

### 5.5 Discussion and Conclusion

As the government aimed at moving the higher education from an elite system to a mass system (Wyness, 2010) and implemented a series of policies related to education in the 1990s, the number of higher education students has grown massively. Individuals from disadvantaged family backgrounds might be more likely to pursue higher qualifications than before, partly in response to the demand for highly skilled workforce in the labour market, as well as the grants and loans provided for poor students (i.e., students whose parents' earnings were below the median) (Blanden and Machin, 2004; Wyness, 2010). This chapter explored the changes in influences of grandparental and parental social origins on higher educational attainment over the decades captured by three cohorts. The data used in this chapter contain three cohorts: the 1960s cohort who experienced the pre-expansion period, the 1970s cohort who experienced the initial expansion stage, and the 1980s cohort who experienced the expansion maturation stage. Based on the evidence, it would be difficult for one to say that the educational expansion, in and of itself, necessarily lead to the reduction of inequalities in access to higher education and the promotion of social mobility. My findings are in line with previous studies (e.g., Blanden and Machin, 2004; Boliver, 2011), in that students from advantaged families have disproportionately benefited from the expansion and educational inequalities have been maximally maintained.

I ran a series of binary logistic regression models on the chance of obtaining degree qualifications and added the interaction between the birth cohorts and family origins. The results showed clear gender differentials in the changes of family origin effects over time. For grandsons, the effect of parental education seemed to be particularly strong on the 1970s cohort who experienced the initial stage of education expansion as
compared with the other cohorts. In contrast to grandsons, whereas parental education effects on granddaughters' education remained essentially unchanged over time, the size of effects of parental class and parental wealth appeared to be greater on the 1980s cohorts as compared to the 1960s cohort. Grandparental effects were found to be constant for grandsons and granddaughters alike. However, as I discussed earlier, because of the nature of the dataset, the results should not be taken as conclusive empirical evidence of the trends of social mobility over time in its strict sense; rather it indicates that the multigenerational components of family origins, as shown in grandparental effects and parental effects, have their own features and may not follow the same patterns of persistence or change over time.

Using the predicted margin method, I calculated the chance of acquiring university degrees by treating each grandchild as though he or she originated from a specific family type regardless of the actual family backgrounds and leaving all other characteristics as they were. The findings suggest that since higher education expanded, the inequalities driven by family origins may have widened or remained stable, but they were by no mean reduced.

The theory of Maximally Maintained Inequality (Raftery and Hout, 1993) assumes that the barriers of family origins in education are unlikely to be removed automatically by the expansion and that the weakening of the inequalities in educational attainment occurred only when the admission of favourable educational qualifications among the advantaged group reaches a 'saturation point' (Boliver, 2011, p.236), that is, when the demand of the advantaged group for higher education is satisfied. The foregoing analyses of the second research question indicated that the gain from the upgrading of
higher education was shared far from equally between grandchildren from different family origins. Whereas the chance of grandchildren from disadvantaged backgrounds achieving higher education has been improved, the extent of improvement appeared to be much lower than that to which those in advantaged group benefited from the educational expansion.

How do grandparental effects contribute to the understanding of the Maximally Maintained Inequality thesis? From a three-generational perspective, the findings suggest a picture which is more complicated than the theory. A few points can be argued here.

First, the saturation point was manifested in the success in the higher education of Type 1 granddaughters, that is, the granddaughters from the most advantaged families in which both grandparents and parents were found in privileged positions. In comparison, although other types of granddaughters and grandsons displayed trends of increase, these trends were far less remarkable than what is found in Type 1 granddaughters. In other words, the granddaughters who secured most of the benefits that the expansion provided did not just have advantaged parents but also had deep-rooted advantaged family backgrounds which have been stable for generations. In this regard, it is clear that having salariat grandparents reinforces the favourable position of granddaughters from advantaged parental backgrounds. As discussed in the previous chapter, grandparental effects operate to its maximum for the grandchildren originating from advantaged parents.

Second, in terms of grandchildren originating from disadvantaged parents, lack of advantaged grandparents did not seem to be further damaging on their chance, as shown in the result that the younger cohort grandsons at the bottom position had a better chance of attaining tertiary education than their peers in the old cohort. In particular, unlike for the advantaged grandchildren, the educational opportunities that the disadvantaged grandson (Type 7 and Type 9) experienced were not improved at the initial stage of the expansion; instead, but at the maturation stage of expansion. This trend partially confirms the assumption that after the demand of the advantaged group for desirable educational qualifications was satisfied, the disadvantaged group would be given chances to fill in the positions that the expansion offered. The effects of the expansion on reducing inequalities in education operate like a queue (Hout, 2007), where its initial stage benefits the most the advantaged families who stand at the front of the queue, and then the benefits flow down the social stratification.

The granddaughters' side of the story is different from what happened to grandsons. For disadvantaged granddaughters, regardless of their grandparental classes, the chance of obtaining university degrees remained largely unchanged during the expansion. In other words, the improvement of educational opportunities occurred only to disadvantaged grandsons but not to disadvantaged granddaughters. Without looking into details of gender differentials, it would be dangerous for the researchers and policy-makers to assume that the educational expansion had improved opportunities of higher education for individuals originating from disadvantaged backgrounds.

To correctly understand educational inequalities, I combine the pictures of gender differentials and of inequalities related to family origins. At first glance, one may be
tempted to arrive at a conclusion that women reaped most of the benefit of the 1990s educational expansion because a good proportion of granddaughters experienced substantial increases in terms of access to degree qualifications. Yet I found that these granddaughters were more likely to come from advantaged and intermediate-level family backgrounds and that those granddaughters whose chances stayed unchanged were more likely to come from disadvantaged families. This is also reflected in Section 5.3; parental class and parental wealth seemed to have become more important for the 1980s cohort who experienced the expansion maturation stage than they were for the 1960s cohort who experienced the pre-expansion period. Meanwhile, whereas gender gaps in education have been greatly improved, inequalities by family origins appeared to have deteriorated. Without undermining the importance of gender gaps, I suggest that researchers and policy-makers need to move beyond analysing inequality in relation to single categories and adopt a perspective of simultaneous interaction between different aspects of social characteristics. Focusing on only gender differences would have concealed the inequalities regarding family origins.

The incorporation of grandparental effects into models develops the thesis of Maximally Maintained Inequalities in education by extending the inequalities over three generations. That is, three-generational models further improve the understanding of the association between family origins and educational equalisation by (1) differentiating the positions of grandchildren from the similar parental backgrounds (2) redefining the advantaged group who reached the 'saturation' point. If one says that parental backgrounds cast a shadow of family origins on individuals' educational attainment, the account of multigenerational family origins then makes the shadow even longer. The

1990s educational expansion was initiated aiming at the equalisation of educational opportunity; however, with the long shadow of family origins, the improvement of educational inequality did not appear to be a simple linear process. It would not be fair to say that individuals at the bottom of social stratification were rejected by educational expansion. However, the 1990s educational expansion has occurred in a way that did not bring out immediate equalisation.

## Chapter 6 Grandparental Effects on Class Attainment

### 6.1 Introduction

This chapter discusses the questions of how the grandparental class was associated with grandchildren's class outcomes. Grandparental class, as demonstrated in previous chapters, played an important role in determining grandchildren's education. This chapter focuses on grandparental effects on class attainment before and after education is taken into account. Education is regarded as the ticket out of poverty and into affluence. However, numerous studies on two-generational mobilities have found that after controlling for education, parental backgrounds still hold significant impacts on their offspring's class mobility. That is, individuals originating from socially advantaged parents have a better chance of obtaining higher positions in social stratification as compared with their counterparts from less-advantaged parental backgrounds even though they have achieved similar educational qualifications. These studies have intensively tested the topic, but they are limited to two-generational associations. A few studies seeking to examine empirically three-generational class mobility reported a positive association between grandparental class and grandchildren's class independent of parental characteristics (e.g., Beck, 1983; Chan and Boliver, 2013; Erola and Moisio, 2007; Hertel and Groh-Samberg, 2014). However, none of them took into account grandchildren's education, which will be incorporated in this chapter.

This chapter draws on data from the British Household Panel Survey (BHPS) and the UK Household Longitudinal Study (UKHLS). This chapter is largely akin to previous chapters regarding measurement and research methods.

### 6.1.1 Core findings

This chapter will contribute to the understanding of the impacts of grandparental class on grandchildren's class attainment. Previous chapters have provided evidence on the influences of grandparental class on grandchildren's education independent of grandchildren's parental resources. This chapter will focus on the independent effects of grandparental class on grandchildren's class attainment with and without grandchildren's own educational achievements being controlled for. Research on parent-child mobility has been extensively documented that while education greatly mediates the influences of parental resources on children's class destination, children from different class origins have unequal chances of career success even when they have similar educational qualifications. I am interested in the questions of whether the grandparental class has direct impacts on grandchildren's social class and of whether grandparental class still makes a significant difference to grandchildren's chance of class attainment after education has been controlled for.

1. Does grandparental class have significant impacts on grandchildren's class attainment independent of the effects of parental resources? Do the results change after having controlled for grandchildren's education?

Research has reported substantial gender differentials in parent-child class mobility patterns (e.g., Breen, 2004; Devine and Li, 2013). The question then arises as to whether grandparents-grandchild associations also display gender differences. This chapter explores the potential gender differentials in direct associations between grandparental class and grandchildren's class. I conduct analyses for grandsons and granddaughters separately. An important reason for so doing is that men and women have different career development. Women have now caught up with men in gaining access to the salariat occupation, but they are still lagging behind men in top-level salariat positions (Heath, 2018). Women are more likely than men to take intermediate positions and less likely to be in small employer and lower supervisory and technical occupations.

- Do these impacts of grandparental class and parental characteristics differ between grandsons and granddaughters?

The grandparental class will be observed to have significant associations with grandchildren's social class independent of parental characteristics. When I take grandchildren's education into account, the findings will show that the direct effects of grandparental class were greatly mediated by its effects on grandchildren's education. For grandsons, maternal grandparental class continued to be significant even after grandsons' education has been controlled for. While granddaughters' education is closely associated with grandparental class, the impact of grandparental class on granddaughters' social class will be found to be insignificant after granddaughters' education is taken into consideration. The effects of grandparental class on education
fully mediated the direct association between grandparental class and granddaughters' class

With respect to the impacts of parental characteristics on grandchildren's class attainment, the chapter will find that both grandsons and granddaughters benefited from parental wealth despite taking credentials into account. Father class will also be found important to grandsons' success in the labour market.

In addition, the evidence will show that self-employed grandparents have a strong impact on grandsons' likelihood of engagement in self-employment, a pattern that holds true even when parents are not self-employed.

### 6.1.2 Chapter structure

Section 6.2 briefly reports the preliminary results of log-linear models after discussing the reasons for why log-linear modelling is statistically limited in addressing threegenerational mobility and. Section 6.3 reports the results of ordinal logistic regression models on grandchildren's class attainment. Section 6.4 reports the construction of pathway analysis and its results. Finally, Section 6.5 summarises the main findings of the chapter.

### 6.2 Finding 1: Log-linear modelling

The application of different statistical methods has long been the subject of intensive debates in research on inequalities of opportunities (e.g., Breen and Goldthorpe, 1999; Bukodi and Goldthorpe 2013), and the research in this area has tended to be 'notoriously technical' (Breen and Jonsson, 2005, p.234). In Chapter 2 Data and Methods, I explained why log-linear modelling, which is widely used in social mobility research, may not be the most appropriate method for examining three-generational mobility and why I choose ordinal logistic regression model over log-linear models as the primary research method. I will briefly report the results of log-linear modelling and suggest that these model results should be treated with caution due to the limitations of log-linear models.

Since log-linear modelling does not allow for the introduction of grandchildren's age as a continuous variable, analyses are confined to the grandchildren over 30 in an effort to control for age effects on their class attainment. The analyses are separated by gender and survey sources, and as a result, the sizes of samples used for each analysis are reduced dramatically. I first attempted to use the five-class version of NS-SEC scheme, and it created a number of empty cells that may become problematic in the log-linear analysis. For the BHPS, a relatively small number of empty cells are present (4 for grandsons, 10 for granddaughters), and a small constant such as $1 / 2$ is added to each cell. For UKHLS, the number of empty cells appears to be far from negligible. With the fiveclass version of NS-SEC, the contingency tables with the data from the UKHLS contain

7 empty cells for grandsons and 21 for granddaughters. The method of adding constants to each cell in this case would smoothen the model results too much and give unrealistic model fit indexes (Agresti and Kateri, 2011), in particular for granddaughters. As a result, I have to collapse class measure into three categories for the data drawn from the UKHLS, and no empty cell is found with the 3-class version of NS-SEC. The analyses are therefore based on three-way mobility contingency tables of grandparents' class, parents' class and grandchildren's class with 125 cells for BHPS data (as the application of the five-class version of NS-SEC produced a $5 \times 5 \times 5$ cross-tabulation table) and 27 cells for the UKHLS data (as the application of the three-class version of NS-SEC produced a $3 \times 3 \times 3$ cross-tabulation table).

In order to evaluate and compare the models that suggest different mobility patterns, I provide a range of model fit statistics. The model fit is assessed using the deviance of contingency tables ( $\mathrm{G}^{2}$, also referred to as likelihood ratio values) and chi-squared tests. The index of $\mathrm{rG}^{2}$ estimates the difference in the $\mathrm{G}^{2}$ between the full association model and the baseline conditional independence model. The closer the number comes to 100 , the more the deviance is reduced, and the better the model fits the data. If the test result is statistically significant ( $\mathrm{p}<0.05$ ), the model would be estimated as a poor model fit, and there may be some associations that have explanatory power but are omitted from the model. For example, if for a conditional independent model that assumes only adjacent two-generational mobilities the p-value is smaller than 0.05 , the model reaches a poor fit, which may suggest the significance of the effects of grandparental class. Alternatively, if the p-value of the conditional independence model is shown larger than 0.05 indicating a good model fit, one may say that social mobility can be explained in a
two-generational process and there is no need to introduce grandparental effects. The Dissimilarity Index (DI), which measures the percentage of the cases misclassified, and Bayesian Information Criterion (BIC) are also provided. These two indexes favour the models with the lower values.

Table 6.1 reports summary statistics of the log-linear models estimated for grandsons and granddaughters with the data drawn on from BHPS and the UKHLS. The conditional independence models assume that family origin effects operate only over the adjacent two-generational associations and that grandparents have no direct impacts on grandchildren. They do not fit the observed data well ( $\mathrm{p}<0.05$ ) with the exception of the sample of granddaughters from the UKHLS data. This provides empirical grounds on rejecting the hypothesis of the nonexistence of net grandparental effects, suggesting that mobility processes that occur between adjacent two generations do not adequately account for the three-generational mobility experiences.

The full association models incorporate the skipped-generational association between grandparents and grandchildren, implying that there are three mobility processes that affect grandchildren's class attainment: the adjacent-generational associations between grandparents and parents, the adjacent-generational between parents and grandchildren, and the direct association between grandparents and grandchildren. As indicated by the p-values of the full association models with the BHPS data, the models are shown to fit the data rather well.

Table 6.1 Model fit statistics of conditional independence and full association models using log-linear method for grandsons and granddaughters

BHPS (five-class)

| Model | N | df | $\mathrm{X}^{2}$ | p | $\mathrm{G}^{2}$ | $\mathrm{rG}^{2}$ | BIC | DI |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |  |
| Grandsons | 1787 | 80 | 109.2 | 0.02 | 110.4 | 0.0 | -488.6 | 9.8 |
| Cond. indep. | 1787 | 64 | 58.4 | 0.67 | 58.4 | 47.1 | -420.8 | 6.5 |
| Full association |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Granddaughters | 1453 | 80 | 112.1 | 0.01 | 111.4 | 0.0 | -471.1 | 10.3 |
| Cond. indep. | 1453 | 64 | 65.7 | 0.42 | 67.3 | 39.6 | -398.7 | 6.6 |
| Full association |  |  |  |  |  |  |  |  |

## UKHLS (three-class)

| Model | N | df | $\mathrm{X}^{2}$ | p | $\mathrm{G}^{2}$ | $\mathrm{rG}^{2}$ | BIC | DI |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |  |
| Grandsons | 994 | 12 | 32.9 | 0.00 | 33.0 | 0.0 | -49.8 | 6.4 |
| Cond. indep. | 994 | 8 | 17.4 | 0.03 | 17.0 | 48.5 | -38.2 | 4.0 |
| Full association |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Granddaughters | 647 | 12 | 13 | 0.37 | 12.8 | 0.0 | -64.9 | 5.4 |
| Cond. indep. <br> Full association | 647 | 8 | 7.1 | 0.52 | 7.0 | 45.4 | -44.8 | 3.4 |

Notes:
Cond.indep.: Conditional independence model that considers only adjacent two-generational associations between grandparents and parents and between parents and grandchild.
Full association: Full association model that considers adjacent two-generational associations and the skipped-generational associations between grandparents and grandchild.
Source: Grandchildren aged between 30 and 65 years

Since the conditional independence models and full association models are nested, I am able to compare the model fit using likelihood ratio test. The results suggest that with the exception of the granddaughters' sample drawn from the UKHLS, the introduction of the net grandparental effects significantly improves the model fit to the data. The Dissimilarity Indexes and BIC are also reduced to varying degrees. Overall, the model fit indexes indicate (1) that the associations between grandparents' class and
grandchildren's class mobility outcomes may exist net of parental class, (2) that there is no need to introduce three-way interactions among grandparents, parents and grandchildren to reach an acceptable model fit.

### 6.3 Finding 2: Ordinal logistic regression

Table 6.2 reports the results of ordinal logistic regressions on grandchildren's social class measured by the five-level NS-SEC scheme. These models have controlled for grandchildren's age, age-squared, birth cohorts, race, residential regions, and survey sources (see details of control variables and cut points in Appendix Table A6.1). As grandchildren's age has been controlled for, I include only grandchildren over the age of 25 (with a mean of 32$)^{31}$. Grandchildren's educational qualifications, which were used as the outcome variable in previous models, now are introduced as explanatory variables.

To begin with, I will give a brief note on control variables. The occupational structure has upgraded substantially with more room at the top (Erikson and Goldthorpe, 1992; Goldthorpe, 1987), and this also clearly shown in the data in that the younger cohorts, particularly men, were more likely to gain advantaged class positions. Ethnic minority

[^26]groups are found to fare worse than British white in the labour market. Owing to the uneven socioeconomic development, people in Wales and Northern Ireland had lower class positions than their counterparts in England.

The Models M6-1 and M6-4 report the results of the models that partially imitate the procedure of log-linear models (see Table 6.2). These two models take only grandparental class and parental class into account and take grandchildren's class as the dependent variable with control variables. The result shows that both the influences of the grandparental and parental class were significant on grandchildren's class, suggesting that the significant association between grandparental class and grandchildren's class existed independent of parental class.

The Models M6-2 and M6-5 introduce parental educational qualifications and parental wealth. Although the strength of grandparental effects was greatly reduced due to the inclusion of parental characteristics, grandparental effects maintained their statistical significance for both grandsons and granddaughters. Grandchildren with salariat grandparents had markedly high class positions, with odds being around 1.44 times for grandsons and 1.24 times for granddaughters as compared to those of working-class grandparents. The newly added parental characteristics were significantly related to grandchildren's class. It would be unsurprising to see high class positions held by grandchildren from advantaged homes with highly educated parents situated in high class positions and living in the owner-occupied house, but the crucial point is that, even with all these factors taken into account, having salariat grandparents had significant influences on adult grandchildren's class.

In Table 6.2, the coefficient reductions that reach the statistical significance at the level of 5 per cent are in bold. The reductions of the parental class are found to be statistically significant for both grandsons and granddaughters. These changes confirm the assumptions that the log-linear models on three-generational mobility that uses parental class as the only indicator of parental resources failed to estimate the effects of parental resources and grandparental resources accurately. As a result, both the estimated effect of grandparental class and that of parental class in log-linear models may have picked up to varying extents the effects of unobserved parental resources. These models thus may have overestimated both grandparental class effects and parental class effects and underestimated the effects of family origin resources as a whole.

I now turn to grandparental effects after controlling for grandchildren's own education (see Models M6-3 and M6-6 in Table 6.2). For grandsons, the benefit of having advantaged grandparents has dropped by nearly one third. However, the contrast between having salariat grandparents and having working-class grandparents continued to exert a significant influence on grandsons' class attainment. The overall effects of the grandparental class were also statistically significant. In the case of granddaughters, the extent of the reduction of grandparental effects was larger. Without considering the educational qualifications granddaughters achieved, grandparental class effects are found to have relatively strong effects on their granddaughters' class outcomes; once granddaughters' own educational qualifications are added, however, grandparental effects did not contribute substantial differences in influencing granddaughters' class attainment anymore. For both grandsons and granddaughters, the strength of grandparental class effects became weaker than that of parental class effects. The
changes in the strength of grandparents-grandchild associations due to the introduction of education imply that grandparents may channel their main effects through their influences on grandchildren's education.

Regarding grandchildren's educations (see the models M6-3 and M6-6), it is evident that grandchildren's educational qualifications had strong influences on their class attainment. It appears to be of dominant importance in determining grandchildren's class positions. Nevertheless, parents' social class, education, and economic resources are shown to retain their significant influences.

Table 6.2 Ordinal logistic regressions predicting grandchildren's class attainments

|  | Grandsons |  |  | Granddaughters |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | M6-1 | M6-2 | M6-3 | M6-4 | M6-5 | M6-6 |
| Grandchildren's Education: |  |  |  |  |  |  |
| Degree |  |  | $12.264^{* * *}$ |  |  | $12.914^{* * *}$ |
| Sub-degree |  |  | $5.109^{* * *}$ |  |  | 4.836*** |
| A-level |  |  | $3.540^{* * *}$ |  |  | $3.281^{* * *}$ |
| GCSE or O-level |  |  | $2.044^{* * *}$ |  |  | $2.196^{* * *}$ |
| Grandparents: |  |  |  |  |  |  |
| Salariat | $1.687^{* * *}$ | $1.444^{* * *}$ | $1.258^{* *}$ | $1.421^{* * *}$ | 1.236* | 1.041 |
| Intermediate occupations | $1.244^{*}$ | 1.151 | 1.095 | $1.242^{+}$ | 1.136 | 1.055 |
| Small employers | 1.100 | 1.059 | 0.998 | $1.453 * * *$ | 1.315** | 1.101 |
| Lower supervisor and technician | 1.226* | $1.148{ }^{+}$ | 1.103 | 1.248* | 1.156 | 1.042 |
| Parental class: |  |  |  |  |  |  |
| Salariat | 2.846*** | 1.788*** | $1.608^{* * *}$ | $2.699^{* * *}$ | 1.636*** | 1.406** |
| Intermediate occupations | $2.075^{* * *}$ | 1.536*** | $1.374 * *$ | 2.052*** | 1.471** | $1.312^{+}$ |
| Small employers | $1.691^{* * *}$ | 1.420** | $1.525^{* * *}$ | 1.473 ** | 1.213 | 1.209 |
| Lower supervisor and technician | 1.290* | 1.090 | 1.049 | $1.487^{* *}$ | 1.265 | 1.203 |
| Parental education |  |  |  |  |  |  |
| Degree |  | $2.047^{* * *}$ | 1.182 |  | $1.799^{* * *}$ | 1.161 |
| Sub-degree |  | $1.631^{* * *}$ | 1.157 |  | $1.676^{* * *}$ | $1.308^{+}$ |
| A-level |  | $1.561 * * *$ | $1.260^{*}$ |  | $1.579^{* * *}$ | $1.330{ }^{*}$ |
| GCSE or O-level |  | $1.363 * *$ | 1.146 |  | $1.560 * * *$ | $1.472^{* *}$ |
| Parents' economic: |  |  |  |  |  |  |
| House ownership |  | $1.491^{* * *}$ | 1.238** |  | $1.609^{* * *}$ | $1.297^{*}$ |
| Monthly income |  | $1.293^{* * *}$ | $1.236 * *$ |  | $1.571^{* * *}$ | $1.447^{* * *}$ |
| Observations | 4915 | 4915 | 4915 | 4039 | 4039 | 4039 |

### 6.3.1 Specific class effects in small employers

Through additional analyses, I find a direct association between grandparental class and grandsons working as small employers. It may partially explain the findings that grandparents still had some significant influences on grandsons' class attainment even after education was being controlled and that these grandparental influences were not found in the case of granddaughters. Distinctive inheritance pattern within small-employer class has been well documented in the twogenerational mobility research (e.g., Bukodi and Goldthorpe 2013; Erikson and Goldthorpe, 1992; Goldthorpe 1982). Sons of small-employer class parents are often expected to take over family business; in contrast, daughters are rarely placed in the same position and tend to move away from their family origins. The similar tendencies are also observed in the grandparents-grandchild associations.

I conduct logistic regression model on a binary indicator of taking small employer as an occupation with the same focal explanatory variables that were used in the previous analyses (see Table 6.3). Grandsons of small employer grandparents were significantly more like than those of other class grandparents to work as small employers. In line with the results of the ordinal logistic models on class attainment, grandsons' education was also a strong factor affecting the status of working as small employers. Unsurprisingly, having small employer parents had salient impacts on the chance of grandsons being found in the same position. In order to further test the grandparents-grandchild associations in relation to the small employer status, I rerun the same model but include only the grandsons who did not have small employer parents. The results confirm the inheritance of the status of small employer from grandparents to grandsons. Even without small employer parents, having selfemployed grandparents would still increase grandsons' chance of self-employment
with a probability of around 61 per cent higher than that for someone with grandparents in working-class positions. In other words, grandsons of small employer grandparents may be devised to enter small employer business even though they did not inherit these occupations directly from their parents. This is a remarkable effect. Although the data did not allow for details of small self-employer status and one could not get to know if grandparents and their offspring worked in the same or related categories, this finding provides strong evidence of a skippedgeneration pattern of small employer inheritance.

These associations are not found among granddaughters. Neither having smallemployer parents nor having small-employer grandparents is shown to be related to the probability of granddaughters working as small employers.

Table 6.3 Logistic regressions predicting the probability of being small employer

|  | Grandsons |  |  | Granddaughters |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | M6-7 | M6-8 | M6-8 | M6-9 | M6-10 | M6-11 |
| Education |  |  |  |  |  |  |
| Degree |  | $0.436 * *$ | $0.445^{* *}$ |  | 0.722 | 0.864 |
| Other higher degree |  | $0.534^{+}$ | $0.535^{+}$ |  | 1.058 | 1.243 |
| A-level |  | 1.549* | 1.663* |  | 0.932 | 1.037 |
| GCSE or O-level |  | 1.349 | 1.353 |  | 1.305 | 1.451 |
| Grandparental Class |  |  |  |  |  |  |
| Salariat | 0.997 | 1.050 | 1.061 | 1.044 | 1.072 | 1.096 |
| Intermediate occupations | 1.066 | 1.093 | 1.125 | 0.942 | 0.924 | 0.902 |
| Small employers | $1.573^{* * *}$ | $1.609^{* * *}$ | $1.540^{* *}$ | 1.180 | 1.226 | 1.201 |
| Lo supervisor \& technician | 0.969 | 0.951 | 0.981 | 0.813 | 0.820 | 0.828 |
| Parental Class |  |  |  |  |  |  |
| Salariat | 1.242 | 1.332 | 1.532* | 1.387 | 1.476 | 1.500 |
| Intermediate occupations | 1.574* | 1.638** | $1.812^{* *}$ | 1.061 | 1.124 | 1.112 |
| Small employers | $2.782^{* * *}$ | $2.856^{* * *}$ |  | 1.522 | 1.554 |  |
| Lo supervisor \& technician | 0.818 | 0.817 | 0.868 | 0.504 | 0.528 | 0.547 |
| Parental education |  |  |  |  |  |  |
| Degree | 0.709 | 0.868 | $0.629^{+}$ | 0.402* | $0.465^{+}$ | 0.406* |
| Other higher degree | $0.549^{* *}$ | $0.612^{+}$ | $0.537^{*}$ | 1.093 | 1.199 | 1.200 |
| A-level | 0.773 | 0.785 | 0.596 | 1.365 | 1.444 | 1.262 |
| GCSE or O-level | 0.816 | 0.820 | $0.662^{*}$ | 0.745 | 0.758 | 0.817 |
| Economic resources |  |  |  |  |  |  |
| House ownership (Yes) | 1.291 | 1.304 | 1.318 | 1.101 | 1.154 | 1.224 |
| Monthly income | 0.900 | 0.927 | 0.852 | 0.800 | 0.812 | 0.782 |
| Controls |  |  |  |  |  |  |
| Age | $1.036{ }^{*}$ | 1.038** | 1.025 | 1.022 | 1.023 | 1.026 |
| Age squared | $0.996^{*}$ | $0.996^{+}$ | $0.997{ }^{+}$ | 0.998 | 0.999 | 1.000 |
| Cohorts |  |  |  |  |  |  |
| 1970s | 1.050 | 1.054 | 1.072 | $0.515^{*}$ | $0.536{ }^{*}$ | 0.688 |
| 1980s | 0.829 | 0.816 | 0.933 | 0.482 | 0.498* | 0.502 |
| White | 1.102 | 0.828 | 0.740 | $3.205^{*}$ | $2.926{ }^{*}$ | $2.338^{+}$ |
|  |  |  |  |  |  |  |
| Wales | $1.657^{* *}$ | 1.599* | $1.552^{*}$ | 0.564 | 0.564 | 0.508 |
| Scotland | 1.016 | 1.051 | 1.136 | 0.806 | 0.840 | 0.983 |
| Northern Ireland | $2.127^{* * *}$ | $2.257^{* * *}$ | $2.271^{* * *}$ | 0.890 | 0.953 | 1.227 |
| UKHLS | 1.065 | 1.041 | 1.089 | 1.208 | 1.260 | 1.470 |
| Constant | $0.176{ }^{*}$ | $0.156^{*}$ | $0.311^{*}$ | 0.161 | 0.135 | 0.144 |
| Observations | 4915 | 4915 | 4360 | 4039 | 4039 | 3541 |

Notes: The lowest levels used as reference categories ; age is centred within birth cohorts;
figures refer to odds ratios; ${ }^{+} p<0.10,{ }^{*} p<0.05,{ }^{* *} p<0.01,{ }^{* * *} p<0.001$
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

### 6.4 Finding 3: Path analysis

### 6.4.1 Variables and path setting

The path analysis models are fitted on the key variables which have been used in previous analyses: grandchildren's NS-SEC class and educational qualification, paternal and maternal grandparents' NS-SEC class, father's and mother's NS-SEC class, father's and mother's educational qualification, household monthly income and property ownership. Grandchildren's birth cohorts, centred age, centred-agesquared, race, regions, and data sources enter the model as control variables. The analysis is constrained to the sample of grandchildren between 25 and 68 and excluded those who were born earlier than 1950. Following the default setting of Mplus, I estimate the model using all available data. I compared the model results with those using listwise deletion (i.e., if an observation of a grandchild has missing values on any of the variables used in the analysis, the observation would be excluded from the model) and found no essential differences regarding estimated coefficients or model fit.

The recursive structural models are constructed according to the hypothesised orders of intergenerational mobility ${ }^{32}$. The basic path setting is as follows. For the paternal lineage, paternal grandparents' class is linked to father's education and to father's

[^27]class; father's education is linked to father's class; father's class is linked to both household income and property ownership. For the maternal lineage, maternal grandparents' class is linked to mother's education and to mother's class; mother's education is linked to mother's class; mother's class is linked to both household income and property ownership. Father's and mother's education decide their class positions; father's education and mother's education are correlated, and so do father's and mother's class. Household income is linked to property ownership. All the variables measuring parental resources are set up to link directly to grandchildren's education and class; grandchildren's education is assumed to determine their class attainment. In the three-generational mobility models, both paternal and maternal grandparents' classes are directly linked to grandchildren's education and class. Five-level class and education of both parents and grandchildren enter the models as ordinal variables and monthly household income as continuous variables. The descriptive information of the measures is reported in Appendix Table A6.2.

Mplus treats these ordered categorical variables as their latent unobserved continuous scores that underlie thresholds of different categories. In other words, class and education of parents and grandchildren are measures as continuous scores with thresholds in Mplus (Muthén and Muthén, 2012). Paternal and maternal grandparents' NS-SEC five-level class, however, are treated as dummy variables ${ }^{33}$.

[^28]Since grandchildren's education and class as dependent variables are treated as ordered categorical variables, the models are estimated with a robust weighted least squares approach using a diagonal weight matrix (WLSMV) as Mplus recommends (Muthén and Muthén, 2012). With the WLSMV method and categorical outcome variables, Mplus calculates the parameters as probit regression parameters (Muthén and Muthén, 2012).

The path analysis models contain two parts. The first part measures the grandparents-father/mother pathways where father's/mother's education and class are treated as the dependent variables, assuming that while grandparental class determines parents' education, it may also have direct influences on parents' class. The second part describes the grandparents/parents-grandchildren associations in which grandchildren's educational and class attainments are taken as dependent variables. Three-generational mobility models assume that grandparental and parental variables are related to grandchildren's education and class. These grandparental- and parental-related variables are assumed to have potential impacts on grandchildren's class attainment after grandchildren's education has been controlled for. Taking the first and second parts together, I hypothesise the influences of grandparental class to be direct as well as being mediated by parental characteristics. The direct effects are measured by the associations between grandparents' class and grandchildren's class, while parental resources were taken into account. The indirect effects are identified as the connections via grandchildren's education and via parents; that is, first, grandparents affected grandchildren's education which in turn determined grandchildren's class attainment; and second, grandparents affected parental characteristics which in turn determined the grandchildren's outcomes.

In the present path analysis, the variables at the beginning end of the arrows are estimated simultaneously in models, and thus the effect of each of these variables on grandchildren's outcomes is estimated net of each other. For example, where the arrows starting from grandparental class and parental resources point to grandchildren's education and class attainments, the effects of grandparents and of parents are calculated net of each other. Grandchildren's age, age squared, birth cohorts, race, regions, and survey sources enter the models as control variables. They are not shown in the figures for ease of presentation.

Considering potential gender differentials in mobility patterns, I apply a multiple group analysis for grandsons and granddaughters. Grandparents-parents associations are assumed to be independent of grandchildren's gender; in other words, associations between grandparents and parents do not vary between grandsons and granddaughters. The parameters of the grandparents-parents associations, therefore, are constrained to be constant across the groups of grandsons and granddaughters ${ }^{34}$, and the parameters of the grandparents/parents-grandchildren association are allowed to differ. This multiple group model is found to achieve a good model fit: RMSEA $=.042,90$ Per cent C.I.: $0.039,0.044 ; \mathrm{CFI}=0.913^{35}$. Figure 6.1 and Figure 6.2 show the results of grandsons and granddaughters respectively, with simplified paths in which insignificant paths are removed and in which only coefficients of the paths linked to grandchildren's education and class are marked.

[^29]
### 6.4.2 Results

In general, all the variables are shown to act in the expected direction. Advantaged family backgrounds are positively associated with higher education and class attainment, and higher educational qualifications are also strongly related to favourable class positions. Details are reported in Table A6.3, Appendix 6.

Looking at the grandparents-father/mother part of the model, I find that all the speculated paths from grandparents to parents were statistically significant. While grandparental classes affected the father's and mother's education to similar extents, the effects of paternal grandparental class on father's class outcomes after father's education was controlled for are found to be stronger than what happened in the maternal lineages. The higher the grandparents' class was, the more likely the fathers and mothers were to obtain better education and thus more advantaged class positions. Parents with the salariat class grandparents have been given a head start in their career, compared with their counterparts without such privileged family backgrounds. Both father's and mother's class positions significantly determined the household economic resources represented by household incomes and property ownership. These findings suggest a good foundation for significant indirect impacts that grandparental classes exerted on grandchildren's outcome via parental resources.

Figure 6.1 The simplified results of the path analysis model of grandsons


Notes: All the paths shown in the diagram reached statistical significance at the level of 5 per cent; only coefficients of the paths linked to grandchildren's outcomes were marked in numbers; grandchildren's age, age-squared, birth cohorts, race, regions, and survey sources were used as control variables whose coefficients are not shown in the graph; blue lines represent the direct associations between grandparental class and grandchildren's education; red lines represent the direct associations between grandparental class and grandchildren's class; the coefficients of grandparental class refer to only the coefficients of the effect of having salariat instead of working-class grandparents. Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Figure 6.2 The simplified results of the path analysis model of granddaughters


Notes: All the paths shown in the diagram reached statistical significance at the level of 5 per cent; only coefficients of the paths linked to grandchildren's outcomes were marked in numbers; grandchildren's age, age-squared, birth cohorts, race, regions, and survey sources were used as control variables whose coefficients are not shown in the graph; blue lines represent the direct associations between grandparental class and grandchildren's education; the coefficients of grandparental class refer to only the coefficients of the effect of having salariat instead of working-class grandparents.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

The findings in the grandparents/parents-grandchildren part of the model in which grandchildren's educational and class attainments are dependent variables are largely consistent with the previous discussion. There seem to be only slight gender differences in the patterns of family origin influences on education; the patterns of class mobility, however, appeared to diverge across grandchildren's genders. Grandsons and granddaughters are found to follow different mobility patterns. In the associations where their own education is taken into accounts, grandchildren seemed to benefit from different components of family resources; those without these resources were thus disadvantaged in the career competition in the labour market. The following sections will discuss the direct effects and indirect effects on grandchildren's class attainment.

### 6.4.3 Direct effects

Looking at the direct effects on grandchildren's class outcomes, I find that while the analysis took into account educational qualifications that grandchildren achieved, the direct impacts of family origins were greatly reduced. For grandsons, among a fairly wide range of parental resources that are present in the model, only the effects of father's class and household income are found to have significant associations with grandsons' class at the level of 5 per cent.

Having salariat instead of working-class maternal grandparents had statistically significant direct impacts on grandsons' class outcomes. This suggests that of grandsons who were raised with similar parental resources and had achieved the similar educational levels, those with salariat maternal grandparents had a significantly better chance of attaining a higher instead of lower class position as
compared with their peers of working-class maternal grandparents. For having salariat instead of working-class maternal grandparents increased the z -score of grandsons' social class by 0.22 . In this regard, the maternal grandparental effects seemed to be fairly strong, considering the significant influences of grandparents on grandsons' education and the employment of various measures of parental resources. The significant direct grandparental effects are not found in the paternal lineage. Regarding granddaughters' class attainment, with educational qualifications holding the strongest explanatory power, parental wealth was the only significant family origins in determining class mobility at the 5 per cent level ${ }^{36}$. The grandparentsgrandchild associations are found to have positive but statistically weak associations with granddaughters' class outcomes.

### 6.4.4 Indirect effects

Two types of significant indirect effects that originated from grandparental class and pointed to grandchildren's class outcomes are to be identified. The first one works through grandchildren's educational attainment, which is the strongest determinant of grandchildren's class outcomes, and the second one refers to the paths that operate indirectly only with parental resources but not via grandchildren's education. Each factor operates on the other in a way as to preserve the individual family

[^30]positions in social hierarchy over three generations. The details of estimations of the indirect effects of grandparents and specific paths are reported in Table 6.4, Appendix 6.

The findings of family origins effects on grandchildren's education largely confirm the picture that I constructed from earlier chapters on education. Grandchildren originating from the well-educated parents continued to maintain these advantages emerging from parental origins. Both parents' social classes were significantly associated with grandsons' education while only mother's class is found to have significant impacts on granddaughters' education. Parents' economic resources are also shown to have strong associations with the education of both genders.

The results of the path analysis model show that both paternal and maternal grandparental class positions had significant impacts on grandchildren's education independent of the observed parental characteristics. Having salariat instead of working-class paternal grandparent increased the z -score of education by 0.26 for grandsons and by 0.42 for granddaughters. Having salariat maternal grandparents, versus working-class maternal grandparents, increased the $z$-score of education by 0.40 for grandsons and 0.39 for granddaughters. The direct contribution that grandparents made to their grandchildren's education accounted for a substantial proportion of total effects of grandparental effects.

The grandparental class also influenced grandchildren's education through parents' education and class. The path that grandparental class influenced ran through parental education appeared to be the second significant contribution of grandparents to grandsons' and granddaughters' education. This finding is not unexpected, considering that grandparental class had close relations with parental education and
that parental education operated as the strongest determinants on grandchildren's education.

Parents' economic resources are found to be a significant intervening element of the indirect effects via grandchildren's education. Grandparental class affected parental education and parental class, which determined parental wealth, and parental wealth in turn had significant associations with grandchildren's education and with grandchildren's class. These pathways are found to be statistically significant, but their strength is fairly weak or even nearly negligible. The major reason is that the chain that originated from grandparental class and arrived at grandchildren's class via parental wealth is simply too long. The longest chain that involves parental economic resources contains seven variables and six paths. The strength of a specific indirect relation is estimated by multiplying the coefficients of the paths involved. It is common that a long chain, while being identified as a significant indirect effect, may be shown to have weak strength.

Turning to the second type of indirect effects of grandparental class that operated through parental characteristics but not through grandchildren's education, I find the patterns varied with grandchildren's gender. The paternal grandparental class had significant relations with grandsons' class attainment indirectly through father's education and father's class: paternal grandparental class influenced father's education and father's class; and father's class in turn determined grandsons' class attainment. The strength of this pathway is found to be second to that of the direct association between grandparents and grandsons' education. The pathway was not significant in the maternal lineage. For granddaughters, the impacts mainly worked indirectly through parental economic resources: paternal and maternal grandparental
class determined father's and mother's education and class; and father's and mother's classes in turn determined household economic resources which had direct relations with granddaughters' class positions. While such paths are found to be statistically significant, their strengths are relatively weak.

### 6.4.5 Model comparison

Grandparental class positions have been shown to be significantly associated with grandchildren's educational and class attainments both in direct and indirect ways; a question then raises as to whether the introduction of direct grandparents-grandchild associations has improved the model fit. If direct grandparents-grandchild associations did contribute to the understanding of social mobility patterns, a threegenerational model would be expected to fit the data better than did a model that accounted only for adjacent two-generation mobility.

I use chi-square difference tests to examine the differences between a threegenerational mobility model and a two-generational mobility model ${ }^{37}$. A twogenerational mobility model employs the variables that are identical to those used in the three-generational model, but the parameters that measure the direct associations between grandparental class and grandchildren's education and class attainments are constrained to be zero. The grandparents-father/mother associations are arranged in the two-generational mobility models in the same paths as the three-generational mobility model. By constraining the parameters, the two-generational mobility is constructed as being nested in the three-generational mobility. According to model

[^31]fit indexes, the two-generational mobility model fails to reach acceptable model it: While RMSEA shows a decent model fit, CFI and TLI are below the critical lines $($ RMSEA $=.047 ; \mathrm{CFI}=.888 ; \mathrm{TLI}=.854)$. The result of chi-squared tests also shows significant differences between the two models. This is to suggest that taking into account the direct grandparents-grandchild associations significantly improves the model fit. The two-generational mobility model that overlooks grandparentsgrandchild associations should not be retained.

### 6.5 Discussion and Conclusion

From the perspective of three-generational mobility, this chapter discusses the impacts of family origins on grandchildren's class outcomes in Britain and the mobility processes that connect both grandparental and parental backgrounds to grandchildren's class attainments. For grandsons and granddaughters alike, grandparental class and parental characteristics have significant and independent contributions to grandchildren's class attainment, net of each other. The findings are largely in line with previous studies on three-generational mobility in Britain by Chan and Boliver (2013).

Building on the previous findings, this chapter introduced grandchildren's education as an explanatory variable and reported that education became the strongest determinant of grandchildren's class outcome and greatly mediated the influences of grandparental class. The results largely support the hypothesis that education is the main channel through which grandparents passed on family advantages/ disadvantages to grandchildren. As expected, the exact features of these processes varied across gender. Despite education being taken into consideration, maternal
grandparental class still had modest but statistically significant influences on grandsons' class attainments. Father's class and parental wealth were also found to play a role in determining grandsons' class mobility outcomes. While grandparental class did not have significant impacts on granddaughters' class attainment after education has been controlled for, parental wealth certainly gave granddaughters significant advantages in achieving desirable class positions.

The empirical analysis started with log-linear modelling. Log-linear modelling has been a common practice in social mobility research and has also been utilised as a major method in previous research on three-generational mobility (Beck, 1983; Chan and Boliver, 2013; Erola and Moisio, 2007; Hertel and Groh-Samberg, 2014). The characteristics of log-linear modelling allow researchers to measure relative mobility chances while separating the influences of the marginal distributions of class structures of three generations. The log-linear modelling shows that grandparental class may have independent effects on their grandchildren's class outcomes, while these results varied across data sources and grandchildren's gender. I argued that the association between parents and grandchildren may not adequately capture the influences of family origins because of the limitations of log-linear models and that these results of log-linear models therefore may not be as much accurate as the data permit.

Instead, I used ordinal logistic regression as the main analytic approach to explore the three-generational class mobility pattern. Like log-linear modelling, the method of ordinal logistic regression also can separate relative mobility chances from the margins of class structures of three generations. A major advantage of ordinal logistic regression method over log-linear modelling is its ability to incorporate multiple explanatory variables and clustered data structure. Ordinal logistic
regression models are able to control for various types of parental resources that are available in the current data as well as demographic information related to grandchildren. By so doing, I expected the models to estimate the grandparental effects with as much accuracy as the data permit.

The application of ordinal logistic regression also allows for taking grandchildren's education into account. Table 6.2 shows that grandchildren's education, after being added into models, contributed much more than any measures of family origins in explaining difference in grandchildren's class. Education is shown to mediate the impacts of family origins but not entirely. Some family origins effects remained even after education has been accounted for. The specific inheritance pattern of small employer class may partially explain the direct grandparents-grandsons association. Independent of parental effects, having small employer grandparents significantly increased the probability of grandsons taking up the same career; these significant grandparental effects are also found among grandsons who did not have self-employer parents. I did not find any similar associations among granddaughters. Having determined that multi-variable measurements of parental characteristics are indeed important for children's outcomes, I constructed multi-group path analysis models that outline the paths through which family resources are passed on over three generations. The path diagrams presented in Figure 6.1 and Figure 6.2 show that grandchildren's class and educational attainments were related both directly and indirectly to the grandparental and parental characteristics.

The findings suggest some common processes across genders-education as the main channel of grandparental effects-as well as distinctive patterns which seem to be gender-specific. For grandsons, the association between grandparental class and
grandsons' education accounted for a substantial part of grandparental effects, and maternal grandparents continued to have a modest but significant explanatory power for class outcome even after grandchildren's education is taken into account. The pattern of how grandparental class directly affected grandsons' educational qualification is largely consistent with the discussion in previous chapters on education. It is interesting that while some effects of parental resources on grandsons' class outcomes were greatly weakened as a result of incorporation of grandchildren's education, the association between maternal grandparental class and grandsons' class, although also weakened, remained to be statistically significant. This remains intriguing of why such association is found only with maternal grandparents but not with paternal grandparents. Previous findings that as compared to the relationship with paternal grandparents, grandchildren tend to feel more intimate to and maintain more frequent contact with their maternal grandparents (Anspach, 1976;; Danielsbacka and Tanskanen, 2012; Eisenberg, 1988) may be helpful in understanding the different effects of maternal and paternal grandparents. However, these explanations should be taken as suggestive, since information of emotional bonding of grandparents-grandchild relationships is not available in the BHPS and the UKHLS. Regarding parental effects, the results show that the association between father's class and grandsons' class is another important channel that mediated the effects of grandparental class.

Granddaughters share with grandsons the feature of education operating as the main channel of grandparental effects. Grandparental effects on granddaughters' class attainment were fully mediated through education and parental effects. The grandparental class is found to have significant effects on granddaughters' education, and it accounted for a substantial part of total effects of grandparents. While
granddaughters' education is included in the model, unlike the case of grandsons, neither paternal nor maternal grandparental class remained to have any significant effects on granddaughters' class attainment. Parental economic resources were the only parental characteristic that exerted significant impacts to granddaughters' class. The results of the path analysis model indicate that grandparental class determined parents' education and class which in turn determined monthly household income and property ownership. The path that linked indirectly from grandparental class to parental economic resources and then to granddaughters' class attainment is found to be weak but statistically significant.

Taking into account three-generational mobility associations significantly improved the model fit indexes as compared with two-generational mobility results. In other words, a model that considers the direct association between grandparents and grandchildren fitted the data significantly better than a model of adjacent twogenerational associations.

It is also needed to consider the fact that given the close associations between grandparental class and parental characteristics, grandchildren who had privileged parents were more likely to have privileged grandparents. In this light, I argue that the accumulation of family advantages (or disadvantages) over generations greatly influenced individuals' achievement in education and occupational career.

This is not to suggest that class inequality is completely self-perpetuating and forming a watertight enclosure circle. Individuals from disadvantaged family origins are put at disadvantages, which are prior to their birth, but they are not destined to fail, for the most crucial factor that determined class attainment is not any indicators of family origins but education. The finding that most of these grandparental
influences operated via the channel of educational achievement may lead to the argument that granddaughters who have managed to acquire university degrees may be able to overcome some disadvantages of having low-class grandparents in the competition in the labour market.

That said, education is far from sufficient to justify inequalities shown in the threegenerational mobility process. Individuals who originated from disadvantaged families and achieved higher education credentials are often held up as examples of 'work hard, get ahead', as opposed to the outliers that they are. As Marshall and Swift (1996, p.379) pointed out in their discussion on the association between meritselection and social mobility, 'equals are here being treated unequally'. The results show that even when grandchildren have acquired the same education, those who originate from socially disadvantaged families have significantly lower chances in the competition in the labour market, and such disadvantages granted from family origins can be traced back to class positions of the grandparental generation. In other words, they have made it; but not as far as their counterparts from the advantaged families will. 'Sclerotic' class rigidity in Britain (Olson, 1982, p.86) is certainly shown in evidence.

Due to the limitation of data, this chapter did not fully explore why grandsons and granddaughters benefit from different types of family resources, and in particular why maternal grandparents appeared to favour grandsons but not granddaughters. To further understand how grandparents impact their grandchildren's class attainment, it will be important for future research to introduce measures relevant to the mechanism of mobility process and examine why these processes might differ by gender.

## Chapter 7 Discussion and Conclusion

### 7.1 Introduction

Using the data from the British Household Panel Survey (BHPS) and the UK Household Longitudinal Survey (UKHLS), this thesis set out to explore social mobility over three generations in the UK, that is, the question of whether social mobility in the UK can be described as a first order Markovian chain. The first order Markovian chain view of social mobility posits that individuals' social attainment is determined only by their adjacent generation. According to the Markovian continuity of families, grandchildren' social attainment is determined only by parental resources and is independent of grandparents, as grandparents-grandchild associations are fully mediated by parental effects. The thesis suggests that grandparental class has significant impacts on grandchildren's education and class outcomes independent of parental mediation and that family advantages/disadvantages persist over at least three generations in Britain.

The persistence of social inequalities has attracted long-standing heated debates in social sciences and, in particular, the topic of multigenerational inequalities, albeit still in its infancy stage, is developing with exciting findings in different social contexts. This thesis is concerned with contributing to the existing literature on multigenerational mobilities. To my knowledge, the present thesis is the first study that explores educational inequalities over three generations in Britain and also the first study that connects the three-generational effects on education to the persistence of inequalities in class attainment. This thesis also makes important headway in testing the mechanisms through which grandparental effects operate.

The data allow for the possibility of estimating different parental characteristics and grandparental class, which are not included in typical two-generational social mobility research. With a relatively wide range of parental characteristics being taken into consideration, the model results are expected to be able to control for the influences of parental resources and to estimate the independent effects of grandparental class on grandchildren's education and class attainments.

### 7.1.1 Chapter Structure

In this chapter, Section 7.2 summarises the major findings and arguments of the previous chapters. Section 7.3 highlights the academic and political implications of the thesis findings. Section 7.4 discusses the limitation of the study and future research agenda. Section 7.5 concludes the final remark of this thesis.

### 7.2 Main findings

The Introduction Chapter outlined a general paradigm of social mobility over three generations (see Figure 1.1). As shown in the paradigm, the major focus of research questions is whether the grandparental class has significant effects on grandchildren's attainment net of parental characteristics. The research questions are concerned with whether parental effects fully mediate the influences of grandparents on grandchildren and whether there are any direct associations between grandparents and grandchildren after parental effects are taken into account.

The first empirical chapter (Chapter 3), serving as an opening of the quantitative analysis, provided descriptive findings on absolute class mobility between
grandparents and grandchildren. The results showed that inequalities related to family origins coexist with a remarkable increase in the size of salariat class as a result of upgrading of occupational structure. Grandparental class is important to grandchildren's class outcomes even when grandchildren originated from similar parental class. For grandchildren who had salariat parents, those of salariat grandparents had a higher proportion of staying in salariat occupations than those of other class grandparents. In particular, although the grandchildren were raised by parents of the same advantaged class, there was a striking gap in the proportion of being found in salariat positions between those with working-class grandparents and those with salariat grandparents. Of grandchildren originating from working-class parents, those who had grandparents working as salariat and small employers had the higher proportions of climbing to salariat position, relative to their counterparts of other class grandparents. To sum up, grandparental effects were evident in grandchildren's absolute mobility outcomes, even among those who had parents of the same class.

The second empirical chapter (i.e., Chapter 4) moved to examine direct grandparental effects on grandchildren's education. Over and above parental characteristics, grandparents' class positions had distinctive contributions to their grandchildren's education with a considerable magnitude. After incorporating a wide range of parental characteristics, including parents' education, parents' class, and parents' economic resources, the impacts of the grandparental class remained statistically significant.

In exploration of the operation of grandparental effects on grandchildren's education, I found that the living status of grandparents had little relevance for the effects of
grandparental class and that grandparental effects were significantly reduced when grandparents were alive but did not have regular contact with parents (and grandchildren). Furthermore, the form of face-to-face interaction did not matter; grandparents who did not frequently see the offspring but contacted them every day by telephone, email or letter still had important impacts, despite lack of face-to-face interaction. These findings suggested that the grandparental effects operated through contact and also through life legacy. However, when grandchildren did not share strong bonding with grandparents in the case where grandparents were alive but did not keep frequent touch with parents and grandchildren, grandchildren were less likely to benefit from grandparents' economic resources and also less likely to take grandparents as role models or as an important component of family traditions. These findings suggested that multigenerational family influences as complicated social processes operated through multiple mechanisms.

The chapter suggested that grandchildren from advantaged parental backgrounds were the main beneficiaries of grandparental effects. First, grandchildren originating from socially advantaged parents were more likely to have socially advantaged grandparents than those originating from the disadvantaged parental backgrounds. They were the main recipients of the resources of advantaged grandparents. Second and more importantly, grandparental effects were found to be concentrated on the top level of social stratification. I tested the augmentation hypothesis and the compensation hypothesis. The augmentation hypothesis suggested that advantaged parents were able to activate and maximise the advantages of grandparents' resources to improve grandchildren's education, and as a result, parental resources should augment the effects of grandparents' resources on grandchildren's education (Chiang and Park, 2015). The compensation hypothesis suggests that grandparents
were more likely to compensate the grandchildren who did not obtain sufficient resources from disadvantaged parents; and as a result, grandparental effects might be manifested for grandchildren who had disadvantaged parents (Jæger, 2012). The evidence appeared to support the augmentation hypothesis. That is, the analysis showed that grandparental effects were stronger for grandchildren with advantaged parents than for those with disadvantaged parents. Education is viewed as 'ticket' out of the disadvantaged origins and as a path in which individuals fulfil their talents and potentials. However, the incorporation of grandparental effects revealed the persistence of educational privileges of families at the top position of social stratification. The chapter did not find the evidence supporting the compensation hypothesis that grandparental effects were strong at the bottom of social stratification. This chapter, as the first piece of quantitative analysis for grandparental effects on education in Britain, is an important addition to the literature.

The third empirical chapter (Chapter 5) discussed the persistence of education inequalities over three generations during the 1990s higher educational expansion. First, the evidence suggested that grandparental class and parental resources might have changed in different ways over time. The parental effects appeared to be particularly strong on grandchildren's chance of acquiring university degrees during the educational expansion. Second, although the proportion of the disadvantaged grandchildren attaining tertiary education increased, educational expansion, in and of itself, did not necessarily weaken the inequalities of access to higher education. Using three-generational data, the analyses highlighted the clear interplay between gender inequality and inequality based on family origins. The initial stage of the educational expansion benefited the most advantaged grandchildren, particularly
granddaughters, whose grandparents and parents were both socially advantaged. After the admission of higher education among the most advantaged grandchildren approached 'saturation' points (Boliver, 2013, p.236), the disadvantaged grandsons took up the opportunities to fill in the positions that the tertiary educational expansion offered, whereas the educational chances of the disadvantaged granddaughters remained unchanged. The findings suggested that the 1990s educational expansion benefited the most advantaged grandchildren who were standing at the front of the queue, and then the benefit would flow down to the social stratification. Furthermore, the Chapter 5 findings seemed to confirm the findings in Chapter 4 that grandparental effects appeared to be limited for the disadvantaged group. Taking the Chapter 4 and Chapter 5 together, the findings showed that grandparental class partially explained the inequalities in the dimension of education, indicating an important inequality reproduction mechanism that can be expected to have further consequences for late life conditions.

The fourth empirical chapter (Chapter 6) returned to the analysis of class mobility over three generations based on the foregoing discussion. The analyses suggested that grandparents and parents made significant contributions to grandchildren's class attainment, net of each other. After including grandchildren's education in the model, the findings showed that education, which is the most important predictor to class attainment, greatly mediated the effects of family origins. Whereas grandparental class became insignificant for granddaughters' class outcome due to the introduction of granddaughters' education, they continued to have statistically significant, albeit limited, impacts on grandsons' class. The chapter also found that the chance of grandsons working as small employers was directly related to grandparents' status of small employers, net of grandsons' own education and parental characteristics. This
finding remained significant even for those grandsons who did not have small employer parents. However, this specific small-employer effect was not found on granddaughters.

Path analysis was adopted to account for parental characteristics on the causal paths through which grandparents passed on family advantages to grandchildren. The influences of grandparental class could be partitioned into an indirect effect via parental characteristics and direct effects on grandchildren's educational qualification and on grandsons' class attainment. The evidence suggested that education was the main channel through which the impacts of grandparental class operated. While education mediated the most of grandparental effects on granddaughters, maternal grandparental class still exerted significant impacts on grandsons' class attainment even after educational effects have been accounted for. Regarding parents' resources, parental class and wealth continued to be statistically significant to grandchildren's class attainment.

The findings of this thesis are consistent with previous findings on grandparental effects on education in other countries (e.g., Celhay and Gallegos, 2015; Chiang and Park, 2015; Deindl and Tieben, 2017; Ferguson and Ready, 2011; Hancock, 2016; Jæger, 2016; Modin, Erikson and Vagero, 2013; Møllegaard and Jæger, 2015; Sharkey and Elwert, 2011; Wightman and Danziger, 2014; Zeng and Xie, 2014). The findings also agree with the previous research by Chan and Boliver (2013) that discovered significant grandparental effects on grandchildren's class attainments in Britain. While the persistence of multigenerational inequalities may not always be the same across time and space (Mare, 2011), the evidence shows that at least in contemporary Britain, there are statistically significant associations between
grandparents' social positions and grandchildren's education and class, independent of a wide range of parental characteristics. Multigenerational family origins construct inequalities in the human capital dimension. This creates the fundamental mechanisms of inequality reproduction that are in turn found to have significant consequences for later life attainment such as class positions. The multigenerational transfer of family advantages is found to be particularly substantial among the advantaged. One may say that even before their parents were born, advantaged grandchildren's starting points have been largely decided.

Grandparents-grandchild associations are multi-dimensional activities which have been found at different life stages of grandchildren. The Introduction chapter discussed the potential mechanisms of how grandparental resources directly affect grandchildren's achievements. Unlike the parent-child relationships, the grandparents-grandchild relationships are not guided by explicit norms or laws (Clavan, 1978). The support from grandparents, however, is widely valued and expected by both grandparents and grandchildren (e.g., Griggs et al., 2010; Hagestad, 2006; Kemp, 2004). Grandparents may provide childcare service for their preschool grandchildren and, after grandchildren reach school age, the focus of grandparental involvement move to education-related activities. The research found that grandparents may provide various types of support that benefits grandchildren' school experiences, such as school pick-up to homework, extracurricular activity assistance, and career advisor (e.g., Griggs et al., 2010). As grandchildren move to adulthood, grandparents may provide financial resources for their grandchildren (e.g., Attias-Donfut, Ogg and Wolff, 2000; Beach, 2013; Hoff, 2007; Silverstein and Marenco, 2001; Tan, et al, 2010), which can be used to improve grandchildren's living standards and help their education or career advancement. Financial support
from grandparents may also indirectly benefit grandchildren, for example, by contributing to a good residential environment (Ferguson and Ready, 2011; Hagestad, 2006). Grandparental resources may also serve as an 'invisible' insurance: the idea of 'my grandparents are there for me' may encourage grandchildren of privileged grandparents to take rewarding, but risky, decisions in education and career development.

Alternatively, grandparents may have symbolic influences on grandchildren's attainment. 'Achievement orientations are viewed as personal attributes that may be passed down, or 'transmitted', from generation to generation in families, promoting continuity over multiple generational lines across many decades of history' (Bengtson, 2001, p.10). Grandparents may serve as a source of wisdom and knowledge that help grandchildren make decisions regarding education and occupational development (e.g., Crosnoe and Elder, 2002; Griggs et al., 2010) and as a role model or a reference frame guiding grandchildren's aspiration (Denham and Smith, 1989; Hertel and Groh-Samberg, 2014).

Due to data limitation, the thesis did not seek to disentangle which speculative mechanisms are the main driver of grandparental effects on multigenerational inequalities. However, the findings that grandparental effects existed regardless of whether grandparents kept contact through face-to-face interactions or through telephone, email or letter and whether grandparents have passed away and that grandparental effects disappeared only when grandparents were alive but did not have frequent contact do lend weight to the assumption that grandparental class is related to grandchildren's outcome via multiple mechanisms. While in-kind support and the socialization process call for face-to-face involvement of grandparents, the
transmission of values and wealth from grandparents to grandchildren does not necessarily require grandparents to be alive or active in grandchildren's life. If only face-to-face involvement mattered, one would assume that grandparental effects would have existed only when grandparents frequently visited grandchildren and that grandparental effect would have disappeared if grandparents had deceased. The thesis did not support this speculation. Furthermore, the findings that grandparental class had direct impacts on grandchildren's education and on their class suggest that grandparental class represents need-directed resources which may operate at the different life stages of grandchildren.

### 7.3 Implication of Findings

The findings of three-generational social mobility in the UK have significant implications at the theoretical level and at the political level. This section shall first discuss the academic implications and then move to policy-related implications.

### 7.3.1 Academic implication

With a decrease in fertility and an increase in longevity, most British families' generational structure, like in other industrialized societies, has transformed to what is referred to as a 'beanpole', a family structure in which 'the shape is long and thin, with more family generations alive, but with fewer members in each generation' (Bengtson, 2001, p.5). One of the implications of these demographic transformations is long years of shared life between grandparents and grandchildren (although the shared life may be not co-residential in the social context of Britain). Thanks to the welfare system and improvement of standards of living, the old generation have also
become healthier and wealthier than before. These social changes are consequential for family members and their life chances.

Contextualizing intergenerational mobility in the contemporary family configurations broadens the inquiry about the significance and functionality of family origins in the equality of opportunities. Grandparents as important family resources are an essential component of an extended multigenerational family network, which supports the young offspring's well-being. From the perspective of social mobility, this means, however, that grandparents also make essential contributions to multigenerational inequalities. The thesis suggests substantial associations between grandparental class and grandchildren's education and class attainments, which are only partially mediated by parents' resources. In other words, over and above the considerable influences of parental resources, grandparents' class position has also exerted direct impacts on grandchildren's attainments.

This thesis also makes progress in testing the mechanisms through which grandparental effects work. Researchers in multigenerational inequalities postulate a number of reasonable explanations for why grandparents' social characteristics can be directly associated with grandchildren's achievements (e.g., Mare, 2011; Pfeffer, 2014). However, no matter how plausible these explanations appear to be, they have hardly been empirically tested in quantitative analyses due to data limitation (Knigge, 2016). Using data from the UKHLS, the thesis tested the mechanisms that require contact and the mechanisms that can operate without contact. I found evidence supporting both mechanisms. On the one hand, face-to-face interaction seemed to have little relevance for grandparental effects. Grandparental effects remained to be significant even if grandparents have passed away, or if grandparents did not
frequently see grandchildren but maintained intensive contact via long-distance communication. On the other hand, grandparental effects became insignificant when grandparents were alive but hardly kept contact with the offspring. Lack of strong bonding may explain why grandchildren are less likely to receive support from grandparents and also less likely to take grandparents as role models. I regard the present findings as an important improvement from using geographical distance in previous studies (Knigge, 2016).

## The three-generational approach

The two-generational social mobility approaches assume a Markovian chain process: parental resources play a pivotal role in transferring family advantages from grandparents to grandchildren and introducing new variation in the social stratification of grandchildren that is independent of socioeconomic positions of grandparents and earlier generations. Theoretically, it is not clear why the transfer of family advantages should be a simple two-generational association. The process of social mobility may vary across time and space (Mare, 2011). For example, in the 1950s U.S. state of Wisconsin (Warren and Hauser, 1997) and in recent Netherland population (Bol and Kalmijn, 2016), the social mobility approach based on parentchild associations may be able to represent fully how families pass on advantages/disadvantages to the offspring. In other words, a two-generational social mobility approach may fit specific contexts. It is reasonable to assume that the impacts of family origins may be traced back to more than just the parental generation. Whether multigenerational inequalities exist or not in certain social contexts should be tested as an empirical question (Long and Ferrie, 2015), and the
assumption of the Markovian two-generational process should not be taken as granted. The findings of this thesis may not be generalized to other industrialized societies; however, they lend weight to the argument that social mobility research that restricts the focus to two-generational associations due to data limitation may have overestimated the amount of openness in social mobility process and underestimated the inequalities driven by family backgrounds in education and the labour market.

Moreover, if this argument is true, one needs to be cautious in interpreting the twogenerational studies that compare social mobility across countries or time periods. The thesis suggests that the influences of grandparental class and influences of different types of parental resources may not share similar trends of persistence or change over time. This is also somewhat consistent with a previous two-generational study by Bukodi and Goldthorpe (2013) that decomposed family origins into parental class, status, and education and found that these three components changed in different patterns over time. It is, therefore, questionable to infer from some observed weakening of certain parental effects that the inequalities based on family origins have been improved. For example, the well-received non-persistent educational inequality trends claimed by Breen and his colleagues (2009) who used parents' occupational status as the only indicator of parental resources may need more adequate conceptualisation and measures of family characteristics to validate their argument. It would be misleading if some politicians and scholars take this estimated non-persistent educational inequality trends as the evidence of the improvement of educational inequalities.

What this thesis highlights here, along with other research in multigenerational inequalities, is that the influences of family resources on individuals' prospects are long-lasting and inherently complicated. Instead of taking the two-generational approach as granted without any questioning, a three-generational approach I proposed is essential to an adequate understanding of the characteristics and the extent of social inequalities in education and the labour market. Once again, I argue that whether independent grandparental effects exist or not should be taken as an empirical question instead of a prior theoretical assumption. The researchers should pay more attention to underscore the demographic contexts in which the inequalities exist. Contextualizing social mobility in family configuration may guide the efforts to provide clear pointers to the exploration and interpretation of the social processes through which social reproductions of inequality are linked to different components of family origins. The findings of three-generational social mobility in Britain add up to a clear demonstration of how grandparents pass on family advantages to their grandchildren.

## Causality inference

Research on multigenerational inequalities is often subject to the critique that observed grandparental effects may be explained away by parental influences that were unobserved in models (e.g., Hällsten, 2014; Mare, 2016; Pfeffer, 2016; Zeng and Xie, 2014). Whereas most studies on multigenerational influences control for only a single indicator of parents' social positions (Beck, 1983; Bol and Kalmijn, 2016; Celhay and Gallegos, 2015; Erola and Moisio, 2007; Hancock, et al., 2016; Hertel and Groh-Samberg, 2014; Knigge, 2016; Modin, Erikson, and Vågerö, 2013;

Sharkey and Elwert, 2011), an important advantage of this thesis is that it takes into account a relatively wide range of parental characteristics and contextual factors, including social class, educational qualifications, household income, and property ownership. The findings show that the grandparental effect remains statistically significant, even though its magnitude is reduced after introducing the full range of parental characteristics. The analyses managed to capture the parental resources that are key determinants to the offspring's life chances and used household clustered robust estimate of variance (Rogers, 1993). Therefore, I am fairly confident that the findings are robust. That said, due to data limitation, this study may have faced the same critique as most of the studies on multigenerational inequalities. In order to fully challenge multigenerational mobility as a first order Markovian process, researchers need to take into account all the parental characteristics that have potential impacts on children's well-being, which is, as Hällsten described, 'a daunting task' (Hällsten, 2014, p.24). Although the detailed measures in the present thesis may not capture every possible parental impact, the observed grandparental effects are too large to be counted as unobserved parental impacts. Zeng and Xie (2014) argued that if unmeasured variable bias explained away the observed grandparental effects, it would have affected the interactions between grandparental class and the condition in which grandparental effects operate. The estimated effects of grandparents who were alive and did not have close contact with the offspring were significantly weaker than the effects of other grandparents. This suggests that the interaction effects between grandparental effects and contact may describe actual operation of grandparental effects.

The weakness of unobserved parental effects is almost unavoidable to social mobility studies (Pfeffer, 2014) due to measurement issues pertaining to the inherent
nature of large-scale quantitative data. In two-generational social mobility studies, unmeasured parental resources that are relevant to children's achievement may lead to underestimation of family origin effects and overestimation of observed parental characteristics, in that the effects of observed parental characteristics will pick up those relevant but unobserved parental background effects (Bukodi and Goldthorpe, 2013).

It is worth noting that the regression methods as powerful statistical modelling, which have been used as the primary research techniques in this thesis as well as in a substantial number of publications in social sciences, have their own limitations when it comes to the concern over causality. 'Regression analyses reveal relationships among variables but do not imply that the relationships among variables but do not imply that the relationships are causal. Demonstration of causality is a logical and experimental, rather than statistical, problem' (Tabachnick and Fidell, 2007, p.122). Theory-driven regression analysis methods can be very useful in supporting the development of causal argument from correlational data (Constantine, 2012).

Although this study focuses on social inequalities, it intensively discusses the research in sociology of family relations that establishes the explanatory framework: Grandparents may impact their grandchildren via various types of support that operate in different life stages of grandchildren, such as in-kind assistance, financial support, and symbolic influences. Some forms of grandparental influences may operate without direct face-to-face interaction. Based on the family relation literature on potential mechanisms of grandparents-grandchildren associations, I outlined the conceptual diagram of social mobility over three generations. I employed a series of
regression models with a wide range of explanatory variables in hopes of ruling out alternative explanations related to unobserved parental effect bias and identified that empirical evidence well supports my focal arguments on grandparental effects. The theoretical explanation provides explicit directions for the interpretation of empirical results.

Furthermore, as discussed in the chapter of Introduction, descriptive research in multigenerational inequalities without claiming causal interference is valuable for its own sake in improving understanding of inequality generation and reproduction (Mare, 2014). From this perspective, the grandparental class would no longer be viewed as an essential constituent of family resources that are causally linked to grandchildren's attainment, but instead as a defining characteristic of the family origins. For example, the investigation of educational expansion revealed that while grandchildren with advantaged parents disproportionally benefited from the educational expansion, grandchildren whose grandparents and parents both belonged to the advantaged group clearly had advantages over those whose parents moved upward from the working class. Research (Ferrie, Massey, and Rothbaum, 2016; Solon, 2015) suggests that while the role of grandparents in the causation of grandchildren's attainments is uncertain, the information related to grandparents' social positions can be used to reduce bias in the estimation of the family-child associations. In this sense, I suggest that having salariat grandparents is identified as one of the defining characteristics of the grandchildren that reaped the most benefit from the educational expansion, rather than directly claiming a causal association that this phenomenon results from the support that advantaged grandparents provided.

The issue of social mobility concerns the question of social justice as much as it does the efficiency grounds. On the one hand, the barriers to social mobility that are extended to the grandparental generation waste or misallocate human talents in Britain. On the other, the finding that grandchildren's starting points are largely determined before they were born may have adverse impacts on individuals' motivation and efforts, which may in turn affect labour productivity and overall efficiency. Social mobility depends on a range of factors. Some factors are associated with social policy only to a limited extent, such as social norms, professional ethics and risk evaluations, while other factors can be greatly influenced by social policy (OECD, 2010).

### 7.3.2 Political implication

Moving to the political implications of the findings of this thesis, I would like to emphasise what the findings may contribute in terms of policy-making in education. Education has long been viewed as the potential to remove barriers of disadvantaged family backgrounds to promote social mobility and to help young people to fulfil their ambition. Politicians also advocate the equalisation of educational access as a key element in the development of a fair and open society. However, if political efforts to increase educational equalities were mainly concentrated on the expansion of the number of educational institutions, it is questionable how the opportunities would have been distributed over children from different family backgrounds. The analyses suggested that the effects of the 1990s educational expansion operated as a queue in which individuals originating from the most stable advantaged family backgrounds stood at the front. The results support the previous studies (e.g.,

Blanden and Machin, 2004) that the educational expansion actually widened the inequality gap.

Soon after Theresa May took over as Prime Minister, she pledged herself to the expansion of grammar schools in the hope of '[setting] Britain on the path to being the great meritocracy of the world’ (May, 2016b). However, evidence from Kent suggests that the disadvantaged pupils are less likely to gain places in the process of selection into grammar schools understated: 'securing access to a grammar school...is like rolling a loaded dice' (Guardian, 2017). Research also suggests that educational systems that select students into different schools at a young age would not significantly improve social mobility (Boliver and Swift, 2011; OECD, 2010). In line with many commentators and scholars, I doubt that the results of May's plan of grammar schools would be very similar to the 1990s higher education expansion. Despite aiming to 'a country that works for everyone' (May, 2016b), the expansion of grammar school may disproportionally benefit children of advantaged parents and grandparents and leave the disadvantaged children further behind.

I suggest that it is not enough to put political focus only on educational expansion. Charles Clarke, the former Education Secretary, commented that he was less interested in reaching the goal of the $50 \%$ participation rate and would rather choose 'a much better class basis' in the currently enrolled students (BBC News, 2002). I would like to invite British politicians to think of the issues of inequalities from the perspective of the mechanisms of how family advantages and disadvantages are reproduced over generations. Without tackling the mechanisms of inequality reproduction, the only promotion of grammar schools could be in the long run
counterproductive to increasing social mobility and may even widen the gap between the advantaged and the disadvantaged.

The detailed discussion of how to improve educational inequality in the UK is beyond the scope of the thesis; however, the study does cast light on several ways to increase social mobility. First, for the children who are capable, but lack supports in home environment, schools should offer accurate information and raise aspiration to reach the most rewarding educational tracks. The results of three-generational mobility implied that successful grandparents may serve as role models or consultants who inspire the grandchildren to aim high and that grandchildren who do not have such grandparents may not benefit from it. I suggest that schools should provide a probability to offset the family background differences in educational success. Schools have the potential to 'function as important agencies of re-socialisation-that is, can not only underwrite but also in various respects complement, compensate for or indeed counter family influences in the creation and transmission of "cultural capital" ...on a mass scale" (Goldthorpe, 2007, p.14). The Sutton Trust recently found that $43 \%$ of state secondary school teachers rarely or never advise their bright pupils to apply to either the University of Oxford or the University of Cambridge (Sutton Trust, 2016). Both the University of Oxford and the University of Cambridge run teacher summer schools and events to advise and inspire school teachers (Guardian, 2016). In order to overcome the social barriers that may be stopping potential students from applying good universities, there are more that need to be done to narrow the gap of information and aspiration between students from different family backgrounds. Bright students should be encouraged to aim at elite universities regardless of their family backgrounds, and students,
particularly those from disadvantaged families, should be given appropriate advice and support to help them to make informed decisions.

What educational policy alone can achieve to create an open society characterised by high social mobility is limited, 'far more so than politicians find it convenient to suppose' (Goldthorpe in Guardian, 2016). If politicians are seriously concerned with inequality of opportunities, I urge that politicians look beyond education policy and take up the challenge of tackling the class-based inequalities of conditions-the basic source of inequality of opportunities. The connections between education and inequalities of conditions are complicated: whether children have a hygienic and warm environment to focus on homework; whether children receive enough attention and support from families; how families consider educational developments; how families take care of children's mental and physical health; whether good quality of teaching is available in the areas where children live. Recent OECD research shows that higher levels of income inequality are related to lower amounts of intergenerational mobility and that higher levels of unemployment benefits are related to higher amounts of intergenerational mobility (OECD, 2010). The recent benefit cuts which hit more than 333,000 children of low-income parents (Guardian, 2015) may lead to further widening of the inequality gaps. This thesis suggests that grandparental effects operate through complicated mechanisms and that these grandparental effects, together with parental effects, contribute to the perpetuation of social inequalities in education and the labour market. In seeking to increase social mobility and build up an open and fair society, public policy would do well to consider the ways in which the effects of family origins which are extended to the grandparental generation can be offset.

### 7.4 Limitation

This thesis has strongly advocated the multigenerational perspective of inequality persistence. The contributions in this thesis make important inroads into exploring the existence and extent of direct effects of grandparents and their consequences. However, more needs to be done. This section will discuss the research's main limitations that are related to the concerns about data and identify the topics that need to be addressed in future research.

First, this study has faced the same limitation as almost all other studies using retrospective data. The retrospective data provides only an approximate measure of grandparents' class. Despite the risk of recall bias, retrospective data can reliably collect socioeconomic standing, such as occupation and education (Pfeffer, 2014). I mitigated the recall bias by extracting the information on grandparents' class from the parental generation rather than from the grandchildren's generation.

Second, like most longitudinal surveys, the current data is subject to sample attrition and non-response. The three-generational data I constructed do not contain nationally representative sub-samples of each generation. Two major reasons for potential bias are that the data do not include respondents who did not have children ${ }^{38}$ and that the data do not include respondents whose information of parental occupation was missing. The lack of information on parental occupation

[^32]may be related to disadvantaged backgrounds of respondents. It can be explained by the following reasons: both parents passed away before the respondent reached the age 14; parents did not work; parents did not have custody of the respondent. Without respondents' parental information, the data is unable not derive grandparental class. The thesis does not intend to examine generational replacement; rather it takes the grandchildren generation as a specific subpopulation and investigates the influences of multigenerational inequalities.

Non-response is also a potentially important issue. In BHPS, the 'wave-on-wave' dropout was highest in wave 2 (approximately 11 per cent of Original Survey Members from wave 1 did not attend wave 2), but after the early waves, the response rates have remained high (at least 95 per cent between waves) (Lambert, 2006). Lynn (2006) documented that the BHPS respondents who dropped from the surveys disproportionately included people who were young, single and had low education and low income and in certain regions ${ }^{39}$. The models have incorporated as independent variables the information that might account for disproportionate sampling strategies or non-response attrition. Lynn also noted, 'Although underrepresentation of these groups is statistically significant, the actual magnitude of under-representation is generally small' (Lynn, 2006, p.76).

Broadly the same can be said of the UKHLS; the 'wave-on-wave attrition' was high in the transition from wave 1 to wave 2 , but since the initial stage, the re-contact

[^33]rates have been acceptable (between 78 per cent and 85 per cent, wave 3 to wave 5) (Knies, 2015). Survey weights correct for non-response rates. I applied survey weights in regression analyses and did not find essential differences between weighted and unweighted regressions.

Third, the young sampling ages of the grandchildren generation may potentially bias the estimation regarding educational attainment and class attainment. Regarding education, for those individuals who attain tertiary educational qualification at the age older than 25 and dropped from the BHPS or the UKHLS before they have acquired the qualifications, their tertiary educational qualifications were not included in the data. Compared with young students, the mature students that entered the university after the age of 21 have higher proportions of having known disability, being ethnicity minorities, not having traditional qualifications, and working in disadvantaged occupations in their most recent jobs (NUS. 2012). This would affect only to a limited extent the estimations of the chance of obtaining tertiary educational qualifications but would not have important impacts on the estimation on general educational attainment.

The young sampling ages of grandchildren should be kept in mind regarding the results of class attainment. The strength of the association between class origins and class destination is expected to be strong when individuals reached occupational maturity, as individuals, particularly men, may experience 'counter-mobility' and return to their class origins after moving away from it at the initial stage of career development (Erikson and Goldthorpe, 1992; Goldthorpe, 1987). However, thanks to the application of five-level NS-SEC scheme, I expect that the potential career mobilities that young grandchildren may experience at the older age occur within
combined higher and lower salariat class, or within combined semi-routine and routine working-class rather than crossing over these class categories. The application of the five-level NS-SEC scheme takes into account most of the cases of work-life mobilities, such as the situations in which one worked as lower salariat as the entry-level job and then was promoted to higher salariat position or in which one initially worked in a routine occupation and then moved to a semi-routine job. In addition, the age effects were also controlled for by incorporating the age and agesquared variables in the models.

Fourth, the study was unable to take different indicators of grandparental resources into consideration in the major analysis, which would have been desirable to develop the understanding of the mechanisms through which grandparental socioeconomic resources directly affect grandchildren's attainments. The tentative analysis with grandparental education (see Table A4.3, Appendix 4) showed that non-missing grandparents' education had no much explanatory power to grandchildren's educational attainment if grandparents' social class was considered.

Therefore, the main models use grandparental class as the only indicator of grandparental resources. This means that the effects of grandparental class may be conflated with unobserved grandparental characteristics such as wealth, social network, cultural capital, ambitions, and work ethics. Previous studies show that grandparental economic resources played an important role in determining grandchildren's prospects (Jæger, 2012). In the future research, it would be ideal to include different dimensions of grandparental resources and disentangle the mechanism of the persistence of inequalities over generations.

Fifth, the current empirical analyses did not specify grandchildren from singleparent families due to practical reasons. The data, British Household Panel Survey and the UK Household Longitudinal Survey, have panel structures that followed respondents over years and captured the changes in their life. With this structure, it is difficult to define single-parent family ${ }^{40}$. Family structures are closely related to grandparents-grandchild relationships and may mediate the persistence of multigenerational inequalities (Song, 2016).

Last but not the least, given that the multigenerational inequalities vary over time and places, I suggest that in order to understand the association between multigenerational inequalities and institutional settings, the approach to exploring multigenerational inequalities should be followed by cross-national comparative research. The interpretation of the mechanisms of how they occur needs to be more theoretically elaborated, and future research would benefit from a focus on examining the mechanisms by seeking explanations at the family level and at the broader institutional level.

### 7.5 Recommendations for future research

Three-generational mobilities may be strongly conditional on the institutional contexts (Pfeffer, 2014). In the extensive comparative study of two-generational social mobility, Erikson and Goldthorpe (1992) found that although cross-national variation exists, patterns of class mobility are essentially similar across nine

[^34]European countries. Political institutions have certainly impacted social mobility patterns. The research (Breen and Luijkx, 2004; Erikson and Goldthorpe, 1992) reported that former socialist countries show higher social fluidity than other European countries. Cross-national variation in the characteristics of social institutions such as educational systems, employment institutions, trade unions, and welfare systems can also determine the strategies that advantaged families act to maintain their privileges and that disadvantaged individuals act to overcome social barriers. For example, Erikson and Goldthorpe (1992) noted how the German dual systems of vocational education and apprenticeships could explain the mobility pattern between non-skilled manual class and skilled manual class. Interestingly, Hertel and Groh-Samberg (2014) also found that German's dual system played a role in the pattern of three-generational class mobilities.

A few studies on cross-national comparisons contribute tos valuable understanding of the relationship between the multigenerational reproduction of inequality and institutional factors, such as the influences of vocational education and training system in Germany (Hertel and Groh-Samberg 2014) and association with welfare systems in European countries (Deindl and Tieben, 2017). Other institutional contexts may also be particularly consequential for three-generational mobility. For instance, cross-national differences in the university tuition fee system may determine the degrees to which family wealth affect students' educational choices; legal system of inheritance taxation may impact the degree to which family pass on accumulated wealth over generations; health care service system may explain the gaps of health conditions of grandparents in different countries, which in turn may affect the grandparents-grandchild interaction and availability of grandparental support. Hertel and Groh-Samberg (2014) speculated that while industrial countries
may share a common pattern of the three-generational mobility process, the mechanisms would vary with institutional arrangements. The thesis has revealed a non-linear grandparental effect on grandchildren's education: they are particularly strong among the advantaged, which is in line with previous three-generational mobility studies conducted in different countries (e.g., Chan and Boliver, 2013; Chiang and Park, 2014; Hällsten, 2014). I am interested in the questions of whether this nonlinear process can be observed in wider social contexts and of how this process is related to institutional settings.

Cross-national research can be inherently challenging particularly in constructing data of multigenerational family lineages that contain comparable measures of family origins in cross-national surveys. It will be possible to do so if one moves from class inequalities to income inequalities. In addition, because the observed direct grandparental effects, if they exist, are likely to be modest, the future crossnational comparison may need to have a large sample size to hold up the statistical explanatory power.

Future studies are needed to examine the question of whether multi-generational inequalities that are observed in the present thesis can be generalised to the UK immigrants. I identified two issues that are relevant to grandparental effects in migrant families. First, multigenerational inequalities may appear to be weak among grandchildren from immigrant families due to family relocation. Section 4.4.3 shows that grandparental class effects on education disappeared if grandparents were alive but did not maintain frequent contact with their offspring. It is relatively common that when the parental generation moved into the UK, grandparents who stayed in
country of origin ${ }^{41}$ were separated from the grandchildren and might have difficulties with remaining up to date with grandchildren' lives. Multigenerational inequalities that rely on skipped-generational bonding may, therefore, matter less in relation to educational and class achievements for grandchildren from immigrant families than for those whose grandparents lived in the UK.

Second, multigenerational inequalities may appear to be strong among grandchildren from immigrant families due to the chance that the observed grandparental effects may have picked up underestimated effects of immigrant parents. First-generation immigrant parents are likely to suffer downward social mobility largely due to discrimination in the labour market. The occupations available to the migrants were often incommensurate with their educational qualifications and they could not retain the class positions as high as that which their education allowed in their country of origin. These migrant parents may have a strong desire to encourage their children to pursue education and regain family privilege, which is not fully reflected in their class positions. Observed grandparental effects may pick up underestimated effects of migrant parental class, and as a result, grandparental effects may be observed in the absence of 'real' causal associations between grandparents and grandchildren; this measurement issue would be more severe if the model lacks sufficient measures of parental characteristics such as education, parenting style, and expectation for children's education. Future studies on multigenerational inequalities among migrant families need to be cautious in addressing the causal effects of grandparents and may

[^35]benefit from the empirical evidence of the mechanisms through which grandparental effects operate.

### 7.6 Overall conclusion

This thesis has contributed to the literature by analysing the grandparental effects in perpetuating the inequalities driven by family origins in educational and class attainments. Combining British nationally representative data and appropriate statistical modelling techniques, the thesis has accomplished the aims set out in the introduction.

This research explores associations in social attainments across three generations in contemporary Britain, a country which is diagnosed as having 'a deep social mobility problem’ (Social Mobility Commission, 2016, p.iii). The overarching conclusion of this research is that independent of parental characteristics, grandparents' social class is significantly associated with grandchildren's education and class attainments. The first order Markovian chain does not represent social mobility in contemporary Britain; rather, family advantages that shape individuals' education and class outcomes can be extended to the generation of grandparents.

Grandparent class has significant impacts on grandchildren's attainment even after parents' social class, education, and economic resources have been taken into consideration. Grandparents may transfer various types of resources directly to grandchildren or serve as role models or an important constituent of family norms. Some of these mechanisms require intensive contact, and thus they are contingent on
the living status of grandparents; the others may operate without contact between grandparents and grandchildren. The findings provide empirical evidence supporting both of these mechanisms. Grandparent effects continued to be significant on grandchildren's education even when grandparents have passed away or did not have frequent face-to-face interaction; however, grandparental effects disappeared when grandparents were alive but lost regular contact with the offspring.

Grandchildren originating from advantaged families are found to be the main beneficiaries of grandparental effects because they were more likely to possess the salariat grandparents and grandparental effects on education were also stronger in this group. This indicates the persistence of family advantages in access to higher education in contemporary Britain. Taking a three-generational perspective, I found that while the chance of disadvantaged grandsons attaining university degrees increased to a limited extent during the 1990s higher educational expansion, it was advantaged grandchildren, particularly those granddaughters of salariat grandparents, who took the most advantage of the increased number of universities. The persistence of inequalities in relation to family origins seriously compromised the promising role of higher education as a path for social mobility.

Grandparental effects were not limited in education. While education was the main channel through which grandparental effects operated, education did not explain away the direct effects of grandparental class on grandsons' class. Despite educational qualifications being taken into account, maternal grandparental class still exerted modest but significant effects on grandsons' success in the labour market. In other words, for grandsons who achieved similar education and were born to similar socioeconomic parental origins, those who had salariat maternal grandparents still
had a better chance in the job opportunities than those of working-class maternal grandparents.

The findings that grandchildren's life chances were significantly associated with grandparental class over and above parental effects show that social mobility in contemporary Britain could not be fully described by a first order Markovian chain process. Family advantages are maintained over generations; they outlive individuals (Mare, 2011). The thesis suggests that the conventional social mobility approach based on parent-child associations may overestimate the effects of parental characteristics because of the confounding effects that occur with what should rather be understood as the grandparental effects. Meanwhile, the lack of measures of grandparental social positions may risk an underestimation of the total effects of family origins, particularly in the dimension of education. In contrast, the analyses of inequalities in education and class attainment that measure family origins from a three-generational perspective are essential to the development of an adequate understanding of the processes through which social inequalities are associated with family origins.

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## Appendix 2

Table A2.1 Distribution of grandparental class in the analytic samples

|  | Sample 1 |  | Sample 2 |
| :--- | :---: | :---: | :---: |
| Grandparental class | Maternal | Paternal | Grandparents |
| Salariat | grandparents | grandparents |  |
| Intermediate | 21.5 | 19.8 | 20.7 |
| Small-employer | 9.8 | 9.5 | 9.6 |
| Lo supervisors \& technicians | 15.6 | 15.9 | 15.7 |
| Working-class | 16.0 | 18.1 | 17.0 |
| N | 37.1 | 36.8 | 37.0 |

Source: BHPS \& UKHLS; grandchildren aged between 25 and 65 years.
Note: Sample 1 refers to the sample where each grandchild is observed once and both maternal and paternal grandparents are incorporated simultaneously. Sample 2 refers to the sample where the grandchild who had the available information on both maternal and paternal lineages is observed twice and maternal and paternal grandparents are pooled together.

## A2.1 Log-linear Modelling Formulas

For the research question of whether grandparental class has significant relations net of parental class to grandchildren's class, three two-way associations can be specified in unsaturated models: (1) an adjacent two-generational association between grandparents and parents; (2) an adjacent two-generational association between parents and grandchildren; (3) a skipped-generational association between grandparents and grandchildren. ${ }^{42}$

The null hypothesis implies a Markovian-chain mobility pattern that the parentsgrandchild association completely represent the whole impacts of family origins and thus grandparents' class positions are not directly associated with grandchildren's class if parental effects are taken into account. Based on the outlined mobility associations, the null hypothesis which assumes that grandparental class is not directly related to grandchildren's class would be reflected in a model that only contains adjacent two-generational associations between grandparents and parents and between parents and grandchildren. This model is referred to as 'conditional independence', as grandparents' class and grandchildren's class are only conditional independent on the adjacent two-generational associations mentioned above. In the situation in which there was no net grandparental effect, conditional independence models would fit the data well. For this reason, conditional independence models serve as the baseline models for studying the subsequent three-generational mobility models.

[^36]A model that incorporates the skipped-generational association between grandparents and their grandchildren is produced from the alternative hypothesis that implies a grandparents-grandchild mobility association independent of parental effects. This model that takes into account all three two-way associations is referred to as the 'full association models'. If the net grandparental effect exists, the full association models are expected to fit the data well and show improvement of the model fit indexes relative to those of conditional independence models. I compare the conditional independence models and full association models to investigate the research question of whether or not there is a direct grandparents-grandchild association independent of parental effects in three-generational mobility.

A contingency table that represents three-generational mobility has three dimensions representing grandparents', parents' and grandchildren's class position, indexed by i $=1, \ldots, \mathrm{I}, \mathrm{j}=1, \ldots, \mathrm{~J}$, and $\mathrm{k}=1, \ldots, \mathrm{~K}$, respectively. In the BHPS sample with fiveclass NS-SEC scheme, $\mathrm{i}=5, \mathrm{j}=5$ and $\mathrm{k}=5$; in the the UK Household Longitudinal Study sample with three-class NS-SEC scheme, $\mathrm{i}=3, \mathrm{j}=3$ and $\mathrm{k}=3$. The expected frequency in the $i j k$ th cell of the table is denoted as $\mathrm{f}_{\mathrm{ijk}}$. There is also a function of a constant term, m .

In a contingency table representing perfect mobility in which the joint distribution of grandparents' and parents' and grandchildren's classes is determined by their margins, this complete independence can be expressed as:
$\mathrm{f}_{\mathrm{ijk}}=\mathrm{mt}_{\mathrm{it}_{\mathrm{j}} \mathrm{t}_{\mathrm{k}}}$
$\mathrm{t}_{\mathrm{i}}$ denotes the effects associated with being found in the $i$ th grandparental class and $\mathrm{t}_{\mathrm{j}}$ and $\mathrm{t}_{\mathrm{k}}$ are the effects associated with being found in the $j$ th parental class and $k \mathrm{th}$ grandchildren's class.

In the model, the logarithms transformation of the expected frequency in each cells, $\mathrm{F}_{\mathrm{ijk}}$, are expressed as:

$$
\mathrm{F}_{\mathrm{ijk}}=1+\mathrm{l}_{\mathrm{i}}^{\mathrm{G}}+\mathrm{l}_{\mathrm{j}}^{\mathrm{P}}+\mathrm{l}_{\mathrm{k}}^{\mathrm{C}}
$$

In this equation, each effect is labelled but also distinguished by their superscript, G for grandparents, P for parents and C for grandchildren. Here the expected frequency depends on values indexed by $\mathrm{i}, \mathrm{j}$ and k but not interaction of any combination of them.

For the conditional independence model which assumes a first-order Markovian chain (two adjacent-generational associations but not the direct grandparentsgrandchild associations), the logarithms transformation of the expected frequency in each cell are given by:
$\mathrm{F}_{\mathrm{ijk}}=1+1_{\mathrm{i}}{ }^{\mathrm{G}}+1_{\mathrm{j}}{ }^{\mathrm{P}}+1_{\mathrm{k}}{ }^{\mathrm{C}}+1_{\mathrm{ij}}{ }^{\mathrm{GP}}+\mathrm{l}_{\mathrm{jk}}{ }^{\mathrm{PC}}$

For the full association model which includes two adjacent-generational associations and also direct grandparents-grandchild associations but not the three-way interaction among them, the logarithms transformation of the expected frequency can be expressed as:
$\mathrm{F}_{\mathrm{ijk}}=1+\mathrm{l}_{\mathrm{i}}^{\mathrm{G}}+\mathrm{l}_{\mathrm{j}}^{\mathrm{P}}+\mathrm{l}_{\mathrm{k}}{ }^{\mathrm{C}}+\mathrm{l}_{\mathrm{ij}}{ }^{\mathrm{GP}}+\mathrm{l}_{\mathrm{jk}}{ }^{\mathrm{PC}}+\mathrm{l}_{\mathrm{ik}}{ }^{\mathrm{GC}}$

## A2.2 Sampling zero in log-linear models

Two methods can be applied to address the issue of sampling zero. First, one can collapse categories of involved variables in a reasonable manner to reduce the possibility of sampling zero. In the present study, however, doing so may raise another measurement issue of grandparental effects. For example, one may be tempted to use three-fold version of NS-SEC scheme. This method effectively solves sampling zero but grandparental effects that the model captures may result from the crudeness of measurement of parental class. That is, measured grandparental effects might pick up some effects of the differences among refined parental class, say, the differences between intermediate occupations and small employers, that are lumped together under collapsed three-fold version class classification. It has to be admitted that the five-category class classification is already rather crude; collapsing into even cruder classification would further endanger the measurement accuracy ${ }^{43}$.

Another solution of addressing problems caused by empty cells is to add a small constant such as $1 / 2$ to each cell (Agresti, 2002). This method reduces the bias in the

[^37]estimation of odd ratios when applied to a saturated model ${ }^{44}$. However, for an unsaturated model as the one of three-generational mobility with the assumption that grandparents-grandchildren association exists and its strength remains constant with the controlling of parental class, doing so may result in conservative estimations of effects and test statistics ${ }^{45}$ (Agresti, 2002).

[^38]${ }^{45}$ Goodman (1971) recommended adding a small constant to each cell to achieve convergence of fitting algorithms for saturated models. Doing so shrinks the estimated odds ratios that are larger than 1 and inflates estimates that are 0 .

This method is expected to reduce the bias in estimating odds ratio. A saturated model of three-generational mobility is a model that considers not only three two-way associations: grandparents-parents, parents-grandchild and grandparents-grandchild; but also a three-way association among grandparents, parents and grandchild. This three-way association describes the question of whether the grandparents-grandchild associations vary by parental characteristics, which, however, is not of the main interest of research questions here.

Agresti pointed out that adding a small constant to each cell for an unsaturated model would smooth the data too much.

## A2.3 Binary and Ordinal Logistic Regressions

## Binomial Logistic regression modelling

Binomial logistic regression modelling is a regression method for binary outcome variables. Logistic regression modelling is used in the chapter on educational expansion to estimate the probability of attaining higher education; it is also used in the chapter on class attainment to estimate the probability of working as small employers (see Section 6.3.1); it is also a part of the path analysis used in the same chapter

The following explanation takes the outcome variable of whether grandchildren worked as small employers (coded as 1 ) or other occupations (coded as 0 ) for examples.

The formula of binominal logistic regression model with a single explanatory variable can be written as
$\log \left(\frac{\operatorname{Pr}(\mathrm{Y})}{1-\operatorname{Pr}(\mathrm{Y})}\right)=\alpha+\beta_{1} x_{1}$
where the probability that $\mathrm{Y}=1$ is represented as $\operatorname{Pr}(\mathrm{Y})$ and the probability that $\mathrm{Y}=$ 0 is represented as $1-\operatorname{Pr}(\mathrm{Y})$. This formula implies that the possibility of Y changes as the explanatory variable $x_{1}$ changes.

I use the concept of odds ratio to interpret the coefficients $\beta$. The odds of $\mathrm{Y}=1$ can be represented as the following exponential relationship
$\frac{\operatorname{Pr}(\mathrm{Y})}{1-\operatorname{Pr}(\mathrm{Y})}=\exp \left(\alpha+\beta_{1} x_{1}\right)=e^{\alpha}\left(e^{\beta 1}\right)^{x_{1}}$

The odds multiply by $\mathrm{e}^{\beta}$ as $\mathrm{x}_{1}$ increases one unit. For example, the result of the binomial logistic regression modelling where grandchildren's education, grandparental class and parental class are taken as the explanatory variables and the state of grandchildren working as small employers as the outcome variable indicates the regression coefficient of having small employer instead of working-class grandparents is .44 and in this case, the odds ratio is approximately 1.55 (because $\left.\mathrm{e}^{0.44}=2.72^{0.44}=1.55\right)$ which suggest that after controlling for parental class and grandsons' own education, for grandsons of small-employer grandparents, the chance of working also as small-employers is 1.55 times as high as those of working-class grandparents.

## Ordinal logistic regression modelling

Ordinal logistic regression modelling is employed as one of the main statistical methods to test the hypotheses about grandparental effects on relative mobility chances of grandchildren. Ordered logistic regression method is mainly employed in the two chapters on education and one chapter on class; it also plays a key role in the structural equation modelling used in the chapter on class. Apart from log-linear modelling, ordinal logistic regression modelling is also commonly used in studies on persistency of social mobility over two generations and over three generations (see Breen, et al., 2009; Chan and Boliver, 2013; Bol and Kalmijn,2016).

The majority of the ordered logistic models used in this thesis take educational qualifications or class positions as the outcome variables. The measurement of educational qualifications can be regarded as following a hierarchical order. For example, having attained a university degree or higher is considered as holding a
more advantaged credential than having a sub-degree (i.e., further educational (FE) qualification) or any qualification at lower levels; having a further educational qualification is considered as more advantaged than having an A-level qualification or any qualification lower than that. The ordinal logistic regression modelling assumes that the distances between each category are allowed to be unequal. For example, in an ordered logistic regression on education, the distance between university degree and further education does not have to be the same as that between further education and A-level qualification (Statacorp, 2015).

In the case of an ordered logistic regression model with educational credentials as the outcome variables (denoted by $\mathrm{Y}_{\mathrm{i}}$ ), educational success that underlies the levels of the outcome variable is treated as an unobserved continuous variable, referred to as $\mathrm{Y}^{*}$ in the following demonstration. This latent variable is divided into intervals, which are the levels that are actually observed in the ordered categorical variables. The parallel assumption is discussed in the Appendix 2.4.

The structural model with a single independent variable (x) would be
$Y^{*}{ }_{i}=\alpha+\beta x_{i}+\varepsilon_{i}$
where i denotes the observation and $\varepsilon$ denotes a random error.

This continuous latent variable $Y^{*}$ has a number of threshold points (some authors and statistical software refer to thresholds as cutpoints). When the value of this latent variable has reached a threshold point, the response of the observed categorical variable would fall in a certain category (which is referred to as $m$ ). The number of threshold points is the value of the number of observed categories minus 1 . The
probability of an observed outcome falling into the $m$ category for specific values of $x$ can therefore be represented
$\operatorname{Pr}(Y=m \mid x)=\operatorname{Pr}\left(\kappa_{m-1} \leq Y_{i} \leq \kappa_{m} \mid x\right)$

Where $\kappa$ indicates threshold points.

For example, when educational qualification is measured with three levels:
$Y_{i}=l($ Tertiary education $)$ if $Y^{*}{ }_{i} \leq \kappa_{l}$
$Y_{i}=2$ (Secondary education) if $\kappa_{1} \leq Y^{*}{ }_{i} \leq \kappa_{2}$
$Y_{i}=3$ (Primary education) if $Y^{*}{ }_{i} \geq \kappa_{2}$

An ordinal logistic regression formula has a similar form to that of a binary logistic regression model. The formula of an ordinal logistic regression formula with a single explanatory variable can be written as
$\operatorname{logit}[\operatorname{Pr}(Y \leq j)]=\kappa_{j}+\beta x_{l}, j=1, \ldots . . m-1 ;$
while the odds that an observed outcome is less than or equal to $j$ against greater than $j$ given specific values of x are:
$\operatorname{Pr}(\mathrm{Y} \leq \mathrm{j})=\frac{\exp \left(\alpha_{j}+\beta x_{1}\right)}{1+\exp \left(\alpha_{j}+\beta x_{1}\right)}$

In the preceding formula, the combined categories $1-\mathrm{j}$ are taken as a single category and the combined categories $\mathrm{j}+1$ as a second category. The $\beta$ and thresholds $\kappa_{\mathrm{j}}$ are the parameters to be identified. The parameter $\beta$ reports the effects of the explanatory variable $x$ on the $\log$ of odd ratio of response in category j or
lower categories. The parameter $\beta$ does not come with a $j$ subscript because the effect of x is constant as the observed outcome variable Y is found in any higher instead of lower levels within m categories.

Returning to the example where the variable of three-level educational qualification is taken as the outcome variable, one may say that the odds that a respondent has tertiary educational qualification rather than any lower qualifications can be defined as
$\operatorname{logit}[\operatorname{Pr}(\mathrm{Y} \leq 1)]=\kappa_{1}+\beta \mathrm{x}_{1}$

The odds that a respondent has tertiary or secondary educational qualifications rather than a lower qualification (i.e., primary education) can be defined as
$\operatorname{logit}[\operatorname{Pr}(\mathrm{Y} \leq 2)]=\kappa_{2}+\beta \mathrm{x}_{1}$

The results of ordinal logistic regression can be interpreted in the forms of odds ratios. Regarding the above examples, one may say that as the variable x changes by one unit, the probability of a respondent attaining a higher rather than lower educational qualification changes would be $\mathrm{e}^{\beta}$ times better or worse.

## A 2.4 Parallel assumption of the ordinal logistic regression

One of the assumptions that underlie the ordinal logistic regression is parallel regression assumption (or, proportional odds assumption); the ordinal logistic regression needs to meet the parallel regression assumption to produce correct model estimation. Using Brant test, I found that the key models in this thesis violate the parallel regression assumption. I argue, however, that despite that the parallel regression assumption does not hold, ordinal logistic regression modelling is still an appropriate method to the research questions of interest.

Looking back to the equations where the variable of three-level educational qualification is taken as the outcome variable and a single explanatory variable is used;
$\operatorname{logit}[\operatorname{Pr}(\mathrm{Y} \leq 1)]=\kappa_{1}+\beta \mathrm{x}_{1}$
$\operatorname{logit}[\operatorname{Pr}(\mathrm{Y} \leq 2)]=\kappa_{2}+\beta \mathrm{x}_{1}$

The slope coefficient $\beta$ is identical for each equation. Ordinal logistic regression assumes that the slope coefficient representing the association between, say, the primary level education and other higher-level education is the same as that representing the association between the secondary-level education and higher educational qualification. This assumption is not necessarily always true.

A Brant test compares slope coefficients of the $m-1$ binary logistic regressions, where $m$ refers to the number of categories of ordinal variables. It examines the slope coefficients of binary logistic regression for the lowest category against all higher categories and those of binary logistic regression for the next lowest category
and all higher categories. According to Brant test results, the parallel regression assumption has been violated in the ordinal logistical regressions I propose.

In practice, the parallel regression assumption is frequently violated. As a caveat regarding the parallel regression assumption, in the case in which the assumption does not hold, researchers should consider alternative models that do not impose the constraint of parallel regression (Long and Freese, 2006). Using the Stata program gologit2 (Williams, 2006), I apply less restrictive models and find that these less restrictive models (1) are not statistically superior as compared with the current ordinal regression models2; (2) do not show any substantial improvement in understanding the research questions.

The gologit2 program fits generalized ordered logit models for ordered categorical outcome variables. A generalize ordered logit model where only a single independent variable is used can be defined as (Williams, 2006. p.59)
$\operatorname{Pr}(\mathrm{Y} \leq \mathrm{j})=\frac{\exp \left(\alpha_{j}+\beta_{j} x_{1}\right)}{1+\exp \left(\alpha_{j}+\beta_{j} x_{1}\right)}, j=1, \ldots . . \mathrm{m}-1 ;$
where once again, $m$ refers to as the number of the categories of the ordinal outcome variable.

There are three special cases of the generalized ordered logit modelling that the gologit2 program can estimate: the parallel-lines model (i.e., conventional ordinal logistic regression), the partial proportional odds model, and the logistic regression model. First I compare the logistic regression modelling with ordinal logistic regression which has the parallel regression assumption imposed.

The gologit2 program provides a series of binary logistic regressions that estimate the outcome variable in which the categories are combined. In the model on threelevel education (i.e., $\mathrm{m}=3$ ), for $\mathrm{J}=1$ category 1 is contrasted with categories 2 and 3; for $\mathrm{J}=2$ the contrast is between categories 1 and 2 versus 3 . Please note that the slope coefficients $\beta$ for these two regressions are estimated separately and therefore are allowed to vary. Without assuming the parallel regression coefficients, this model has more parameters and is less restrictive than is ordinal logistic regression in which coefficients are constrained to be equal as the outcome variables shift across different categories.

Comparing the BIC index of the binary logistic regressions with that of ordinary logistic regression, I find that ordinary logistic regressions, despite of violating the parallel regression assumption, fit the data significantly better than do binary logistic regression. In other words, freeing the parallel regression assumption does not improve, but reduce, the model fit. In this case I argue that this finding provides a strong support for the application of ordinal logistic regression in terms of model fit.

Next I fit partial proportional odds models which are less restrictive than ordinal logistic regression but more parsimonious than the binary logistic regressions I discussed above. In the partial proportional odds model, some of the slope coefficients $\beta$ can be freed to vary for all categories $j$, while other can be constrained to be equal. In this case, I can relax the constraint of the parallel regression assumption for those variables in where this assumption does not hold. The gologit2 models with the autofit option allow to simplify the process of identifying the constraints that best fit the data. It employs a backward stepwise procedure. Starting from a totally constrained model, the same model as a series of binary logistic
regression, the gologit 2 models use a series of Wald tests on each variable to examine whether its coefficients satisfy the parallel regression assumption. The process is repeated until no more variables are found to meet the parallel regression assumption.

Using the gologit2 program and its autofit option, I am able to fit partial proportional odds models that do not violate the parallel regression assumption. I find that the majority of family origins measurements do not violate the parallel regression assumption. The most of the variables that do not meet the parallel regression assumption are control variables, such as data sources, grandchildren's birth cohorts and gender. These results are observed in the main ordinal logistic regression models that I use in the present research on grandchildren's education and class. I demonstrate in Appendix Table A2.2 the comparison between ordinal logistic regression and partial proportional odds models estimated by the gologit 2 command the autofit option while modelling on the grandchildren's five-level educational qualification.

Table A2.2 Ordinal logistic regression and partial proportional odds logistic regression on grandchildren's educational qualification

|  | Ordinal | Proportional odds |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{gathered} 1 \mathrm{vs} \\ 2,3,4,5 \end{gathered}$ | $\begin{aligned} & 1,2 \text { vs } \\ & 3,4,5 \end{aligned}$ | $1,2,3 \mathrm{vs}$ | $1,2,3,4 \mathrm{vs}$ $5$ |
| Grandparental class (Working class as base) |  |  |  |  |  |
| Salariat | $0.292^{* * *}$ | $0.292 * * *$ | $0.292^{* *}$ | $0.292^{* * *}$ | $0.292^{* *}$ |
| Intermediate occupations | 0.163 * | 0.163 * | $0.163^{*}$ | 0.163 * | 0.163 * |
| Small employers | $0.294 * *$ | $0.294 * * *$ | $0.294^{* * *}$ | $0.294^{* * *}$ | $0.294^{* * *}$ |
| Lower supervisor and technician | $0.197 * *$ | $0.197 * *$ | $0.197 * *$ | $0.197 * *$ | $0.197 * *$ |
| Father class (Working class as base) |  |  |  |  |  |
| Salariat | $0.331^{* * *}$ | $0.427^{* * *}$ | $0.292^{* *}$ | $0.267^{* *}$ | $0.436^{* * *}$ |
| Intermediate occupations | $0.426^{* * *}$ | $0.424^{* * *}$ | $0.424^{* * *}$ | $0.424^{* * *}$ | $0.424^{* * *}$ |
| Small employers | 0.114 | 0.122 | 0.122 | 0.122 | 0.122 |
| Lower supervisor and technician | 0.113 | 0.118 | 0.118 | 0.118 | 0.118 |
| Mother class (Working class as base) |  |  |  |  |  |
| Salariat | $0.316^{* * *}$ | $0.303^{* * *}$ | $0.303^{* * *}$ | $0.303^{* * *}$ | $0.303^{* * *}$ |
| Intermediate occupations | $0.284^{* * *}$ | $0.291{ }^{* * *}$ | $0.291 * *$ | $0.291^{* * *}$ | $0.291 * *$ |
| Small employers | $0.235{ }^{*}$ | $0.241^{*}$ | $0.241^{*}$ | $0.241^{*}$ | $0.241^{*}$ |
| Lower supervisor and technician | -0.184 | -0.184 | -0.184 | -0.184 | -0.184 |
| Father's education (Other or no qualification as base) |  |  |  |  |  |
| Degree | $0.825^{* * *}$ | $0.812^{* * *}$ | $0.812^{* * *}$ | $0.812^{* * *}$ | $0.812^{* * *}$ |
| Other higher degree | $0.583^{* * *}$ | $0.574^{* * *}$ | $0.574^{* * *}$ | $0.574^{* * *}$ | $0.574^{* * *}$ |
| A-level | $0.448^{* * *}$ | $0.554^{* * *}$ | $0.497^{* * *}$ | $0.313^{* * *}$ | $0.399^{* * *}$ |
| GCSE or O-level | $0.342 * * *$ | $0.323^{* * *}$ | 0.323 *** | $0.323^{* * *}$ | 0.323 *** |
| Mother's education (Other or no qualification as base) |  |  |  |  |  |
| Degree | $0.828^{* * *}$ | $0.837^{* * *}$ | $0.837^{* * *}$ | $0.837^{* * *}$ | $0.837^{* * *}$ |
| Other higher degree | $0.728^{* * *}$ | $0.723^{* * *}$ | $0.723^{* * *}$ | $0.723^{* * *}$ | $0.723^{* * *}$ |
| A-level | $0.517^{* * *}$ | $0.510^{* * *}$ | $0.510^{* * *}$ | $0.510^{* * *}$ | $0.510^{* * *}$ |
| GCSE or O-level | $0.328^{* * *}$ |  | $0.301{ }^{* * *}$ | $0.301{ }^{* * *}$ | $0.301{ }^{* * *}$ |
| Economic |  |  |  |  |  |
| House ownership | $0.613^{* * *}$ | $0.622^{* * *}$ | $0.622^{* * *}$ | $0.622^{* * *}$ | $0.622^{* * *}$ |
| Monthly income | $0.144^{* *}$ | $0.136 * *$ | $0.136^{* *}$ | $0.136 * *$ | $0.136^{* *}$ |
| Control variables |  |  |  |  |  |
| Age | 0.05 | -0.012 | -0.009 | $0.136 * *$ | $0.147^{* *}$ |
| Age-squared | -0.001 | 0.000 | 0.000 | -0.002* | -0.002* |
| Birth cohorts (1960s as base) |  |  |  |  |  |
| 1970s | $0.646^{* * *}$ | $0.554^{* * *}$ | $0.554^{* * *}$ | $0.554^{* * *}$ | $0.554^{* * *}$ |
| 1980s | 0.269 | $0.334^{*}$ | 0.129 | 0.034 | 0.257 |
| 1990s | 0.038 | $0.659 * *$ | 0.21 | -0.427* | -0.282 |
| White (non-white as base) | $-0.972^{* * *}$ | $-0.976^{* * *}$ | -0.976*** | -0.976*** | -0.976*** |
| Region (England base) |  |  |  |  |  |
| Wales | -0.081 | -0.08 | -0.08 | -0.08 | -0.08 |
| Scotland | 0.220 ** | $0.329^{*}$ | $0.422^{* * *}$ | 0.185 | -0.13 |
| N.I. | 0.300 ** | $0.295 * *$ | $0.295 * *$ | $0.295 * *$ | $0.295 * *$ |
| UKHLS (BHPS as base) | $0.631{ }^{* *}$ | $0.967^{* * *}$ | $0.568{ }^{* * *}$ | $0.761^{* * *}$ | $0.551^{* * *}$ |
| Male (female as base) | $0.495^{* * *}$ | $0.785^{* * *}$ | $0.442^{* * *}$ | $0.458^{* * *}$ | $0.491^{* * *}$ |

Notes: grandchildren's educational qualification coding: $1=$ degree; $2=$ sub-degree; $3=$ A-level; $4=$ GCSE/O-level; $5=$ other/no qualification; coefficients in which the parallel regression assumption is relaxed are marked as grey shaded; $\mathrm{N}=7594$ ); ${ }^{*} p<0.05,{ }^{* *} p<0.01,{ }^{* * *} p<0.001$. Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

## Appendix 3

Table A3.1 Absolute mobility rates between three generations for grandchildren over 30

|  | G-P | P-C |  |  | G-C |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Grandsons | Granddaughters | Grandsons | Granddaughters |  |
| Immobility | 32.2 | 35.9 | 35.9 | 29.0 | 25.9 |  |
| Total Mobility | 68.7 | 64.1 | 65.1 | 71.0 | 74.1 |  |
|  |  |  |  |  |  |  |
| Upward | 42.0 | 26.8 | 29.5 | 41.1 | 44.8 |  |
| Downward | 16.2 | 29.7 | 26.8 | 21.4 | 19.0 |  |
| Horizontal | 9.6 | 7.6 | 7.8 | 8.6 | 10.3 |  |
| Obs |  |  |  |  |  |  |

Notes: G-P denotes the movement between grandparents to parents;
$\mathrm{P}-\mathrm{C}$ denotes the movement between parents and grandchildren;
G-C denotes the movement between grandparents and grandchildren.
Source: BHPS and UKHLS; grandchildren aged between 30 and 65 years

Table A3.2 Outflow tables for parental class, father class, and mother's class

| Grandparental class | Parental Class |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Salariat | Intermediate occupation | Smallemployers | Lo supervisor \& technicians | Workingclass |
| Salariat | 60.0 | 14.5 | 7.2 | 7.5 | 10.8 |
| Intermediate | 49.5 | 20.3 | 8.9 | 8.5 | 12.9 |
| Small-employers | 33.0 | 15.8 | 18.1 | 7.8 | 25.3 |
| Lo supervisor \& technicians | 41.5 | 17.0 | 9.2 | 12.1 | 20.3 |
| Working-class | 27.4 | 15.4 | 11.1 | 13.6 | 32.5 |
| $\underline{\mathrm{N}=9,599}$ |  |  |  |  |  |
| Paternal grandparents' class | Salariat | Intermediate occupation | Father's class <br> Smallemployers | Lo supervisor \& technicians | Workingclass |
| Salariat | 57.9 | 9.6 | 9.6 | 10.0 | 12.9 |
| Intermediate | 45.3 | 11.5 | 8.5 | 17.0 | 17.7 |
| Small-employers | 31.4 | 6.0 | 25.0 | 10.9 | 26.8 |
| Lo supervisor \& technicians | 38.3 | 8.6 | 13.0 | 20.2 | 19.9 |
| Working-class | 21.1 | 7.3 | 15.4 | 19.0 | 37.2 |
| $\underline{\mathrm{N}=4,096}$ |  |  |  |  |  |
|  | Mother's class |  |  |  |  |
| Maternal grandparents class | Salariat | Intermediate occupation | Smallemployers | Lo supervisor \& technicians | Workingclass |
| Salariat | 40.8 | 23.0 | 6.7 | 3.9 | 25.7 |
| Intermediate | 33.4 | 22.9 | 10.1 | 3.6 | 30.1 |
| Small-employers | 18.1 | 19.7 | 9.0 | 6.0 | 47.2 |
| Lo supervisor \& technicians | 21.6 | 22.0 | 3.4 | 5.4 | 47.7 |
| Working-class | 14.5 | 17.6 | 4.4 | 5.4 | 58.1 |
| $\mathrm{N}=5,213$ |  |  |  |  |  |
| $\square$ Immobility | Downward mobility |  | Upward mobility | Horizontal mobility |  |

Notes: Figures refer to row percentages; parental class is measured by the dominance approach.
Source: BHPS and UKHLS; grandchildren aged between 25 and 65.

Figure A3.1 Outflow rates from parents' class to grandchildren' class
Panel A: Mobility rates when grandchildren had salariat grandparents


Panel B: Mobility rates when grandchildren had working-class parents.


Notes: values refer to row percentages; in Panel A, for grandsons, $\mathrm{N}=972$, for granddaughters, $\mathrm{N}=841$; in Panel B , for grandsons, $\mathrm{N}=1,953$, for granddaughters, $\mathrm{N}=1,482$.
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Figure A3.1 reports the outflow mobility rates from parents to children, separated by grandparents' class. First, from grandsons and granddaughters, immobility across three generation is common in the salariat class and the working class. Over 50 per cent of grandchildren who had salariat grandparents and parents worked in a similar class position (see Figure A3.1 Panel A). About 51 per cent of grandsons and 44 per cent of granddaughters whose grandparents and parents both have been in the working class are found in working-class occupations themselves (See Figure A3.1 Panel B). Second, grandchildren of salariat grandparents are more likely to be upwardly mobile into the salariat class compared to those who had similar parents but had working-class grandparents. For example, among grandchildren of salariat grandparents, 36 per cent of grandsons and 31 per cent of granddaughters who had working-class parents return to salariat class. In contrast, 17 per cent of grandsons and 23 per cent of granddaughters whose grandparents and parents both were working-class did the same. Third, long-range downward mobility rates from salariat parents to working-class grandchildren seem to differ between grandchildren of salariat grandparents and those of working-class grandparents by approximately 8 percentage points. Grandparental influences seem to be modest for short-ranged downward mobility rates.

Figure A3.2 Grandchildren's outflow mobility rates by grandparental class with 95\% confidence intervals



Notes: These graphs add 95\% confidence intervals on the basis of Figure 3.1: Panel A and Panel B here correspond Panel A of Figure 3.1; Panel C and Panel D here correspond Panel B of Figure 3.1. Blocks in same colours (i.e., grandchildren of grandparents in the same class positions) add up to 100 per cent. If confidence intervals overlap, it does not mean that the difference is necessarily statistically insignificant (Knezevic, 2008). Sources: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

## Appendix 4

Table A4.1 Demographic compositions of grandchildren's education and data sources

|  | Degrees | Sub- <br> degree | A level |  <br> GCSE | Primary \& no <br> qualification | Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Sex |  |  |  |  |  |  |
| Male | 23.7 | 6.9 | 26.7 | 26.4 | 16.3 | 55.1 |
| Female | 31.8 | 8.6 | 25.0 | 23.6 | 11.0 | 44.9 |
| N |  |  |  |  |  | 10,304 |
| Cohorts |  |  |  |  |  |  |
| pre-1970s | 14.7 | 7.0 | 20.0 | 30.4 | 28.0 | 15.0 |
| 1970s | 25.7 | 8.6 | 27.1 | 24.8 | 13.8 | 33.8 |
| 1980s | 32.2 | 7.3 | 26.9 | 23.8 | 9.9 | 51.2 |
| N |  |  |  |  |  | 10,298 |
|  |  |  |  |  |  |  |
| Race |  |  |  |  |  |  |
| Non-white | 46.5 | 9.9 | 21.8 | 13.5 | 8.3 | 13.1 |
| White | 24.5 | 7.3 | 26.5 | 26.9 | 14.8 | 86.9 |
| N |  |  |  |  |  | 10,304 |
|  |  |  |  |  |  |  |
| Region |  |  |  |  |  |  |
| England | 28.9 | 7.3 | 25.7 | 25.0 | 13.2 | 73.0 |
| Wales | 19.5 | 6.5 | 26.9 | 27.4 | 19.8 | 9.5 |
| Scotland | 23.3 | 13.5 | 28.9 | 21.3 | 13.0 | 9.8 |
| NI | 27.6 | 5.7 | 23.1 | 28.6 | 15.0 | 7.7 |
| N |  |  |  |  |  | 10,304 |
| Survey |  |  |  |  |  |  |
| BHPS | 22.4 | 6.3 | 26.9 | 27.1 | 17.3 | 55.8 |
| UKHLS | 33.6 | 9.4 | 24.8 | 22.7 | 9.6 | 44.2 |
| N |  |  |  |  |  | 10,304 |
| Total | 27.4 | 7.7 | 25.9 | 25.2 | 13.9 |  |
| N |  |  |  |  |  |  |

Notes: Values refer to row percentages; the whole sample of three-generational lineages is used; $\mathrm{N}=10,304$.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A4.2 Cumulative percentages of grandchildren' education by grandparental class, parental class, and parental education

|  | Grandchildren's education |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Degree | $\geq$ sub-degree | $\geq$ A-level | $\geq$ O-level |
| Grandparental class |  |  |  |  |
| Salariat | 41.3 | 48.3 | 74.9 | 92.9 |
| Intermediate occupations | 34.4 | 42.3 | 69.2 | 93.4 |
| Small employers | 30.8 | 39.6 | 67.0 | 89.8 |
| Lo supervisor \& technician | 24.8 | 31.5 | 60.9 | 87.3 |
| Working class | 18.4 | 25.8 | 54.0 | 82.8 |
| Parental class |  |  |  |  |
| Salariat | 38.4 | 45.4 | 73.5 | 93.5 |
| Intermediate occupations | 26.9 | 37.1 | 66.5 | 89.8 |
| Small employers | 18.7 | 25.1 | 51.8 | 81.6 |
| Lo supervisor \& technician | 16.1 | 23.7 | 53.1 | 81.3 |
| Working class | 13.9 | 20.9 | 46.3 | 79.2 |
| Parental education |  |  |  |  |
| Degree | 52.0 | 59.2 | 84.5 | 96.5 |
| Sub-degrees | 37.6 | 46.5 | 74.7 | 93.8 |
| A-level | 25.4 | 32.7 | 66.1 | 90.3 |
| GCSE \& O-level | 19.3 | 27.3 | 55.3 | 86.6 |
| Primary \& no qualifications | 9.9 | 16.6 | 40.7 | 74.8 |
| Total | 27.7 | 35.3 | 63.0 | 87.8 |

Notes: $\mathrm{N}=7,042$; Values refer to cumulative percentages and should be compared within columns, for example, of grandchildren of salariat grandparents, 41.3 per cent had degree qualification, 48.3 per cent had qualifications higher than sub-degrees (sub-degrees included), 74.9 per cent had qualifications higher than A-levels (A-levels included), 92.9 per cent had qualification higher than O-levels (O-levels included).
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A4.3 Ordered logit regressions predicting grandchildren's educational qualifications

|  | $\mathrm{M} 4-3$ | $\mathrm{M} 4-4$ |
| :--- | :--- | :--- |
| Grandparents' class | $1.435^{* * *}$ |  |
| Salariat | $1.308^{* *}$ | $1.377^{* * *}$ |
| Intermediate occupations | $1.386^{* * *}$ | $1.276^{* *}$ |
| Small employers | $1.241^{* *}$ | $1.373^{* * *}$ |
| Lower supervisor and technician |  | $1.230^{* *}$ |
| Working-class (base) |  |  |

## Grandparents' education

University degree or Higher Education $1.388^{+}$
$\begin{array}{ll}\text { Post-school qualification } & 1.070\end{array}$
$\begin{array}{ll}\text { Some qualification } & 1.084\end{array}$
Never went to school (base)
$\begin{array}{ll}\text { Missing } & 0.839^{*}\end{array}$

## Father's class

| Salariat | $1.227^{+}$ | $1.219^{+}$ |
| :--- | :--- | :--- |
| Intermediate occupations | $1.314^{*}$ | $1.307^{*}$ |
| Small employers | 1.012 | 1.010 |
| Lower supervisor and technician | 1.080 | 1.081 |
| Working-class (base) |  |  |

## Mother's class

| Salariat | $1.515^{* * *}$ | $1.486^{* * *}$ |
| :--- | :--- | :--- |
| Intermediate occupations | $1.310^{* *}$ | $1.305^{* *}$ |
| Small employers | 1.237 | 1.213 |
| Lower supervisor and technician | 0.819 | 0.814 |
| Working-class (base) |  |  |

## Father's education

Degree
Sub- degree
Higher-secondary
Lower-secondary
Primary (base)

## Mother's education

Degree
Sub- degree
Higher-secondary
Lower-secondary
Primary (base)

## House ownership

Monthly income
Control variables:

| Age | 0.998 | 0.996 |
| :--- | :--- | :--- |
| Age squared | 1.000 | 1.000 |
| 1970 s | $1.861^{* * *}$ | $1.852^{* * *}$ |
| 1980 s | $1.390^{* *}$ | $1.358^{*}$ |
| Female | $1.671^{* * *}$ | $1.666^{* * *}$ |
| White | $0.288^{* * *}$ | $0.286^{* * *}$ |


| Wales | 0.987 | 0.987 |
| :--- | :--- | :--- |
| Scotland | $1.369^{* *}$ | $1.363^{* *}$ |
| North Ireland | $1.363^{*}$ | $1.341^{*}$ |
| UKHLS | $1.339^{* * *}$ | $1.365^{* *}$ |
| cut1 | -.558 | -.547 |
| cut2 | 2.250 | 2.243 |
| cut3 | 3.656 | 3.653 |
| cut4 | 4.084 | 4.082 |
| Observations | 7042 | 7042 |
| $B I C$ | 19477 | 19489 |

Notes: The lowest levels used as reference categories ; Exponentiated coefficients; age is centered within birth cohorts; ${ }^{+} p<0.10,{ }^{*} p<0.05,{ }^{* *} p<0.01,{ }^{* * *} p<0.001$
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A4.4 Outflow rates from grandparents' education to grandchildren's education, to parents' education, and to parents' class

Grandchildren's education

| Grandparental <br> education | Degree | Sub-degree | Higher- <br> secondary | lower- <br> secondary | Primary |
| :--- | :---: | :---: | :---: | :---: | :---: |
| University degree | 52.5 | 9.6 | 25.0 | 9.6 | 3.3 |
| Post-school |  |  |  |  |  |
| qualification | 32.8 | 5.7 | 30.4 | 22.9 | 8.2 |
| Some qualification | 36.2 | 7.9 | 28.9 | 19.5 | 7.7 |
| Never went to school | 24.2 | 7.3 | 27.8 | 25.8 | 14.9 |
| Missing | 21.9 | 8.6 | 25.9 | 29.2 | 14.4 |
| Total | 27.7 | 7.5 | 27.8 | 24.8 | 12.2 |

Parents' education

| Grandparental <br> education | Degree | Sub-degree | Higher- <br> secondary | lower- <br> secondary | Primary |
| :--- | ---: | :---: | :---: | :---: | :---: |
| University degree | 54.6 | 14.6 | 20.8 | 7.9 | 2.1 |
| Post-school | 27.0 | 14.6 | 26.3 | 20.7 | 11.5 |
| qualification | 29.0 | 18.4 | 22.3 | 20.0 | 10.4 |
| Some qualification | 13.9 | 13.3 | 20.5 | 23.5 | 28.8 |
| No qualification | 17.1 | 9.7 | 22.7 | 22.5 | 28.1 |
| Missing |  |  |  |  |  |
| Total | 20.4 | 13.3 | 22.3 | 21.8 | 22.2 |


|  | Parents' class |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Grandparental education | Salariat | Intermediate | Small employer | Lower supervisor | Working class |
| University degree | 79.2 | 8.8 | 5.8 | 2.9 | 3.3 |
| Post-school qualification | 56.0 | 13.1 | 9.2 | 9.2 | 12.6 |
| Some qualification | 55.7 | 16.8 | 11.2 | 6.6 | 9.7 |
| No qualification | 38.4 | 15.9 | 12.8 | 12.1 | 20.8 |
| Missing | 37.9 | 15.9 | 12.8 | 11.0 | 22.5 |
| Total | 45.1 | 15.2 | 11.7 | 10.3 | 17.7 |

Notes: Values refer to row percentages.
Source: BHPS and UKHLS; grandchildren aged between 25 and 65.

Table A4.5 Ordered logit regressions predicting grandchildren's educational qualifications with maternal and paternal grandparents' class

|  | Maternal | Paternal |
| :---: | :---: | :---: |
| Grandparents' class |  |  |
| Salariat | $1.348^{* * *}$ | $1.353^{* * *}$ |
| Intermediate occupations | $1.166^{+}$ | $1.197^{+}$ |
| Small employers | $1.405^{* * *}$ | 1.286** |
| Lower supervisor and technician | $1.289^{* *}$ | $1.157^{+}$ |
| Father's class |  |  |
| Salariat | $1.422^{* * *}$ | $1.361{ }^{* * *}$ |
| Intermediate occupations | $1.512^{* * *}$ | $1.552^{* * *}$ |
| Small employers | 1.126 | 1.116 |
| Lower supervisor and technician | 1.148 | 1.090 |
| Mother's class |  |  |
| Salariat | $1.370^{* * *}$ | $1.373^{* * *}$ |
| Intermediate occupations | $1.325^{* * *}$ | $1.330^{* * *}$ |
| Small employers | 1.213 | $1.328^{*}$ |
| Lower supervisor and technician | 0.829 | 0.831 |
| Father's education |  |  |
| Degree | $2.285^{* * *}$ | $2.269^{* * *}$ |
| Sub- degree | $1.810^{* * *}$ | $1.776^{* * *}$ |
| Higher-secondary | $1.539^{* * *}$ | $1.588{ }^{* * *}$ |
| Lower-secondary | $1.427^{* * *}$ | $1.380^{* * *}$ |
| Mother's education |  |  |
| Degree | $2.223^{* * *}$ | $2.354^{* * *}$ |
| Sub- degree | $1.989^{* * *}$ | $2.157^{* * *}$ |
| Higher-secondary | $1.615^{* * *}$ | $1.740^{* * *}$ |
| Lower-secondary | $1.338^{* * *}$ | $1.440^{* * *}$ |
| House ownership | $1.880^{* * *}$ | $1.812^{* * *}$ |
| Monthly income | $1.160^{* *}$ | $1.151{ }^{* *}$ |
| Control variables |  |  |
| Age | 1.044 | 1.058 |
| Age \# Age | 0.999 | 0.999 |
| 1970s (1960s as base) | 1.997*** | $1.817^{* * *}$ |
| 1980s | $1.361 *$ | 1.254 |
| 1990s | 1.092 | 0.982 |
| female | $1.620^{* * *}$ | $1.659^{* * *}$ |
| white | $0.384^{* * *}$ | 0.372*** |
| Wales (English) | 0.948 ** | 0.899 * |
| Scotland | $1.281 * *$ | 1.212* |
| N.I | $1.361 * * *$ | $1.338^{* *}$ |
| UKHLS (BHPS as source) | $1.857^{* * *}$ | $1.906^{* * *}$ |
| Observations | 5497 | 5201 |

Notes: The lowest levels used as reference categories; Exponentiated coefficients; ${ }^{+} p<0.10,{ }^{*} p$ $<0.05,{ }^{* *} p<0.01,{ }^{* * *} p<0.001$.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A4.6 Binary logistic regressions predicting the chance of grandchildren attaining university degrees, with interactions between grandparental class and grandparent contact

|  | M4-10 | M4-11 | M4-12 |
| :---: | :---: | :---: | :---: |
| Grandparental class |  |  |  |
| Salariat | $1.867^{*}$ | 1.360 | 1.810** |
| Intermediate occupations | 2.095* | 1.466 | $1.618+$ |
| Small employers | 1.723 | 1.239 | $1.496+$ |
| Lower supervisor and technician | $1.980^{+}$ | 1.183 | 1.295 |
| Working class (base) | 1.000 | 1.000 | 1.000 |
| Number of alive grandparents |  |  |  |
| 0 | 1.273 |  |  |
| 1 | 1.575 |  |  |
| 2 (base) | 1.000 |  |  |
| Interaction with number of alive grandparents |  |  |  |
| 0 X Salariat | 1.081 |  |  |
| 0 X Intermediate occupations | 0.857 |  |  |
| 0 X Small employers | 0.889 |  |  |
| 0 X Lower supervisor and technician | 0.844 |  |  |
| 0 X Working class (base) | 1.000 |  |  |
| 1 X Salariat | 0.765 |  |  |
| 1 X Intermediate occupations | 0.580 |  |  |
| 1 X Small employers | 0.709 |  |  |
| 1 X Lower supervisor and technician | 0.521 |  |  |
| 1 X Working class (base) | 1.000 |  |  |
| Contact |  | Face-to-face | Any Form |
| daily/once per week (base) |  | 1.000 | 1.000 |
| once per month |  | 1.109 | 1.650 |
| several times per year/less often/never |  | 1.120 | 1.682 |
| decreased |  | 0.978 | 1.009 |
| Interaction with contact |  |  |  |
| once per month X Salariat |  | 1.407 | 0.459 |
| once per month X Intermediate occupations |  | 0.929 | 0.921 |
| once per month X Small employers |  | 0.701 | 0.287 |
| once per month X Lower supervisor and technician |  | 1.296 | 0.881 |
| once per month X Working class |  | 1.000 | 1.000 |
| several times /never X Salariat |  | 1.226 | 0.127** |
| several times /never X Intermediate occupations |  | 1.016 | 0.174* |
| several times /never X Small employers |  | 1.538 | 0.703 |
| several times /never X Lower supervisor and technician |  | 1.198 | 0.836 |
| several times /never X Working class (base) |  | 1.000 | 1.000 |
| decreased X Salariat |  | 1.500 | 1.108 |
| decreased X Intermediate occupations |  | 1.242 | 1.106 |
| decreased X Small employers |  | 1.248 | 1.023 |
| decreased X Lower supervisor and technician |  | 1.409 | 1.291 |

decreased X Working class

## Father's class

## Salariat

Intermediate occupations
Small employers
Lower supervisor and technician
Working class (base)

## Mother's class

Salariat
Intermediate occupations
Small employers
Lower supervisor and technician Working class (base)

## Father's education

Degree
Other higher degree
A-level
GCSE or O-level
Other or no qualification(base)

## Mother's education

Degree
Other higher degree
A-level
GCSE or O-level
Other or no qualification (base)

## Economic resources

House ownership (Yes)
Monthly income

## Control variables

Age
Age squared
1970s (1960s as base)
1980s
Female
White
Wales (England as base)
Scotland
Northern Ireland
1.000
1.000

| 1.000 | 1.000 | 1.000 |
| :--- | :--- | :--- |
| 0.822 | 0.832 | 0.821 |
| $0.680^{+}$ | $0.685^{+}$ | 0.695 |
| 0.729 | 0.724 | 0.739 |
| 0.824 | 0.827 | 0.839 |


| 1.000 | 1.000 | 1.000 |
| :--- | :--- | :--- |
| 0.788 | 0.796 | 0.776 |
| 1.024 | 1.009 | 0.995 |
| 0.533 | 0.530 | 0.517 |
| 0.747 | 0.740 | 0.732 |


| $2.661^{* * *}$ | $2.602^{* * *}$ | $2.701^{* * *}$ |
| :--- | :--- | :--- |
| $2.637^{* * *}$ | $2.564^{* * *}$ | $2.645^{* *}$ |
| $1.735^{* *}$ | $1.736^{* *}$ | $1.728^{*}$ |
| $1.741^{* *}$ | $1.742^{* *}$ | $1.753^{* *}$ |
| 1.000 | 1.000 | 1.000 |


| $2.942^{* * *}$ | $2.886^{* * *}$ | $2.963^{* * *}$ |
| :--- | :--- | :--- |
| $2.054^{* *}$ | $2.047^{* *}$ | $2.048^{* *}$ |
| $2.535^{* * *}$ | $2.535^{* * *}$ | $2.545^{* * *}$ |
| $1.616^{* *}$ | $1.610^{*}$ | $1.599^{*}$ |
| 1.000 | 1.000 | 1.000 |
|  |  |  |
|  |  |  |
| $2.158^{* *}$ | $2.222^{* * *}$ | $2.217^{* * *}$ |
| 0.970 | 0.972 | 0.962 |


| 1.053 | 1.059 | 1.049 |
| :--- | :--- | :--- |
| 0.999 | 0.999 | 0.999 |
| 2.170 | 2.078 | 2.205 |
| 3.402 | 3.253 | 3.468 |
| $1.899^{* * *}$ | $1.898^{* * *}$ | $1.908^{* * *}$ |
| $0.288^{* * *}$ | $0.295^{* * *}$ | $0.286^{* * *}$ |
| 0.609 | 0.599 | 0.596 |
| 0.950 | 0.974 | 0.935 |
| 1.664 | 1.712 | 1.650 |

Notes: The lowest levels used as reference categories ; Exponentiated coefficients; ${ }^{+} p<$ $0.10,{ }^{*} p<0.05,{ }^{* *} p<0.01,{ }^{* * *} p<0.001$
Source: UKHLS; grandchildren aged between 25 and 65 years.

Table A4.7 Model results of latent factor models on parental backgrounds

|  | Estimate | S.E. | Est./S.E. | Two-Tailed P-Value |
| :---: | :---: | :---: | :---: | :---: |
| Factor loadings |  |  |  |  |
| Father's class | 1.000 | 0.000 | 999.000 | 999.000 |
| Mother's class | 1.013 | 0.040 | 25.375 | 0.000 |
| Father's education | 1.167 | 0.030 | 39.146 | 0.000 |
| Mother's education | 1.103 | 0.040 | 27.531 | 0.000 |
| Property ownership | 0.792 | 0.040 | 19.639 | 0.000 |
| Monthly income | 0.446 | 0.017 | 25.700 | 0.000 |
| Covariance |  |  |  |  |
| Father's education WITH |  |  |  |  |
| Father's class | 0.123 | 0.018 | 6.817 | 0.000 |
| Mother's education WITH |  |  |  |  |
| Mother's class | 0.166 | 0.017 | 9.661 | 0.000 |
| Monthly income WITH |  |  |  |  |
| Property ownership | 0.100 | 0.009 | 11.675 | 0.000 |
| Intercepts |  |  |  |  |
| Monthly income | 7.827 | 0.009 | 832.226 | 0.000 |
| Thresholds |  |  |  |  |
| Property ownership | -0.717 | 0.018 | -39.620 | 0.000 |
| Father's class_1 | -0.558 | 0.018 | -30.890 | 0.000 |
| Father's class_2 | -0.175 | 0.017 | -10.073 | 0.000 |
| Father's class_3 | 0.242 | 0.018 | 13.771 | 0.000 |
| Father's class_4 | 0.451 | 0.018 | 25.108 | 0.000 |
| Father's class_1 | -0.185 | 0.017 | -11.120 | 0.000 |
| Father's class_2 | -0.077 | 0.017 | -4.617 | 0.000 |
| Father's class_3 | 0.076 | 0.017 | 4.511 | 0.000 |
| Father's class_4 | 0.628 | 0.018 | 34.944 | 0.000 |
| Father's education_1 | -0.334 | 0.020 | -16.919 | 0.000 |
| Father's education_2 | 0.171 | 0.019 | 8.855 | 0.000 |
| Father's education_3 | 0.682 | 0.021 | 32.757 | 0.000 |
| Father's education_4 | 0.992 | 0.023 | 43.345 | 0.000 |
| Mother's education_1 | -0.245 | 0.017 | -14.112 | 0.000 |
| Mother's education_2 | 0.375 | 0.018 | 21.321 | 0.000 |
| Mother's education_3 | 0.763 | 0.019 | 40.477 | 0.000 |
| Mother's education_4 | 1.156 | 0.022 | 52.908 | 0.000 |
| Residual Variances |  |  |  |  |
| Monthly income | 0.364 | 0.005 | 73.949 | 0 |

Notes: RMSEA $=0.038$, CFI $=0.986$, TLI $=0.964$; The latent factor's mean is constrained as zero with variance of 0.372 ).
Class and education enter the models as ordinal variable. The measurement model, by Mplus' default setting, was estimated under the missing data theory using all available data. Muthén and Muthén (2012) argue that using all available data is preferable to listwise deletion in factor analysis.
$\mathrm{N}=16253$. Cluster-robust standard errors are used
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A4.8 Estimated marginal effects (dydx) of grandparental class on the chance of grandchildren attaining university degrees at fixed values of factor scores of parental origins.


Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

## Appendix 5

Table A5.1 Class distribution by educational qualifications

|  | Salariat | Intermediate | Small-employer | Lo supervisory <br> \& technician | Working-class |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Degrees | 68.1 | 15.2 | 3.6 | 1.9 | 11.2 |
| Sub-degrees | 42.1 | 24.6 | 5.8 | 9.7 | 17.8 |
| Higher | 34.0 | 19.7 | 10.2 | 10.9 | 25.1 |
| secondary | 22.4 | 17.4 | 11.6 | 12.3 | 36.2 |
| Lower- <br> secondary | 22.4 | 9.3 | 13.1 | 57.7 |  |
| Primary or no <br> qualifications | 12.8 | 7.1 | 9.3 | 8.9 | 27.1 |

Notes: Values refer to row percentages; $\mathrm{N}=6,789$
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Table A5.2 Average marginal effects of parental education across birth cohorts on grandsons' chance of attaining university qualifications

| Parental education (primary/no qualification as the reference category): |  |  |
| :--- | :--- | :--- |
|  | Coef | Std. Err |
| Tertiary | $.159^{* * *}$ | .057 |
| Pre-1970s | $.290^{* * *}$ | .041 |
| 1970s | $.168^{* * *}$ | .035 |
| 1980s |  |  |
|  |  |  |
| Secondary | .077 | .040 |
| Pre-1970s | $.088^{* * *}$ | .027 |
| 1970s | .047 | .029 |
| 1980s |  |  |

Notes: * p < 0.05, ** p < 0.01, *** p < 0.001; the results are estimated with Stata's margins, dydx module; the results are estimated based on Model M5-3, Table 5.1.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A5.3 Average marginal effects of parental class and parental wealth across birth cohorts on granddaughters' chance of attaining university qualifications

| Parental class (working-class as the reference category): |  |  |
| :--- | :--- | :--- |
|  | Coef | Std. Err |
| Salariat | -.035 | .065 |
| Pre-1970s | $.149^{* * *}$ | .049 |
| 1970s | $.104^{* *}$ | .035 |
| 1980s |  |  |
| Intermediate | -.062 | .055 |
| Pre-1970s | $.104^{*}$ | .046 |
| 1970s | $.077^{* *}$ | .033 |
| 1980s |  |  |
| House ownership (no as the reference category) |  |  |
| Yes | .05 |  |
| Pre-1970s | .005 | .056 |
| 1970s | $.096^{* * *}$ | .044 |
| 1980s | $.160^{* * *}$ | .027 |

Notes: * $\mathrm{p}<0.05,{ }^{* *} \mathrm{p}<0.01,{ }^{* * *} \mathrm{p}<0.001$; the results are estimated with Stata's margins, dydx module; the results are estimated based on Model M5-6, Table 5.2.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

## Appendix 6

Table A6.1 Ordinal logistic regressions predicting grandchildren's class attainments

|  | Grandsons |  |  | Granddaughters |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | M6-1 | M6-2 | M6-3 | M6-4 | M6-5 | M6-6 |
| Grandchildren's Education: |  |  |  |  |  |  |
| Degree |  |  | $12.264^{* * *}$ |  |  | $12.914^{* * *}$ |
| Sub-degree |  |  | $5.109^{* * *}$ |  |  | $4.836^{* * *}$ |
| A-level |  |  | 3.540 *** |  |  | $3.281 * * *$ |
| GCSE or O-level |  |  | $2.044^{* * *}$ |  |  | $2.196{ }^{* * *}$ |
| Grandparents: |  |  |  |  |  |  |
| Salariat | $1.687^{* * *}$ | 1.444*** | $1.268 * *$ | $1.421^{* * *}$ | 1.236* | 1.041 |
| Intermediate occupations | 1.244* | 1.151 | 1.095 | $1.242^{+}$ | 1.136 | 1.055 |
| Small employers | 1.100 | 1.059 | 0.998 | 1.453*** | $1.315^{* *}$ | 1.101 |
| Lower supervisor and technician | $1.226^{*}$ | $1.148{ }^{+}$ | 1.103 | $1.248^{*}$ | 1.155 | 1.042 |
| Parental class: |  |  |  |  |  |  |
| Salariat | $2.846^{* * *}$ | 1.788*** | $1.608^{* * *}$ | 2.699*** | 1.636*** | $1.406^{* *}$ |
| Intermediate occupations | $2.075^{* * *}$ | 1.536*** | $1.374^{* *}$ | 2.052*** | 1.471** | $1.312^{+}$ |
| Small employers | $1.691^{* * *}$ | 1.420 ** | $1.525^{* *}$ | 1.473*** | 1.213 | 1.209 |
| Lower supervisor and technician | $1.290{ }^{*}$ | 1.090 | 1.049 | $1.487^{* *}$ | 1.265 | 1.203 |
|  |  |  |  |  |  |  |
| Degree |  | $2.047^{* * *}$ | 1.182 |  | $1.799^{* * *}$ | 1.161 |
| Sub-degree |  | $1.631^{* * *}$ | 1.157 |  | $1.676^{* * *}$ | $1.308^{+}$ |


| A-level |  | $1.561{ }^{* * *}$ | $1.260{ }^{*}$ |  | $1.579^{* * *}$ | $1.330{ }^{*}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| GCSE or O-level |  | $1.363^{* *}$ | 1.146 |  | $1.560{ }^{* * *}$ | $1.472^{* *}$ |
| Economic resources |  |  |  |  |  |  |
| House ownership |  | $1.49{ }^{* * *}$ | 1.238* |  | $1.609^{* * *}$ | $1.297^{*}$ |
| Monthly income |  | $1.293{ }^{* * *}$ | $1.236^{* *}$ |  | $1.571^{* * *}$ | $1.447^{* * *}$ |
| Control variables |  |  |  |  |  |  |
| Age | $1.022^{* * *}$ | $1.026^{* * *}$ | $1.030^{* * * *}$ | 0.997 | 1.006 | 1.009 |
| Age squared | $0.998^{+}$ | 0.999 | 0.999 | 0.999 | 1.000 | 1.000 |
| White | $0.561^{* * *}$ | $0.543^{* * *}$ | 0.876 | 0.808 | 0.718******* | 0.944 |
| Wales (England as base) | $0.690^{* *}$ | $0.642^{* * *}$ | $0.705^{* *}$ | 0.698 |  | $0.606^{* * *}$ |
| Scotland | 0.864 | 0.838 | $0.767^{*}$ | 0.954 | 0.971 | 0.829 |
| Northern Ireland | $0.783^{+}$ | $0.721^{*}$ | $0.743^{*}$ | 0.927 | 0.887 | $0.720^{*}$ |
| UKHLS (BHPS as base) | $0.744^{* * *}$ | $0.597^{* * *}$ | $0.531{ }^{* * *}$ | $0.924{ }^{* *}$ | $0.685^{* * *}$ | $0.518^{* * *}$ |
| 1970s (1960s as base) | $1.247^{+}$ | 1.108 | 0.958 | $1.436^{* *}$ | 1.359 | 1.033 |
| 1980s | 1.120 | 0.952 | 0.850 | 1.156 | 1.057 | 0.851 |
| cut1 | $0.495^{* * *}$ | $3.922^{* * *}$ | $6.969^{* * *}$ | $0.705^{+}$ | 24.922**********) | 26.507***********) |
| cut2 | 0.857 | $6.864^{* * * *}$ | $12.882^{* * * *}$ | 0.923 | $32.9799^{* * *}$ | 35.920*************) |
| cut 3 | $1.404^{+}$ | $11.390^{* * *}$ | 22.881*** | 1.169 | $42.250^{* * *}$ | 47.162**********) |
| cut4 | 2.365 | $19.474^{* * *}$ | 42.149*** | $3.087^{* * *}$ | $116.369^{* * *}$ | $147.396^{* * *}$ |
| Observations | 4915 | 4915 | 4915 | 4039 | 4039 | 4039 |

Notes: The lowest levels used as reference categories; Exponentiated coefficients; ${ }^{+} p<0.10,{ }^{*} p<0.05,{ }^{* *} p<0.01,{ }^{* *} p<0.001$
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A6.2 Description of the measures of three generations that are used in structural modelling

| Grandparental generation |  |  |  |
| :---: | :---: | :---: | :---: |
| Class | Paternal | Maternal |  |
| Salariat | 19.6 | 21.3 |  |
| Intermediate | 9.2 | 9.5 |  |
| Small employers | 16.5 | 16.4 |  |
| Lower supervisors and technicians | 17.2 | 15.6 |  |
| Working-class | 37.5 | 37.2 |  |
| Parental generation |  |  |  |
| Class | Father | Mother |  |
| Salariat | 33.8 | 26.8 |  |
| Intermediate | 8.0 | 21.4 |  |
| Small employers | 15.8 | 6.1 |  |
| Lower supervisors and technicians | 15.3 | 4.0 |  |
| Working-class | 27.1 | 41.7 |  |
| Education | Father | Mother |  |
| Degree or higher | 14.6 | 11.0 |  |
| Other higher education | 8.6 | 9.4 |  |
| A level | 18.4 | 13.1 |  |
| GCSE or O level | 19.4 | 24.8 |  |
| Other or no qualification | 39.0 | 41.7 |  |
| Property ownership |  | Monthly income |  |
| Yes | 18.5 | Mean | 7.86 |
| No | 81.5 | Std.Dev. | . 68 |
| Grandchildren generation |  |  |  |
| Class | Grandsons | Granddaughter |  |
| Salariat | 35.9 | 41.8 |  |
| Intermediate | 11.9 | 23.1 |  |
| Small employers | 11.2 | 5.2 |  |
| Lower supervisors and technicians | 11.7 | 4.8 |  |
| Working-class | 29.3 | 25.1 |  |
| Education | Grandsons | Granddaughters |  |
| Degree or higher | 24.5 | 32.9 |  |
| Other higher education | 7.3 | 7.6 |  |
| A level | 28.1 | 27.2 |  |
| GCSE or O level | 25.0 | 23.6 |  |
| Other or no qualification | 15.1 | 8.8 |  |
| Race |  | Age |  |
| White | 90.5 | Mean | 31.6 |
| Non-white | 9.5 | Std.Dev | 6.4 |
| Region |  | Birth cohorts |  |
| England | 72.2 | 1960s | 11.9 |
| Wales | 10.0 | 1970s | 36.6 |


| Scotland | 10.0 | 1980 s | 51.6 |
| :--- | :---: | :---: | :---: |
| Northern Ireland | 7.8 |  |  |

Survey
BHPS
66.7

UKHLS 33.3
Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.

Table A6.3 Model results of multiple group analysis of the full structural model

|  | Estimates: | S.E. | Two-tailed P-value |
| :---: | :---: | :---: | :---: |
| Father's education ON |  |  |  |
| Paternal Grandparental class 1 | 0.778 | 0.061 | 0.000 |
| Paternal Grandparental class 2 | 0.667 | 0.083 | 0.000 |
| Paternal Grandparental class 3 | 0.199 | 0.064 | 0.003 |
| Paternal Grandparental class 4 | 0.322 | 0.064 | 0.000 |
| Survey | 0.190 | 0.051 | 0.000 |
| Father's class ON |  |  |  |
| Father's education | 0.624 | 0.028 | 0.000 |
| Paternal Grandparental class 1 | 0.571 | 0.069 | 0.000 |
| Paternal Grandparental class 2 | 0.373 | 0.091 | 0.000 |
| Paternal Grandparental class 3 | 0.389 | 0.073 | 0.000 |
| Paternal Grandparental class 4 | 0.261 | 0.068 | 0.000 |
| Survey | -0.252 | 0.054 | 0.000 |
| Mother's education ON |  |  |  |
| Maternal Grandparental class 1 | 0.890 | 0.059 | 0.000 |
| Maternal Grandparental class 2 | 0.569 | 0.081 | 0.000 |
| Maternal Grandparental class 3 | 0.256 | 0.067 | 0.000 |
| Maternal Grandparental class 4 | 0.284 | 0.067 | 0.000 |
| Survey | 0.341 | 0.051 | 0.000 |
| Mother's class ON |  |  |  |
| Mother's education | 0.668 | 0.028 | 0.000 |
| Maternal Grandparental class 1 | 0.343 | 0.069 | 0.000 |
| Maternal Grandparental class 2 | 0.350 | 0.091 | 0.000 |
| Maternal Grandparental class 3 | 0.103 | 0.074 | 0.159 |
| Maternal Grandparental class 4 | 0.067 | 0.076 | 0.372 |
| Survey | -0.156 | 0.058 | 0.004 |
| Property Ownership ON |  |  |  |
| Father's class | 0.275 | 0.030 | 0.000 |
| Mother's class | 0.187 | 0.030 | 0.000 |
| Household Monthly Income | 0.325 | 0.028 | 0.000 |
| Survey | 0.322 | 0.081 | 0.000 |
| Monthly Income ON |  |  |  |
| Father's class | 0.104 | 0.007 | 0.000 |
| Mother's class | 0.086 | 0.007 | 0.000 |
| Survey | 0.535 | 0.027 | 0.000 |
| Correlation: |  |  |  |
| Father's education \& Mother's education | 0.444 | 0.019 | 0.000 |
| Father's class \& Mother's class | 0.185 | 0.027 | 0.000 |
| Intercepts: |  |  |  |
| Household Monthly Income | 7.033 | 0.103 | 0.000 |


|  | Grandsons |  |  | Granddaughters |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Grandchildren's education ON | Estimates | S.E. | P-value | Estimates | S.E. | P -value |
| Maternal Grandparental class 1 | 0.397 | 0.086 | 0.000 | 0.392 | 0.098 | 0.000 |
| Maternal Grandparental class 2 | 0.261 | 0.110 | 0.017 | 0.130 | 0.113 | 0.251 |
| Maternal Grandparental class 3 | 0.093 | 0.089 | 0.295 | 0.282 | 0.096 | 0.003 |
| Maternal Grandparental class 4 | 0.152 | 0.089 | 0.084 | 0.204 | 0.094 | 0.030 |
| Paternal Grandparental class 1 | 0.258 | 0.084 | 0.002 | 0.416 | 0.095 | 0.000 |
| Paternal Grandparental class 2 | 0.225 | 0.123 | 0.066 | 0.226 | 0.120 | 0.061 |
| Paternal Grandparental class 3 | 0.029 | 0.087 | 0.737 | 0.239 | 0.097 | 0.014 |
| Paternal Grandparental class 4 | 0.139 | 0.085 | 0.103 | 0.137 | 0.094 | 0.147 |
| Father's class | -0.011 | 0.039 | 0.785 | -0.004 | 0.042 | 0.910 |
| Mother's class | 0.069 | 0.039 | 0.079 | 0.091 | 0.042 | 0.030 |
| Father's education | 0.234 | 0.046 | 0.000 | 0.095 | 0.049 | 0.050 |
| Mother's education | 0.151 | 0.048 | 0.002 | 0.165 | 0.048 | 0.001 |
| Property Ownership | 0.191 | 0.045 | 0.000 | 0.187 | 0.047 | 0.000 |
| Household Monthly Income | 0.051 | 0.033 | 0.124 | 0.171 | 0.057 | 0.003 |
| Age | 0.000 | 0.006 | 0.939 | -0.003 | 0.008 | 0.742 |
| Age-squared | 0.000 | 0.001 | 0.793 | 0.000 | 0.001 | 0.949 |
| Survey | 0.059 | 0.075 | 0.476 | 0.321 | 0.084 | 0.000 |
| Cohort: 1960s | -0.274 | 0.102 | 0.007 | -0.321 | 0.125 | 0.009 |
| Cohort: 1970s | 0.030 | 0.068 | 0.659 | 0.181 | 0.075 | 0.016 |
| White | -0.763 | 0.110 | 0.000 | -0.271 | 0.112 | 0.016 |
| Wales | -0.147 | 0.105 | 0.161 | 0.035 | 0.109 | 0.745 |
| Scotland | 0.204 | 0.100 | 0.041 | 0.346 | 0.114 | 0.002 |
| Northern Ireland | 0.066 | 0.116 | 0.568 | 0.410 | 0.121 | 0.001 |
| Grandchildren's class ON |  |  |  |  |  |  |
| Grandchildren's education | 0.448 | 0.033 | 0.000 | 0.458 | 0.037 | 0.000 |
| Maternal Grandparental class 1 | 0.224 | 0.087 | 0.010 | 0.072 | 0.101 | 0.477 |
| Maternal Grandparental class 2 | -0.019 | 0.109 | 0.863 | 0.207 | 0.122 | 0.089 |
| Maternal Grandparental class 3 | 0.092 | 0.089 | 0.302 | 0.047 | 0.102 | 0.644 |
| Maternal Grandparental class 4 | 0.065 | 0.083 | 0.434 | 0.001 | 0.098 | 0.989 |
| Paternal Grandparental class 1 | 0.007 | 0.084 | 0.937 | 0.047 | 0.099 | 0.635 |
| Paternal Grandparental class 2 | 0.038 | 0.116 | 0.734 | -0.069 | 0.124 | 0.575 |
| Paternal Grandparental class 3 | -0.120 | 0.084 | 0.154 | 0.154 | 0.106 | 0.145 |
| Paternal Grandparental class 4 | 0.000 | 0.084 | 0.999 | 0.055 | 0.091 | 0.542 |
| Father's class | 0.142 | 0.037 | 0.000 | 0.028 | 0.042 | 0.506 |
| Mother's class | 0.011 | 0.038 | 0.778 | 0.016 | 0.045 | 0.728 |
| Father's education | -0.008 | 0.046 | 0.856 | 0.046 | 0.054 | 0.392 |
| Mother's education | 0.016 | 0.048 | 0.743 | -0.063 | 0.054 | 0.247 |
| Property Ownership | -0.006 | 0.048 | 0.894 | 0.142 | 0.051 | 0.005 |
| Household Monthly Income | 0.099 | 0.032 | 0.002 | 0.196 | 0.056 | 0.000 |
| Age | 0.015 | 0.006 | 0.012 | 0.004 | 0.009 | 0.694 |
| Age-squared | -0.001 | 0.001 | 0.377 | 0.000 | 0.001 | 0.979 |
| Survey | -0.442 | 0.077 | 0.000 | -0.474 | 0.090 | 0.000 |
| Cohort: 1960s | 0.036 | 0.102 | 0.724 | 0.015 | 0.131 | 0.906 |
| Cohort: 1970s | 0.048 | 0.070 | 0.494 | 0.076 | 0.079 | 0.333 |
| White | -0.084 | 0.108 | 0.436 | 0.026 | 0.135 | 0.850 |
| Wales | -0.199 | 0.096 | 0.039 | -0.340 | 0.101 | 0.001 |
| Scotland | -0.117 | 0.096 | 0.222 | -0.161 | 0.109 | 0.139 |
| Northern Ireland | -0.158 | 0.102 | 0.123 | -0.176 | 0.121 | 0.146 |


| Thresholds: |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Grandchildren |  |  |  |  |  |  |
|  | Estimates | S.E. | $P$-value |  |  |  |
| Father's class 1 | -0.288 | 0.150 | 0.055 |  |  |  |
| Father's class 2 | 0.253 | 0.150 | 0.091 |  |  |  |
| Father's class 3 | 0.780 | 0.150 | 0.000 |  |  |  |
| Father's class 4 | 1.059 | 0.150 | 0.000 |  |  |  |
| Mother's class 1 | 0.466 | 0.167 | 0.005 |  |  |  |
| Mother's class 2 | 0.599 | 0.168 | 0.000 |  |  |  |
| Mother's class 3 | 0.801 | 0.168 | 0.000 |  |  |  |
| Mother's class 4 | 1.549 | 0.169 | 0.000 |  |  |  |
| Father's education 1 | 0.259 | 0.127 | 0.041 |  |  |  |
| Father's education 2 | 0.818 | 0.127 | 0.000 |  |  |  |
| Father's education 3 | 1.408 | 0.129 | 0.000 |  |  |  |
| Father's education 4 | 1.780 | 0.131 | 0.000 |  |  |  |
| Mother's education 1 | 0.874 | 0.128 | 0.000 |  |  |  |
| Mother's education 2 | 1.608 | 0.130 | 0.000 |  |  |  |
| Mother's education 3 | 2.076 | 0.131 | 0.000 |  |  |  |
| Mother's education 4 | 2.535 | 0.130 | 0.000 |  |  |  |
| Property ownership 1 | 2.618 | 0.294 | 0.000 |  |  |  |
|  | Grandsons |  |  | Granddaughters |  |  |
|  | Estimates | S.E. | $P$-value | Estimates | S.E. | $P$-value |
| Grandchildren's class 1 | -0.134 | 0.318 | 0.674 | 1.743 | 0.456 | 0.000 |
| Grandchildren's class 2 | 0.249 | 0.316 | 0.432 | 1.918 | 0.457 | 0.000 |
| Grandchildren's class 3 | 0.589 | 0.316 | 0.062 | 2.094 | 0.457 | 0.000 |
| Grandchildren's class 4 | 0.959 | 0.315 | 0.002 | 2.811 | 0.459 | 0.000 |
| Grandchildren's education 1 | -0.356 | 0.309 | 0.249 | 1.088 | 0.417 | 0.009 |
| Grandchildren's education 2 | 0.582 | 0.310 | 0.060 | 2.155 | 0.420 | 0.000 |
| Grandchildren's education 3 | 1.456 | 0.310 | 0.000 | 3.000 | 0.423 | 0.000 |
| Grandchildren's education 4 | 1.721 | 0.311 | 0.000 | 3.244 | 0.424 | 0.000 |

Notes: Estimates refer to probit coefficients.
Source: BHPS and UKHLS, grandchildren aged between 25 and 65 years.

Table A6.4 Estimations of indirect effects of grandparental class on grandchildren's class attainment; only the paths with statistical significance are shown


|  | FC | HHOWN | CE |  |  | . 013 | .004*** | . 013 | .004*** |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | FC | HHIMN | CE |  |  |  |  | . 004 | .002** |
|  | FC | HHIMN | HHOWN | CE |  | . 002 | . 000 *** | . 002 | . 000 |
|  | FE | FC | HHOWN | CE |  | . 011 | .003*** | . 011 | . 003 |
|  | FE | FC | HHIMN | CE |  |  |  | . 004 | .001** |
|  | FE | FC | HHIMN | HHOWN | CE | . 001 | . 000 *** | . 001 | . 000 *** |
| PG 2 | FC |  |  |  |  | . 053 | .019** |  |  |
|  | FE | FC |  |  |  | . 060 | .017*** |  |  |
|  | FC | HHOWN |  |  |  |  |  | . 014 | .006* |
|  | FE | FC | HHOWN |  |  |  |  | . 016 | . 006 |
|  | FC | HHIMN | HHOWN |  |  |  |  |  |  |
|  |  |  |  |  |  | Grandsons |  | Granddaughters |  |
|  |  |  |  |  |  | Estimate | SE | Estimate | SE |
|  | FC | HHIMN |  |  |  | . 004 | .002* | . 007 | .003** |
|  | FE | FC | HHIMN |  |  | . 004 | .001** | . 008 | .003** |
|  | FE | FC | HHIMN | HHOWN |  |  |  | . 002 | .001* |
| PG 2 | FE | CE |  |  |  | . 072 | .017*** |  |  |
|  | FC | HHOWN | CE |  |  | . 009 | .003** | . 009 | .003** |
|  | FC | HHIMN | CE |  |  |  |  | . 003 | .001* |
|  | FC | HHIMN | HHOWN | CE |  |  |  | . 001 | . 000 ** |
|  | FE | FC | HHOWN | CE |  | . 010 | . 003 *** | . 010 | .003*** |
|  | FE | FC | HHIMN | CE |  |  |  | . 003 | .001** |
|  | FE | FC | HHIMN | HHOWN | CE | . 001 | .000*** | . 001 | . 000 *** |
| PG 3 | FC |  |  |  |  | . 056 | .018** |  |  |
|  | FE | FC |  |  |  | . 017 | .007* |  |  |



| PG 4 | FE | CE |  |  |  | . 034 | .010*** | . 014 | .008* |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | FC | HHOWN | CE |  |  | . 006 | .002** | . 006 | . 002 |
|  | FC | HHIMN | CE |  |  |  |  | . 002 | .001* |
|  | FC | HHIMN | HHOWN | CE |  | . 001 | . 000 ** | . 001 | .000* |
|  | FE | FC | HHOWN | CE |  | . 005 | . 002 ** | . 005 | .002** |
|  | FE | FC | HHIMN | CE |  |  |  | . 002 | . 001 * |
|  | FE | FC | HHIMN | HHOWN | CE | . 001 | .000** | . 001 | . 000 ** |
| MG 1 | CE |  |  |  |  | . 181 | .041*** | . 181 | . 047 *** |
|  | ME | CE |  |  |  | . 061 | . 020 ** | . 066 | .021** |
|  | MC | CE |  |  |  |  |  | . 015 | .007* |
|  | ME | MC | CE |  |  |  |  | . 025 | .012* |
|  | MC | HHOWN | CE |  |  | . 005 | . 002 ** | . 006 | .002** |
|  | MC | HHIMN | HHOWN | CE |  | . 001 | . 000 ** | . 001 | . 000 ** |
|  | ME | MC | HHOWN | CE |  | . 009 | .003*** | . 010 | .003** |
|  | ME | MC | HHIMN | HHOWN | CE | . 001 | . 000 *** | . 001 | . 000 ** |
|  | MC | HHIMN | CE |  |  |  |  | . 002 | .001* |
|  | ME | MC | HHIMN | CE |  |  |  | . 004 | . 001 ** |
|  | MC | HHOWN |  |  |  |  |  | . 009 | .004* |
|  | ME | MC | HHOWN |  |  |  |  | . 015 | .006** |
|  | MC | HHIMN | HHOWN |  |  |  |  | . 001 | .001* |
|  | MC | HHIMN |  |  |  | . 003 | .001* | . 006 | .002** |
|  | ME | MC | HHIMN |  |  | . 005 | . $002 * *$ | . 010 | .003** |
|  | ME | MC | HHIMN | HHOWN |  |  |  | . 002 | .001** |
| MG 2 | CE |  |  |  |  | . 118 | . 050 * |  |  |
|  | ME | CE |  |  |  | . 039 | .014** | . 042 | .014** |



| ME | CE |  |  |  | .019 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| ME | MC | HHOWN | CE |  | .003 |
| ME | MC | HHIMN | CE |  |  |
| ME | MC | HHIMN | HHOWN | CE | .000 |
| ME | MC | HHIMN |  |  | .002 |
| ME | MC | HHOWN |  |  |  |
| ME | MC | HHIMN | HHOWN |  |  |


| $.008^{*}$ | .021 | $.000^{* *}$ |
| :--- | :--- | :--- |
| $.001^{* *}$ | .003 | $.001^{* *}$ |
|  | .001 | $.001^{*}$ |
| $.000^{* *}$ | .000 | $.000^{* *}$ |
| $.001^{*}$ | .003 | .001 |
|  | .005 | $.002^{*}$ |
|  | .001 | $.000^{*}$ |

Source: BHPS and UKHLS; grandchildren aged between 25 and 65 years.


[^0]:    ${ }^{1}$ Cultural capital refers to not only parents' education and knowledge, but also the taste, life style, preference, and 'know-how' of the school system in the home environment (Bourdieu, 1986). Social capital can be understood as the quantity and quality of social networks that parents may use to support children's educational and career developments (Bourdieu, 1986)

[^1]:    ${ }^{2}$ Markov Chain can be described as follows. 'If the chain is currently in state $\mathrm{s}_{\mathrm{i}}$, then it moves to state $\mathrm{s}_{\mathrm{j}}$ at the next step with a probability denoted by $\mathrm{p}_{\mathrm{i} j}$, and this probability does not depend upon which states the chain was in before the current state' (Grinstead and Snell, 2012, pp.405-406).

[^2]:    ${ }^{3}$ Social positions of grandparents pose an interesting picture here. Research has shown that class can be linked to both strong and weak grandparental influences. Traditionally, working-class families are characterized as their strong network, in-kind service exchange, and short geographical distances between relatives (Adams, 1970). In the U.S., grandparents living in less-advantaged communities has more involvement with their descendants possibly because they are not in employment and therefore have more time available (Mueller and Elder, 2003). Nevertheless, researchers also found that grandparents with higher educational qualification in the U.S. are more likely to engage in baby-sitting and recreational activities with their grandchildren after controlling for geographic distance (Silverstein and Marenco, 2001).

[^3]:    ${ }^{4}$ Middle-class or highly educated grandparents who had jobs involving management, autonomy or creativity were more likely to appreciate the characteristics such self-direction, independence, responsibility, and curiosity (King and Elder, 1998). They expected their opinions and behaviours to make differences and felt more confident that they were at a good position to mentor their grandchildren by introducing their experiences and providing advice. In contrast, working-class or less educated grandparents whose jobs demanded routine labour and obedience to their supervisors were more likely to value traits such as conformity, good manners, and obedience to authority. Compared with middle class grandparents who had competing roles outside household, working-class grandparents are apt to take emphasis upon their family roles in which they find their self-identity.

[^4]:    ${ }^{5}$ The respondents' sample status can vary, depending on whether they are Original Sample Members (OSMs). Original Sample Members refer to the individuals who enumerated in respondent households selected at the Wave One of the BHPS. OSM would be followed and interviewed annually. At the subsequent waves, the sample consists of all adult members in all households where at least one original sample member lived. New Entrants became eligible for interview, whether an original sample member moved into a household with new residents or new residents moved in with an original sample member. The individual respondents who lived with an OSM but were not identified as OSM themselves were marked as Temporary Sample Members (TSMs). TSMs remained eligible for the survey as long as they were living with OSM. Children born to OSM were automatically identified as OSM.

[^5]:    ${ }^{6}$ In the BHPS, HRP is identified as 'the person legally or financially responsible for the accommodation or the elder of two people equally responsible' and 'the person legally or financially responsible for the accommodation, or the elder of two people equally responsible' (Taylor, 2010, p. A2-4). In UKHLS, 'the HRP is defined as the owner or renter of the accommodation in which the household lives. If there are multiple owners or renters, the default is the eldest of them is the HRP' (Knies, 2017, p.116).

    Household reference person (HRP) is not identified consistently across the survey waves. 'Note that the HRP is not necessarily the person providing answers to the household questionnaire and the HRP may change as the household composition changes' (Knies, 2017, p.116). For example, it is entirely possible that the records regarding grandparental class are obtained at wave 1 in which a respondent was identified as HRP, whereas the records of household income are obtained at wave 3 in which this respondent was not active in the labour market and his or her spouse became the HRP.

    The identification of the HRP would not make substantial differences to the analytic sample. The key information regarding grandparents is derived from the interview questions that were asked to the respondents who were identified as 'parents', regardless of whether they were the HRP.

[^6]:    ${ }^{7}$ While the identity of the grandchild is fixed, the identities of the parent(s) may be not constant across the waves. Due to the change of marital status of parents, a grandchild may relate to different fathers/mothers defined at different waves. To be consistent with the interview questions 'Thinking back to when you were 14 , what job was your father/mother doing at that time', I define parents by locating those living with the grandchild when grandchild was 14 -year old (or as much as close to the age of 14 , if the record of the grandchild at the age of 14 was unavailable in the data). In the case where a grandchild spent most of his or her childhood and adolescence with a non-biological father, even though the biological father may have moved back in at the later waves, the status of father would be defined by the records of the non-biological father.

[^7]:    ${ }^{8}$ In the study by Erola and Moisio (2007), if a grandchild had two or more grandparents, this grandchild would be included more than once in the analysis.

[^8]:    ${ }^{9}$ The NS-SEC was created on the basis of the unit groups of the Standard Occupational Classification (Rose, Pevalin and O'Reilly, 2005).

[^9]:    ${ }^{10} \mathrm{An}$ alternative approach to measure grandparental class is to create a composite variable that includes both grandfathers and grandmothers. The reason for why I chose the dominance approach over the composite variable is that the composite variable, whether using the summation method or principle component analysis or latent factor analysis, would inevitably lose the records of the actual class position of grandparents. As a result, it would have concealed the effects of specific class of grandparents that the dominance approach reveals, such as small-employer effects on grandsons.

[^10]:    ${ }^{11}$ In a panel data, respondents' education is likely to have different records across waves. I measured parents' and grandchildren's education using 'the highest educational qualification' variables provided in the BHPS and UKHLS data cross-wave data files.

[^11]:    ${ }^{12}$ The models intend to control for the quantitative impacts of parental income. The variable of monthly household income is highly skewed to the right. Using the logarithm of income as the independent variable shows a one-unit change in the outcome variable for approximate percentage change in income.

[^12]:    ${ }^{13}$ A possible solution is to use a random subsample in which I draw one grandchild from each household. Since all grandchildren in this random sample would come from different households, this subsample would not be clustered anymore and would be eligible for loglinear analysis. After I conducted a few tests, however, I found that with different subsamples, the results of log-linear models came across the thresholds of model fit indexes and reported inconsistent answers regarding the question on existence of net grandparental effects on their grandchildren's attainment. This is mostly likely to be due to the limited sample size. The random samples are created by the seed command in Stata.

[^13]:    ${ }^{14} \mathrm{I}$ run the path analysis using Mplus 7.2.
    ${ }^{15}$ Endogenous variable refers to a variable, which is caused by one or more variable in the model.
    ${ }^{16}$ Exogenous variable refers to a variable, which is not caused by any variable in the model. This variable acts to cause one or more variable in the model.
    ${ }^{17}$ With multiple group analysis using the Theta parameterization, Mplus fixed variances and residual variables of latent variables for observed ordered categorical dependent variables at one in the first group and freed in another group (Muthén and Muthén, 2012, p.461)

[^14]:    ${ }^{18}$ I acknowledge and appreciate the suggestions on appropriate weighting adjustment from the UK Household Longitudinal Study support team.

[^15]:    ${ }^{19}$ Intraclass correlation refers to correlation of the observations (cases) within a cluster.

[^16]:    ${ }^{20}$ To clarify, dealing with unbalanced dataset (i.e., different sample sizes in different groups) is deemed one of advantages of multilevel modelling. But Clarke (2008) found that the group level components might be biased upwardly in the unbalanced data with few observations per group. The dataset that Clarke demonstrated contains fewer cases per group ( $\mathrm{n} \leq 2$ ) than the current data; but the current data is more unbalanced and sparse, comparing with the dataset Clarke tested ranging from 1 to 2. Clarke recommended that with the sufficient number of groups, the models still provide unbiased results with as few as five cases per group.
    ${ }^{21}$ Multilevel ordinal logistic regression models are conducted with the meologit command in Stata 14. Combining grandsons and granddaughters together, a multilevel ordinal logistic model on grandchildren's educational attainment did converge. Regarding grandparental class, the effects are found to be significant while parental class, education and economic resources are taken into account.

[^17]:    ${ }^{22}$ The finding that more granddaughters than grandsons are found in salariat class seems to be a little contradictory to the impression of gender-inequality in high-level occupations. It needs to be noted that the salariat class here refers to the combination of salariat members at the higher and lower levels. One may see that gender segregation persisted within salariat class if the seven-fold NS-SEC schema was applied; grandsons dominated in the high-level salariat occupations, but granddaughters outnumbered grandsons in the low-level ones. I found that granddaughters constituted 34 per cent of higher salariat as against 52 per cent of lower salariat. These findings were in lines with previous research on sex segregation on class attainment (e.g., Marshall, Swift and Roberts, 1997). Since there are more low-level than high-levels salariat employment opportunities in the labour market, as a result of the combination of higher and lower salariat, more granddaughters are found in the salariat group.

[^18]:    ${ }^{23}$ The differences in the proportions of being found in upward mobility between grandsons and granddaughters is tested using proportional tests, conducted by Stata command 'prtest'.

[^19]:    ${ }^{24}$ This is by no means to suggest that grandchildren were therefore expected or driven to land in lower social positions; instead, they may experience less pressure to avoid these positions. The families are likely to tolerate, or at least not reject as strongly as those families that are immobile in privilege position, to such movement to lower social positions.

[^20]:    ${ }^{25}$ In the case in which parents were on property mortgage, it is considered as parents having the ownership of household.

[^21]:    ${ }^{26}$ Using Wald tests, I find that the reduction in the effects of grandparental class in Model M4-2 compared with Model M4-1 reaches the statistical significance at the 5 per cent level. In other words, the coefficients of grandparental class in Model M4-2 are significantly lower than those in Model M4-1.

[^22]:    ${ }^{27}$ The latent factor analysis was constructed in a way similar to Confirmatory Factor Analysis. Strictly speaking, confirmatory factor analysis refers to a measurement model using categorical variables. The current factor analysis utilise a mixture of categorical variables and a continuous variable (household income). To be precise, the current factor analysis does not fit the definition of confirmatory factor analysis.

[^23]:    ${ }^{28}$ Root Mean Square Error of Approximation (RMSEA) is one of the most popular indicators of model fit (Hooper, Coughlan, and Mullen, 2008). An RMSEA of below 0.05 shows a good model fit. A model with a Comparative Fit Index (CFI) higher than 0.90 is considered a good fit. These model fit indexes are often used together to indicate model fit. Model fit indexes are discussed in details in Section 2.3.3, Chapter 2 Data and Method.

[^24]:    ${ }^{29}$ In order to ensure sufficient sample size, grandchildren born in 1950s were included into the data set and combined with the pre-1970s cohort. For the ease of exposition, the group of grandchildren born between 1950s and 1960s is shortened as 'the pre-1970s cohort'.

[^25]:    ${ }^{30}$ I carry out Wald test post-estimations using Stata's command 'test'. Overlapping of confidence intervals does not necessarily indicate that the difference is statistically insignificant (Knezevic, 2008). In other words, even though confident intervals overlap, the difference may be or may not be statistically significant. If two parameters have nonoverlapping confidence intervals, they are certainly significantly different.

[^26]:    ${ }^{31}$ With the lower bound of age 25 , grandchildren may be too young to reach their occupational maturity. Ideally the research in class destination collects the data of employees over 35 years old. However, a few influential social mobility studies also include young respondents in determining class positions (over age 25, Marshall, Swift, and Roberts, 1997; men aged 25-65 and women aged 25-63, Devine and Li, 2013; aged 25-59, Li and Devine, 2011; aged 20-64, Chan, 2017; aged 16-60 Li and Heath, 2017). I argue that the low bound of age 25 is, albeit admittedly not ideal, acceptable in the present thesis.

[^27]:    ${ }^{32} \mathrm{~A}$ recursive model refers to a structural model in which the paths between constructs (such as variables and latent factors) all proceed only from the predictors (antecedent) construct to the outcome construct (consequences). It contains only causations flowing in one direction. In contrast, a model is considered non-recursive if it contains feedback loops between constructs. The present models assume that an earlier generation determines a more recent generation and that a recent generation is unable to affect an early generation. Such relations flow in one direction and are not consider reciprocal. The models I constructed were therefore considered as recursive models.

[^28]:    ${ }^{33}$ In Mplus, only endogenous variables that are the ones caused by other variables in the model can be claimed as ordered categorical variables. Grandparental classes are exogenous variables in these structural models as grandparental classes were not caused by any other variables, thus they have to be treated as dummy variables.

[^29]:    ${ }^{34}$ In practice, the coefficients of the pathways, thresholds of related ordinal categorical variables as parental education and parental class and intercept of continuous variable as household income, are held to be equal across the groups of grandsons and granddaughters.
    ${ }^{35}$ A model with an RMSEA lower than 0.05 and a CFI higher than 0.900 is considered as a good model fit. Details are discussed in the Chapter 2 Data and Methods, Section 2.3.3 Path analysis modelling.

[^30]:    ${ }^{36}$ The finding that parental class and education lost their explanatory power on granddaughters' class outcomes seemed unexpected; it could be assumed, however, that this was because of the introduction of granddaughters' education and the presence of various parental resources. In a tentative model where parental class was used as the only indicator of parental resources and education was considered, we found a significant association between parental class and granddaughters' class positions.

[^31]:    ${ }^{37}$ The chi-squared difference tests were conducted by the 'difftest' method with Mplus version 7 (Muthén and Muthén, 2012).

[^32]:    ${ }^{38}$ If respondents do have children but their children never lived with the respondents throughout the survey waves, the respondents and their children would not be included in the data set.

[^33]:    ${ }^{39}$ Lynn (2006) identified that the respondents who failed to attend the survey at least one occasion disproportionately include numbers of people who were at 'age 16-24, never married, unemployed, no qualifications, not active in any organisations, resident in Inner London, West Midlands conurbation, Merseyside, local authority or housing association tenant and in the bottom $40 \%$ of the income distribution' (Lynn, 2006, p.76).

[^34]:    ${ }^{40}$ For example, for a divorced respondent who lived with his/her children and was identified as the only adult living in the household at the first wave, he or she might have live-in partners and then may change the partner or be back to be single again at the later waves. The change of marital status, which is fairly common in the current data, make it difficult to define single-parent family.

[^35]:    ${ }^{41}$ Because of the data design in which parent-child relationship is identified first as the basis of multigenerational family lineages, the majority of grandchildren whose family moved into the UK were not first-generation immigrants. In the current data set, 9 per cent of parents and 3 per cent of grandchildren were born outside the UK.

[^36]:    ${ }^{42}$ In the present stage, considering that the aim of log-linear modelling is to explore the existence of net grandparents-grandchildren associations, I intend to keep the models simple and do not assume that grandparental class effects on their grandchildren's class attainment vary with parents' class.

[^37]:    ${ }^{43}$ An alternative method of collapsing the data is to collapse only parental class while grandparental and grandchildren's class categories remain as they are, because the research interest is in exploring grandparent-grandchildren associations while controlling for parental class. After a few experiments, I found that this method did not solve the problem. First, while applying the three-class NS-SEC scheme to parents and the five-class version to grandparents and grandchildren, it did not eliminate zero cells. Second, the results did not fit the condition of collapsing that collapsing variables does not change the parameters related to those variables of interest. The choice of three-class or five-class NS-SEC scheme greatly affects the association between grandparents' and grandchildren's classes.

[^38]:    ${ }^{44}$ Being aware that empty cells do not always raise severe problems and in some cases, associations remain stable despite of empty cells and that the method of adding a small constant may smooth unsaturated models to various degrees, I performed two sets of models: the log-linear models without modifying any empty cells and the ones with the addition of a small constant (1/2) to each cells. Comparing the results from the two models, I found that adding a small constant have notable influences on estimation of coefficients but less clear influences on that of $t$-test statistics.

