Gender differences in occupational preferences among young people: evidence from the UK

Thesis submitted for the degree of *Doctor of Philosophy* in Sociology



Megan Scott

Nuffield College

Candidate number 403777

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Thesis abstract

This thesis advances the understanding of gender differences in occupational preferences and job values among young people in the UK. There are two main aims; first, to provide an up-to-date description of gender differences. Second, to investigate how job values and occupational preferences are related, and to what extent gender differences are associated with parental education, mother, father, and sibling characteristics, or an individual's own attitudes. My four chapters make several contributions to the literature. First, I explain the theoretical relevance of job values—the features of a job that are important to an individual, and describe differences by gender and parental education, in the UK and wider Europe. Second, I show how job values are associated with gender differences in preferences for science, technology, engineering and mathematics (STEM). Third, I examine the relationship between parental education and gender-typical occupational preferences and assess potential explanations for this. Fourth, I study the role of siblings, and whether preferences cluster within sibships. Overall, this thesis confirms the persistence of significant and substantial gender differences in occupational preferences in the UK. Gender differences in ratings on job values are small but important for occupational preferences; girls consistently value altruistic aspects of jobs highly and this discourages them from STEM aspirations. There are clear differences by parental education, with young people from a low parental education background more likely to have gender-typical aspirations. This is primarily due to the distribution of gender-typical occupations between occupational classes, and differences in the occupational class aspired to. Lastly, siblings do not significantly influence occupational preferences, either due to sibship composition, and/or through clustering of specific occupational preferences. Instead, the main between-family contrast is between only children and those who have siblings—the former are more likely to have gender-atypical aspirations.

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Chapter 1: Introduction

1.1 Background and aims

It is well-known that gender segregation in adult occupational attainment remains pronounced and pervasive in most advanced industrial societies (Charles, 2011; Levanon & Grusky, 2016)—men and women work in different types of occupation (horizontal segregation), and men are more frequently found in higher-paying positions (vertical segregation). Young people's occupational preferences and job values inform their educational and occupational decisions and are closely related to their adult outcomes, in particular to adult occupational attainment (Ashby & Schoon, 2010; Bagnoli, Demey, & Scott, 2014; Polavieja & Platt, 2014). Therefore, in order to address the gender imbalance in the adult labour market, numerous think tanks, government policies and media investigations are dedicated to encouraging young people to consider gender-atypical occupations, particularly within certain high-profile gender-segregated fields, such as Science, Technology, Engineering and Mathematics (STEM). However, for any interventions to be effective, we need to first understand the various factors associated with gender differences in career-planning.

In this thesis, I study two aspects of planning a career between the ages of 14 and 21 in the UK[1]; (i) job values—the aspects of a job that are deemed important to an individual, (ii) occupational preferences—aspirations for specific, named occupations including aspirations for STEM occupations, or for *any* male-dominated or female-dominated occupation. There are two main aims; first, to provide an up-to-date description of gender differences across job values and occupational preferences, among a particular age group in the UK. Second, to investigate how these aspects are related, and to what extent gender differences are associated with parental education, mother, father, sibling or an

[1] Chapter 5 includes a wider age range; 11-21-year-olds, because it does not include job values.

individual's own characteristics, or the structure of the adult labour market. In addressing these aims, I provide a number of contributions; first, to the theoretical literature on the role of job values in young people's occupational preference formation, second, to empirical evidence on the relative importance of various factors explaining gender differences in career-planning, and third, to the public debate on diversity and inclusion.

In this introduction I first define and explain the rationale for the focus on this age range, and each of the aspects studied. Second, I summarise the relevant theoretical explanations and empirical findings for this topic thus far. Third, I describe why this topic should be studied, and how the findings could make important contributions to the field of study. Fourth, I describe the datasets used, and provide an overview of the UK context in comparison to other advanced industrial societies. Finally, I provide a summary of the structure of the thesis.

1.2 Terms and definitions

Throughout, I study the age range 14 to 21, because this is an important time for young people in the UK. Upper secondary education in the UK has a narrow, specialised focus, and early educational choices affect eligibility for tertiary-level education and adult occupations. Subject choices are made in lower secondary school at ages 13 to 14, at age 15 to 16 for upper secondary school, vocational training or part-time education, and at age 17 to 18 for application to university or transition into full-time work. Most undergraduate degrees are three to four years, so those who choose to continue to tertiary education complete education around age 21. Apprenticeship schemes are between one to four years in length, therefore finish between age 17 and 21. In England, students must be in some form of education or training up to the age of 18[2], and in Scotland, Wales and

[2] In the UK, the legal school leaving age depends on where you live. In England, the leaving age was raised to 17 in 2013 and then to 18 in 2015. In practise, you can leave school at age 16 but until the age of 18 you

Northern Ireland, this is the case up to age 16. Therefore, the majority in the age range 14 to 21 are making decisions relevant to the transition from school to work and are yet to fully establish their permanent career.

The primary aspect of career-planning studied in this thesis is an individual's occupational preference—defined as the specific named job to which they aspire. Occupational preferences have been shown to have a direct effect on adult occupational attainment—boys with aspirations for STEM occupations between the age of 11 and 15 are statistically more likely to end up in STEM occupations as adults than their peers who did not consider these careers early on (Bagnoli et al., 2014). More generally, having 'high' aspirations at age 16, is significantly associated with adult occupation for both boys and girls (Ashby & Schoon, 2010; Schoon, Martin, & Ross, 2007:90), and gender-typical occupational preferences predict gender-typical adult occupational attainment (Polavieja & Platt, 2014).

Because of the nature of the UK education system as described, occupational preferences also have more indirect effects on adult occupation because they influence subject choices which open or close future occupational doors—regardless of whether an individual changes their mind about their future career. To become a doctor in the UK, a potential candidate has to make the right subject choices from age 13 onwards, choosing 'triple science'[3] for GCSE, in order to be equipped for studying Chemistry and/or Biology A-Level at age 16, and thus fulfil the criteria for medicine at university. If they make the wrong choice at age 13, they are already on the back foot, compared to their

must either stay in full-time education (e.g. school or college), start an apprenticeship or traineeship or spend 20 hours a week working or volunteering while in part-time work or education. In Scotland, Wales or Northern Ireland you can leave school at the age of 16.

[3] Triple science means studying Biology, Chemistry and Physics individually, to obtain three GCSE qualifications. Alternatively, students can study double science; a lower qualification with a reduced syllabus, including a core science module and an additional science module.

peers. Gender differences in occupational preferences at a young age set the scene for gender differences in the adult labour market.

I categorise occupational preferences in a number of different ways throughout the thesis, to ascertain the factors which are associated with preferences for particular occupational groups. First, I study preferences for STEM occupations, and consider three different definitions for what counts as a STEM occupation, in Chapter 3. Second, I study gender-typical occupational preferences more generally, in Chapter 4. These are defined throughout as preferences for an occupation with greater than or equal to 70% of individuals in the occupation in the adult labour market the same gender as the respondent. This is consistent with the definitions used by others in this literature (Leuze & Helbig, 2015; Polavieja & Platt, 2014), and therefore comparability across studies is straightforward. Thirdly, I separate between aspirations for male-dominated or female-dominated occupations, in Chapters 4 and 5. For robustness checks, I have also estimated models using a continuous variable for the proportion of same-gender occupants in an aspired-to occupation, with no substantial differences in results.

Second, I research young people's job values, defined as the aspects of a job that they deem important (in comparison to other aspects), *prior* to their entry into the labour market. This differs to the extensive literature investigating job values among adults already established in the labour market. For both groups, there is a long list of job attributes that individuals could care about, including job security, job pay, time for leisure, relationships with colleagues or opportunities for on-the-job training. The rating and ranking of these attributes by adults is alternatively referred to throughout the literature as work values, job characteristics, or even work orientations (Goldthorpe, 1968; Halaby, 2003; Kalleberg & Marsden, 2013; Zou, 2015). These are often grouped into extrinsic aspects, such as job pay and job security, or intrinsic aspects, such as a job

that is interesting. I discuss the merits of various definitions in Chapter 2. For both young people and adults, tt is interesting to study both the absolute importance of each attribute, *and* the relative importance of each of the job values; e.g. how important job security is relative to how important job pay is, because these inform occupational preferences. Goldthorpe (1968) groups workers' relative rankings of job values into orientations; "the way in which workers order their wants and expectations relative to their employment"(1968:38), thus for him (and others), a work orientation is the underlying meaning that work has for an individual (Goldthorpe, 1968; Zou, 2015).

Whilst this literature provides useful background, it does not specifically address young people before they have entered the labour market, whilst they are thinking about hypothetical future work. The meaning of job values in this context therefore may be very different to the meaning of job values for people already in work. As one example, the meaning of 'work/family' balance to a 14-year-old considering what occupation to aim for is likely to be very different to the meaning for a 40-year-old who already has a job and a child. In addition, career aspirations for young people may involve considerable uncertainty and idealism. Consequently, job values for adults and job values for young people may have a different influence on aspirations and work-related decisions and it cannot be assumed that theories or empirical findings about adults' job values will equally apply to young people's job values. Therefore, young people's job values merit further research, and this thesis tests for patterns by gender and parental education, as well as for associations with occupational preferences.

1.3 Empirical findings and theoretical explanations

In this section, I outline the empirical findings and theoretical explanations for gender differences in occupational preferences among young people to date. I first outline the

patterns in gender differences in occupational preferences among young people in the UK, and then the theoretical explanations for why these exist.

1.3.1 Setting the scene: patterns in gender differences in occupational preferences

Gender is associated with occupational preferences such that boys aspire to jobs typical for men, and girls aspire to jobs typical for women – Polavieja and Platt (2014) use data from the British Household Panel Survey (BHPS) to show that among UK 11-15-year-olds in the period 1994 – 2004, around 30% of occupational preferences were gender-typical, i.e. aspirations for occupations which are occupied with more than 70% of an individual's own gender. This leads to persistent gender gaps in aspirations for, and occupational attainment in, much-publicised fields like science, technology, maths and engineering (Schoon, Ross, & Martin, 2007; Shen, 2011), but also in the wider labour market, for instance, in apprenticeships (Beck, Fuller, & Unwin, 2006). Occupational gender segregation has been reducing over time, but change has been uneven between occupational fields, genders and socio-economic backgrounds. Some occupations within STEM, like medicine and biological sciences have experienced significant desegregation, whilst others, like economics, physics or information technology, have been much slower to change (The WISE Campaign, 2017). The rate and pattern of change also varies between countries, and in the UK, engineering remains the most segregated by gender of any European country (Perkins, 2014). By gender, in general, girls have been much quicker to adapt than boys – girls are less likely to make gender-typical choices than boys - from a US perspective, Paula England argues that "when boys… take on 'female' activities they often suffer disrespect, but under some circumstances, girls gain respect for taking on 'male' activities." (England, 2010:156). Lastly, in the UK, there are difference in gender-typicality by parental education; those individuals who do aspire to gender-

atypical or gender-neutral occupations are much more likely to be from a higher parental education background than a lower parental education background (Polavieja & Platt, 2014). Girls from high parental education backgrounds are also especially likely to make gender-*a*typical choices, for instance aspiring to science, engineering or other traditionally male fields, as compared to their peers from lower parental education backgrounds (Codiroli, 2015). The adult labour market is also unequally segregated—much media attention focuses on the underrepresentation of women in STEM, but far less attention is paid to gender segregation in jobs outside of the professional occupational groups, where segregation is far more extreme—less than 1% of recruits into construction or plumbing are female (Beck et al., 2006). However, whilst this is known to be the case, the reasons for differences in aspirations are not well understood— is the socio-economic variation due to the differences in 'ambition' and the underrepresentation of gender-typical jobs in professional or managerial occupations, or are there differing preferences for gender-typical jobs between socio-economic groups?

Explanations for gender differences in occupational preferences are numerous and vary in the extent to which they attribute occupational preferences to factors 'innate' to each individual and (in theory) associated with their gender, for instance, interests, attitudes, values, motivation and ability. This is as opposed to attributing preferences to factors external to the individual, such as socialisation, parental or sibling characteristics, and discrimination. Furthermore, explanations are overlapping, and the various components are not easily disentangled – an individual's interests and values certainly may influence preferences but then in turn be influenced by external factors. Structural factors like the characteristics of the adult labour market, or socio-economic background, also mean that preferences and choices do not always reflect an individual's 'ideal' occupation but can instead represent the most realistic choice available. I discuss theoretical explanations

using four main themes: preference theory and job values; decision frameworks, primarily expectancy-value theory and rational choice theory; socialisation and the role of parents and siblings; and, finally the role of structural constraints[4].

1.3.2 Preference theory and job values

In the study of adult women's paid work, it is often hypothesised that women have fundamentally different attitudes and orientations to men, for various reasons, and this explains (to varying degrees) why occupational distribution and career paths are gendered (Goldthorpe, 1968; Hakim, 1996, 2000). Hakim suggests that men are relatively homogenous in their orientation towards work and family, and consistently prioritise work over family, with a greater commitment to the labour force than women. Women on the other hand, have access to work/family lifestyle combinations that are not available to men, and fall into one of three groups in terms of their priorities regarding work and family life; home-centred, work-centred and adaptive. Home-centred women are those for whom family and children are the priority, prefer not to work at all, and make up approximately 20% of the population. Career-centred women on the other hand prioritise paid work, choosing to invest heavily in qualifications to achieve their ambitions, again making up around 20% of the population. The remaining 60% of the population are suggested to be those with 'adaptive' preferences; women who want to work and to have a family, but do not deliberately plan either one of them. Using the UK-based 1958 National Child Development Study Cohort, Hakim tracks hours of work, educational investment, aspirations and gender-role ideology, and argues that women have irreversibly selected into one of the three types by age 33, with persistent goals and priorities across the life course. Whilst she does recognise that preferences can only be fulfilled in reality when certain structural conditions are met, she describes the post-1970s

[4] Note that this is not an exhaustive list of theories on occupational preference formation, rather a discussion of the theories applied and tested throughout the thesis.

era in the UK and the US as "the new scenario" (Hakim, 2000:56), where, following availability of contraception, the 'equal opportunities' revolution in law, increasing tolerance of different lifestyle choices, creation of jobs for secondary earners and expansion of the white collar and service sector, women's work choices are genuine, unconstrained, reflections of their actual preferences. Preferences by this definition are stable throughout the life course – from first educational choices through to occupational preferences, choices and attainment, and therefore, a strict interpretation of this theory would suggest that male/female work orientations can explain occupational preferences for young people, as well as for adults.

Indeed, more recent versions of this argument exist and have been applied to young people's first transition into the labour market. Authors who argue for the importance of underlying and stable gender differences in preferences highlight the 'gender equality paradox'; countries with the highest levels of gender equality, where girls outperform boys in science, and with high educational performance – e.g. Finland, Norway and Sweden – also have some of the greatest gender differences in preferences for STEM education and careers (Geary & Stoet, 2018). Geary & Stoet argue that, "with economic development and advances in human rights, including gender equality, people are better able to pursue their individual interests and in doing so more basic gender differences [in occupational interests] are more fully expressed" (2018). This is reminiscent of Hakim's 'new scenario' – both argue that in an unconstrained environment, underlying gender differences prevail. Geary and Stoet's emphasis is on basic gender differences in an interest in people versus an interest in things – girls, on average, have a greater interest in job attributes in the dimension of 'people', including social aspects, such as positive relationships with colleagues and employers, opportunities to socialise outside of work, and altruistic aspects, such as helping others, whilst boys have a greater interest in

'things', such as working with machinery or physical objects. The latter orientation tends towards STEM (and other male-dominated occupations). However, to my knowledge, little has been written about whether this underlying gender difference prevails among recent cohorts of young people in the UK. Therefore, Chapter 2 describes the distribution of job values among young people considering the transition from school to work in the UK.

1.3.3 Expectancy-value framework and rational choice theory

Eccles' expectancy-value framework of decision-making moderates the preference theory or 'basic gender differences' discussion by emphasising that whilst there *may* be important gender differences in job values and underlying preferences, values are just one of many factors that individuals consider in forming occupational preferences, along with their demonstrated academic ability (including relative ability in one subject as compared to another), perceived ability and efficacy (self-concept), the subject task value (including utility value, interest value and attainment value) and the cost. Using a similar concept, individual rational choice theorists propose that occupational preferences are formed based on an individual-based cost-utility calculation of the perceived probability of future success, expected benefits and costs (Jonsson, 1999). Gender differences result due to differences in the various components of the calculation; for instance, perceived probability of success depends on relative academic strength; whilst girls now do as well as, or better than, boys in science and maths, they also outperform boys significantly in most countries in more 'female' subjects, like languages. If encouraged to choose a career based on where their relative strengths lie, this dissuades girls and encourages boys into STEM (Jonsson, 1999; Stoet & Geary, 2018; M.-T. Wang, Eccles, & Kenny, 2013). Anticipated future success also varies by gender; women are less likely to be promoted than men within science, even holding constant their qualifications and experience

(Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). Expected benefits differ by gender and depend on the outside options; Stoet and Geary suggest that in less developed countries with higher economic risks and fewer economic opportunities, STEM careers are relatively high-paying and an attractive option, whereas in developed countries, with lower risks and many economic opportunities, STEM careers are only one of many potential paths (Stoet & Geary, 2018:2). Men and women may also differ in how they receive utility from a job. Marginal differences in job values therefore may lead to starkly different occupational choices. Eccles (1994) expectancy-value framework expands 'expectation of benefits' to include "the importance or value the individual attaches to the options perceived by the individual as available" (Eccles, 1994). This includes not only the value of the job itself, but the value of the educational or occupational choice relative to other choices. Various elements of this theory have been tested empirically and have been shown to influence STEM preferences, such as academic self-concept (P. Parker, Nagy, Trautwein, & Ludtke, 2014; Philip David Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2014), prior maths and science achievement relative to other subjects (Ming-Te Wang & Kenny, 2014) and the importance of maths and science as subjects relative to other subjects (Lauermann, Chow, & Eccles, 2015).

Eccles et al (1999) finds that, among American teenagers' aspirations; female students who highly value people/society related job tasks are more likely to aspire to healthcare occupations and less likely to aspire to science-related careers. Wang and Kenny (2014) also find that support for altruistic or social job values, again among American teens, leads them away from STEM careers, which are perceived to be less people-oriented. In Germany, 17-year-olds who have higher social job values are more likely to aspire to female-dominated occupations, and women with higher extrinsic job values are more likely to aspire to male-dominated occupations (Busch-Heizmann, 2015). Job values also

affect how likely young people are to *achieve* a certain social status or earnings position; Ashby and Schoon (2010) show that, "young people for whom it was important to have a job that enabled them to get ahead earned more money in adulthood, compared to their less ambitious peers" (2010 p.357). Chapters 3 and 4 test the theory that job values are important for occupational preference formation, assesses their importance relative to other factors and test whether they have a different influence on boys and girls.

1.3.4 Socialisation: societal level

Alternatively, theoretical explanations emphasising gender attitudes, stereotyping and socialisation argue that not all gender differences in preferences are not innate or due to 'basic' or underlying gender differences in interests. Instead, part of the explanation for differences is that young people learn prescriptive gender roles through socialisation, from the expectations of their parents, teachers, peers and the media (Campbell, 2015; Riegle-Crumb & Humphries, 2012), and from the intergenerational transmission of attitudes about gender roles and/or gender-typical parental behaviours (Busch-Heizmann, 2015; Platt & Polavieja, 2016; Polavieja & Platt, 2014). This can be through the influence of societal-level attitudes, or a more direct route through parental or sibling influence (discussed in the next section). Societal attitudes influence occupational preferences if individuals see a job as more suitable because it is a job for their gender, or if it fits with normative gendered life-course plans (Gabay-Egozi, Shavit, & Yaish, 2014). This may be subconscious—Cech (2013) suggests that the emphasis on self-expression, contrary to reflecting 'true' gender differences (Geary & Stoet, 2018b), instead elevates self-conceptions based on gendered stereotypes. These are then viewed as legitimate because they are *thought* to be 'freely chosen' but are actually influenced by the wider gender-essentialist culture; girls no longer think that women in general are better suited to being housewives, but their self-evaluation is more likely to be 'it suits me' due to the influence

of societal norms and expectations. There are many empirical examples that show that gender stereotypes influence how young people evaluate their own competencies, and the occupation they think they are capable of, even after taking academic ability into account (Correll, 2001; Jonsson, 1999; Philip David Parker et al., 2014; M.-T. Wang et al., 2013)

The challenge for these narratives is that segregation has been persistent despite liberalising gender attitudes and/or diminishing prescriptive beliefs about gender roles and, as discussed above, in Scandinavian countries, egalitarian gender attitudes coincide with extremely high levels of segregation. To counter this, authors suggest that different aspects of gender attitudes change within countries at different rates and this is not always picked up by comparisons using a measure of 'average' gender attitudes. Therefore, whilst a country's average measure of 'traditionalism' or 'liberalism' may be shifting over time, this can coincide with stability in other aspects of gender attitudes, for instance in terms of stereotypes regarding men and women's 'essential' competences (Cech, 2013; Charles & Grusky, 2004; Knight & Brinton, 2017).

1.3.5 Socialisation: the influence of parents and siblings

A more clearly defined pathway through which socialisation could operate is through the influence of parents' and siblings' expressed attitudes, occupational preferences, and their behaviour in the labour force or at home. This can be separated into direct imitation or behavioural role-modelling. If children directly copy parental behaviour this can lead to gender differences – when daughters imitate mothers and sons imitate fathers, then this will reproduce any occupational segregation from the adult labour market into children's occupational preferences. Alternatively, influence can be more general, through behavioural role-modelling – if either parent works in a gender-typical field, *or* exhibits gender-typical domestic behaviour, this may encourage a child's gender-typical

behaviour, i.e. if a mother is a housewife, both sons and daughters may aspire to gender-typical roles themselves.

There are mixed findings on this; in terms of occupational imitation, it is frequently found that parental skills and occupational sector matter for children's occupational and educational choices and this is as much linked to socio-economic background as it is to gender (Dryler, 1998; Friedman, O'Brien, & Laurison, 2016). However, in terms of behavioural role-modelling, more recent British studies argue that parental gender-typicality matters for attitudes and preferences, regardless of the *specific* field that the parent is occupied in (Platt & Polavieja, 2016; Polavieja & Platt, 2014).

Dryler's (1998) empirical work focuses on the survey responses from Swedish teenagers born between 1972 – 1976, and looks at the transmission of specific educational fields, such as academic tracks, like engineering versus humanities, or vocational tracks, such as technical/craft versus healthcare. She shows that having a parent working within a particular field increases the probability that a child will make a similar choice of educational programme at upper secondary school. This is found to be a stronger relationship for fathers and sons. Using more general categories of occupation (gender-typical, gender-atypical, gender-neutral) Polavieja and Platt consider what affects gender-typical occupational preference formation among 11-15-year-olds in the BHPS from 1994 – 2004. They consider: (1) observable psychological attributes; motivation and self-esteem, (2) parental gender-typical behaviours and (3) individual's occupational ambition. They find that the two main sources of parental influence are parental gender-typical behaviours and parental socio-economic resources (which they argue affect a child's level of ambition) and find strong evidence for a homolineal transmission between parental characteristics and children's aspirations. Mothers who are in a gender-atypical occupation are associated with daughter's aspirations for gender-atypical occupations,

whilst boys with fathers who have gender-typical occupations are more likely to aspire to these types of jobs themselves (Polavieja & Platt, 2014).

In a further study, Platt and Polavieja (2016) find that, among the same sample of children, what parents say matters as well as what parents do , in terms of influence on children's own attitudes towards the gender division of labour. They argue that parental attitudes and parental behaviours both affect children's attitudes separately; fathers' attitudes affect sons (regardless of mothers' attitudes), but only influence daughters if they are in line with mothers' attitudes. Mothers' attitudes affect daughters (regardless of fathers') but only influence sons if in line with fathers' attitudes.

There are several outstanding research questions that follow these studies. First, it is often assumed that the causal pathway is simple; a parent exhibits gender-traditional attitudes or behaviour, therefore a child has traditional gender attitudes, and this will easily translate into gender-typical occupational preferences and attainment (or vice versa for liberal gender attitudes and gender-atypical occupational preferences). However, gender attitudes for both parents and children may not always easily match up to behaviour. Indeed, attitudes are more complex than a one-dimensional spectrum between traditional or liberal attitudes, as highlighted by Knight and Brinton (2017), and different aspects may have different influences on preferences. Furthermore, resource and structural constraints will influence the types of occupation that are deemed feasible for a child, regardless of their attitudes or preferences. Parental influence is mediated by other factors, both within and beyond the immediate family. This is discussed further in the next section.

Just as young people learn from and are influenced by their parent's characteristics and attitudes, they also learn from and are influenced by their siblings. This can be due to

compositional factors, such as the number of other siblings in the family, the gender of other siblings, birth order, age spacing between siblings, whether siblings are biological, adopted or step-siblings, whether they live in the same household, and how close their relationship is. Empirical evidence on sibling influences to date have shown a relationship between various aspects of sibling composition with educational attainment and the ambitiousness of aspirations (Bu, 2014; Choi, Taiji, Chen, & Monden, 2017; Kalmijn & Van De Werfhorst, 2016). However, less is known about the influence of siblings on the gender-typicality of aspirations. The majority of evidence on sibling influence on gender-typical behaviour comes from the examination of two-sibling families—sibling dyad relationships—and the influence of older siblings on younger siblings. Rust et al (2000) find that pre-school children in the Avon Longitudinal Study (born between 1991 and 1993) with same-gender older siblings are more gender-typical in behaviours (although too early to measure occupational aspirations) than those without siblings, who are in turn more gender-typical than those with opposite-gender older siblings. Other studies disagree, either finding no variation in gender-typical behaviours between those with opposite-gender siblings and those with same-gender siblings, (Bu, 2014; Vroegh, 1971) or finding the reverse—for instance, that girls with brothers are more gender-typical than those with sisters (Seegmiller, 1980). Therefore, there is a need for more in-depth empirical evaluation of the role of siblings on gender-typicality of occupational preferences, which prompts the research questions in Chapter 5.

1.3.6 Resource and structural constraints

Lastly, explanations which focus on resource and structural constraints instead start from the distribution of genders between occupations and consider how this shapes occupational characteristics, and how preferences adapt to available occupations (Reskin & Bielby, 2005). Jobs which are female dominated, such as teaching, are required to

adapt to the fact that women still perform a larger share of childcare and routine domestic labour than men (Kan, Sullivan, & Gershuny, 2011), and therefore part-time work and job sharing arrangements are common. Male-dominated jobs do not need to make provision for this in the same way. Societal structures therefore "determine aspirations by determining the extent to which they can be satisfied" (Bourdieu, 1973:83) – if there is great variation in the extent to which occupations provide for work-life balance, and women still do the bulk of domestic labour and childcare, then this will segregate occupational preferences. It could be argued that these considerations affect adult women and are not relevant to young people. However, other authors, for instance Bagnoli et al (2014), demonstrate that girls start to think about reconciling work and family in their early teens – before boys – and this influences how they perceive their future careers. Girls explicitly spoke about timing issues and the potential conflict between career and family, which was not evident in the responses of boy, e.g., "I would like to be a marine biologist/singer with a family (not sure about the family because I would like to get a stable career *first)* but certainly would like to be married or in a stable relationship" (Bagnoli et al., 2014:336, emphasis added)

Resource constraints also affect the pool of occupations that individuals select from, and this will affect gender-typicality if gender-typical occupations are distributed unevenly throughout the adult labour market. Socio-economic background is one of the most frequently referenced resources constraints. This encompasses a range of characteristics describing the context in which an individual grew up, measured variously within academia by parental education, parental occupation and parental income, and also within UK government policy by other individual- and region-specific indicators, such as whether an individual is eligible for free school meals or other benefits, falls below certain thresholds in neighbourhood deprivation indices, such as ACORN or POLAR, or

is the first in their family to go to university[5]. Blanden (2013) emphasises that the choice of indicator is associated with discipline and can also affect the conclusions drawn. For this thesis, I consider the role of parental education and parental occupation as these are the aspects most frequently linked to the gender-typicality of young people's preferences, within the sociological literature.[6]

It is well-documented that socio-economic background influences the occupations that individuals aspire to and attain, both directly, and indirectly through educational aspirations and decisions. Socio-economic background remains one of the most pronounced cleavages in the UK; the achievement gap by social background in age 16 educational attainment is twice as big as the gap by ethnicity, and six times as big as the gap by gender (Strand, 2014). Young people from a lower socio-economic background in the UK are less likely to attend university, or to aim for, or be accepted at, elite universities, compared to equally qualified peers (L. Blanden & Macmillan, 2016; Boliver, 2013). At occupation-level, they are less likely to aspire to, or attain, professional-level jobs (Ashby & Schoon, 2010). Therefore, if there are *more* gender-typical jobs outside of the professional sphere, then individuals aspiring to jobs which are not professional-level will be more likely to aspire to jobs which are gender-typical, regardless of whether they have preferences for gender-typicality or not. Chapter 4 of this thesis tests alternative explanations for parental education background differences in gender-typical occupational preferences and tests the association of aspirations for gender-typical, male-dominated or female-dominated occupations with parental characteristics.

[5] Further discussions can be had around whether these indicate class, and if this is separable from status etc. These are left for another time.

[6] For robustness, the majority of analyses have also been performed using parental class (using the 5 class version of the National Statistics Socio-Economic Classification).

The challenge with these arguments is that it is difficult to empirically separate the role of resource or structural constraints from an individual's own preferences or gender attitudes. Generally, there is not an opportunity to see the counterfactual, for instance, would an individual have chosen a STEM job if they were not constrained by the lack of family-friendly employment policies? Some experimental evidence *does* show that under different sets of institutional constraints, participants make different decisions regarding future work/family balance (D. S. Pedulla & Thebaud, 2015), but often it is not possible to ask about this.

1.3.7 Justification of research questions and potential contributions

Linking back to these themes of theoretical explanations; preference theory, rational decision frameworks, socialisation, and resource and structural constraints, my thesis makes four potential contributions to the explanation of gender differences in young people's occupational preferences.

First, in Chapter 2, I revive the concept of job values to test whether there is any empirical basis for the theory of underlying or 'basic' gender differences in job values among young people in the UK. This tests whether there is any evidence to support Hakim's preference theory about fundamental differences in orientations towards work and family throughout the life course, or, for the more modern version, any evidence to support theories of underlying sex differences in interest or values.

Second, in Chapter 3, I test whether these differences matter for aspirations for STEM fields, to what extent differences in job values explain gender differences in occupational preferences for STEM fields, and furthermore, whether there are gender differences in how young people's job values relate to their occupational aspirations. Testing for initial associations between gender differences in values and gender differences in occupational

preferences again provides a test for preference theory. However, this chapter also contributes to theoretical explanations based on decision frameworks, such as Eccles' expectancy-value framework, and the rational choice theory of decision-making. This is because as well as including job values, I also consider the role of gender attitudes and parental characteristics and weigh their relative influence.

These research questions are useful to public bodies, such as the Department of Education's STEM strategy, the WISE Campaign, or EngineeringUK, whose mission is to encourage girls to aspire to traditionally male-dominated occupations within the STEM field. Findings about the relevance of job values and/or gender attitudes could influence how STEM occupations are presented by employers in the future, by highlighting the importance of informing applicants about a wide variety of job attributes fulfilled in a job.

Third, in Chapter 4 I investigate the role of parental characteristics and resource constraints in occupational preference formation, with an emphasis on the role of parental education and parental gender attitudes. I test whether the previous association among 11-15-year-olds' gender-typical preferences and parental education can be replicated with an older sample, using more recent data. Next, I test whether any association between parental education and gender-typicality can be mediated by an individual's 'ambition', or by gender attitude differences between parental education groups. These contribute to theoretical explanations based on socialisation via parental role-modelling or based on resource and structural constraints, by testing the contribution of various parental characteristics, an individual's own gender attitudes or job values, and whether or not an a child aspires to a professional-level job.

This is relevant for policy-makers concerned with occupational preferences because it widens the range of gender-typical occupations under consideration. Often, media coverage and policy focus on gender segregation within professional spheres, for instance STEM, or business and finance. In addition, interventions focus on combating gender stereotypes with the assumption that changing stereotypes will change preferences. However, not all gender-typical occupations are the same, and gender attitudes, though important, are likely not the only factor influencing whether or not an individual aspires to a gender-typical occupation.

Finally, Chapter 5 focuses on the role of siblings. I test whether the gender ratio of sibships matters for the gender-typicality of aspirations —if a boy has more sisters than brothers (as compared to a gender-equal sibship), is he more likely to aspire to a female-dominated occupation? I also test the between-family contrast between individuals who are only children, and individuals who have at least one sibling, with the former more likely to aspire to gender-atypical occupations. This contributes to the literature on behavioural role-modelling by extending the discussion beyond parental role-models.

1.4 Datasets and UK national context

1.4.1 Datasets

Throughout the thesis, I use two UK longitudinal household datasets; the British Household Panel Study (BHPS), and the UK Household Longitudinal Survey, also known as Understanding Society (UKHLS), covering the period 1996 to 2016[7]. These datasets have great benefits. First, they ask in detail about young people's career-planning preferences—they are surveyed about occupational aspirations to the level of 3-digit Standard Occupational Classification categories, as well as about the importance of

[7] The specific years used depend on the variables used—chapters 3, 4, and 5 use a later period because occupational preferences are only coded consistently from 2006-2016.

several different job values. Second, because both datasets use household sampling techniques, young people can be matched to their parents and therefore parental occupations, gender attitudes and education can be considered in any analyses. Individuals can also be matched to their siblings in a number of ways, most effectively through shared mothers and fathers. Lastly, although not the main focus of this thesis, the longitudinal nature of the dataset means that some individual's aspirations can be compared to their actual adult occupational outcomes at a later date, and analysis of this features in the Appendix.

1.4.2 UK national context

It is worth comparing the UK national context to other advanced industrial societies to justify using the UK as a detailed case study, and to discuss whether it is likely that the associations, and proposed theoretical explanations, will be replicated in other countries.

First, in terms of the structure of the labour market, the UK has fairly high levels of overall occupational gender segregation as compared to other advanced industrial societies. Jarman et al (2012) study 30 advanced industrial societies, using data from the European Social Survey combined data set for waves for 2002–2006, the International Social Survey waves 2002–2006, and Census data 2000–2001 from the Integrated Public Use Microdata Series. They find that Scandinavian countries have the highest horizontal segregation (men and women working in different jobs), Greece, Ecuador and Romania the lowest, and the UK ranks at 10th highest. This doesn't necessarily correlate with vertical segregation (men and women working at different pay levels); the countries with the highest vertical segregation are Japan, the Czech Republic and Austria, with the lowest found in Slovenia (with a small advantage to women), Mexico and South Africa. The UK is a median case. Therefore, studying the gender differences in young people's occupational preferences in the UK, as in Chapter 4, is useful as the UK is in some ways

a ‘typical’ case, with average to above average segregation, depending on the measure used.

However, for some specific occupations, the UK is also an extreme case. Of course, this depends on the comparison group of countries used, but the UK has fewer women in STEM occupations than other European countries (The European Association for Women in Science, 2015), and, further disaggregating, has the lowest proportion of female engineers (10%), as compared to the majority of EU countries (Perkins, 2014). Therefore, focusing on aspirations for STEM, as in Chapter 3, is interesting because the UK is particularly *un*equal in this field. It is useful to separate out aspirations for STEM from aspirations for gender-typical occupations to ascertain whether there is something unique about the mechanisms behind preference formation for these occupations.

In terms of the distribution of gender-typical occupational preferences, girls in the UK have similarly gender-typical occupational preferences, compared to other advanced industrial societies, whereas boys in the UK tend to have *more* gender-typical occupational preferences than in other countries (Leuze & Helbig, 2015) . Leuze and Helbig (2015) show that at age 15, girls’ occupational aspirations are most gender-typical in Finland, Lithuania, Estonia, Poland and Slovenia, and least gender-typical in Italy, Greece, Norway and Spain. Boys’ occupational aspirations are most gender-typical in Norway, Switzerland, Spain, the UK, and least gender-typical in Bulgaria, Canada and Lithuania. This doesn’t match perfectly to the level of overall gender segregation in a country—Norway has high gender-typicality of preferences among boys, low gender-typicality of preferences among girls and overall high horizontal segregation with low vertical segregation by gender. This is partly because of the difference in measurement (concentration of men and women within occupations versus distribution of men and women between occupations), and partly because the overall country-level measures of

segregation don't differentiate between boys' and girls'/mens' and womens' distributions—in most countries, boys make more gender-typical choices than girls do, regardless of the overall level of gender segregation, and this is especially pronounced in the UK. Differences by socio-economic background in gender-typical preferences have been shown to exist across most advanced industrial societies, but the size of these differences has not been compared (Leuze & Helbig, 2015).

In terms of job values, there has been little work considering between-country differences in the distribution of job values among young people in advanced industrial societies. In general, studies have focused on generational or over time change (Hajdu & Sik, 2015), or on single-country case studies. In Germany, no gender differences were found between work values around a good work/life balance but were found in social work values (Busch-Heizmann, 2015). Among US adolescents, girls valued extrinsic aspects less and intrinsic, altruistic and social aspects more than boys (Johnson, 2001a). Finnish girls, on the other hand, valued some extrinsic aspects, like job security, more than boys, but valued rewards less and intrinsic aspects more (Sortheix, Dietrich, Chow, & Salmela-Aro, 2013). In this respect, there is some consistency between case studies in supporting a general extrinsic/intrinsic split by gender, but it depends on how job values are grouped; studies which disaggregate extrinsic or intrinsic aspects find that gender differences are not as clear cut as assumed. The studies are not perfectly comparable either, as they use different time periods and differently worded surveys. Studies on the distribution of job values among young people in the UK are few and far between since the late 1990s (Eccles et al., 1999). Chapter 2 addresses this gap by providing a detailed description of job values among young people in the UK, and a brief overview of cross-national differences among this age group.

1.5 Structure of the thesis

The remainder of the thesis is structured around four chapters, one descriptive chapter and three journal-style empirical chapters. Each of these chapters addresses a specific gap in the literature, and related research questions, and is designed to be read on its own whilst contributing to an overall understanding of young people's career-planning. The disadvantage of this format is that there is some inevitable repetition across chapters in the context provided, and in the datasets used.

Chapter 2, 'A description of job values among UK youth and a cross-national comparison', is a short descriptive chapter which explains the theoretical relevance of job values and describes differences in job values by gender and parental education in the UK. I review the literature to date, which predicts clear patterns of job value ratings by gender and parental education and compare this with the empirical reality. I provide a cross-national comparison for a more limited range of job values, using the European Social Survey.

The following chapters move to look at the various factors associated with gender differences;

Chapter 3, 'Gender differences in job values and aspirations for Science, Technology, Engineering and Maths occupations', investigates the consequences of job values for occupational preferences, specifically whether gender differences in job values can explain gender differences in occupational preferences for STEM. I consider three different definitions of STEM as well as more disaggregated occupational groups ('fields') within the STEM category.

Chapter 4, 'Parental education and gender-typical occupational preferences: evidence from the UK' studies the association between parental education and gender-typical

occupational preferences, among the same age group. The focus is on testing alternative explanations for why the association between parental education and gender-typicality exists; do differences by parental education in parental role modelling, gender attitudes, job values, or the status of the job aspired to, explain the differing tendencies towards gender-typical occupations?

Chapter 5, 'The role of siblings in gender-typical occupational preference formation' considers the association between sibship composition and siblings' specific occupational preferences on an individual's own preferences for either a male-dominated, female-dominated or STEM occupation. I test associations first, using a pooled cross-sectional approach, and second, using a multi-level structure with individuals nested within families, measured by shared mother and father. I test whether number of siblings, or the gender ratio of a sibship influences the gender-typicality of an occupational preference, , and whether preferences are more similar within sibships.

Chapter 6 concludes the thesis. It summarises the contributions of each chapter and what this thesis contributes as a whole to an understanding of gender differences in young people's occupational preferences in the UK. I discuss limitations and directions for future research.

Chapter 2: A description of job values among UK youth and a cross-national comparison

2.1 Introduction

There are clear associations by gender and socio-economic background, for both educational and occupational aspirations, choices and attainment, over time and across countries. For socio-economic background, Breen et al show associations with educational attainment among cohorts born in the first two thirds of the 20th Century, across eight European countries, although this association is declining over time (Breen, Luijkx, Müller, & Pollak, 2009). Strand (2011) study a more recent UK cohort, those born in 1989/1990, to show that socio-economic background, ethnicity and gender all account for gaps in educational attainment, with social class explaining the largest proportion of variance. Macmillan et al (2014) show that the influence of background persists even among those who went to university—UK graduates finishing in 2006/7 were more likely to attain high-status jobs if privately educated than if state-educated.

For gender, Frome et al (2006) show that in the US, among cohorts born in the 1970s, young women opt out of traditionally male-dominated fields, regardless of ability, and other studies show the importance of gender in informing occupational aspirations, among UK cohorts born in the late 20th Century (Bagnoli et al., 2014). Codiroli (2015) also shows that gender and socio-economic background interact among this UK cohort for degree choice and uptake- there are disparities after accounting for prior attainment, *especially* for young women from less educated families.

However, there is little substantive empirical evidence about present day differences in what young people in the UK think is important in their job—their job values—although gender differences are often assumed to exist. Case studies of the cohorts born in the mid to late 20th Century in the US, Germany, Finland and Switzerland show that gender differences in job values are persistent (Busch-Heizmann, 2015; Johnson, 2001a; Sortheix, Chow, & Salmela-Aro, 2015; Tschopp, Keller, & Stalder, 2015). Research in the last two decades in the UK has focused instead on the job values of those already established in the labour market, older people, or on the existence or absence of generational change in highly aggregated job values (Gallie, Felstead, & Green, 2012; Hajdu & Sik, 2015; Zou, 2015). Additionally, there is a gap in research around differences in job values by parental education, despite a font of knowledge about differences in aspirations. Kalleberg and Marsden (2013) argue that job values change once young people enter the labour force, through socialisation, therefore studying job values after a young person has already become established in their career is likely to give different results compared to studying job values before transition into the labour force.

I look at job values as early as possible in the UK, to fill the gap in current research, and consider differences by gender and parental education. I study the age range 14 to 21, an important time for UK youth, as this is when they are required to make a series of decisions relevant for their adult occupational outcomes. I provide statistics on how the UK compares to other EU countries in the distribution of job values, to provide context for the discussion of career-planning in the UK.

This chapter is structured as follows; first, I outline what is known so far about how young people formulate job values, and theoretical reasons to anticipate differences by

gender and parental education. Second, I describe the actual distribution among young people in the UK and compare this to the theoretical predictions.

2.2 Context

In this section I define job values and why they matter for occupational preferences and later outcomes. I show why differences in job values are expected between groups and why it is necessary to look in detail at young people in the UK, rather than assuming that their job values will be consistent with other research.

2.2.1 What are job values and why do they matter?

There is a long list of job attributes that individuals could care about, including attributes like job security, job pay, time for leisure, relationships with colleagues or opportunities for on-the-job training, and the concept of job values has been written about in several ways. It is interesting to study both how important individuals think each of these specific attributes of a job are, and to consider the relative importance of each of the job values; e.g. how important job security is as compared to to how important job pay is. Goldthorpe (1968) simplifies this by grouping relative rankings of job values into a 'work orientation'; "the way in which workers order their wants and expectations relative to their employment"(1968:38). For Goldthorpe and others, a work orientation is the underlying meaning that work has for an individual (Goldthorpe, 1968; Zou, 2015). He separates job values into either extrinsic or intrinsic attributes, where extrinsic values are values like job pay, job security and opportunities for promotion, and intrinsic values are values like a job that is interesting or work that is challenging. Generally, regardless of whether authors use the terminology 'work orientation', most authors group together job values into themes, most commonly into extrinsic or intrinsic job values, but also into other categories like altruistic, such as a job that helps others, a job that contributes to

society, a job that makes a difference; social, such as good relationships with colleagues, working with like-minded people, a good relationship with the boss; and work/life balance, such as time for family, time for leisure, flexible working, and whether you can work from home (Busch-Heizmann, 2015; Johnson, 2002; Tschopp et al., 2015). One exception to these categories is found in Halaby (2003), who instead categorises job values as either entrepreneurial or bureaucratic. This is discussed later.

The relative ranking of job values matters for a variety of adult outcomes (where adult is defined as age>21). It is argued that the relative ranking of job values affects job satisfaction, to the extent that the gender differential in job satisfaction disappears once differences in work orientation are accounted for (Goldthorpe, 1968; Zou, 2015:1). Goldthorpe argues that the predominant work orientation for men is an instrumental orientation; the primary meaning of work is as a means to an end, rather than valuing the work for its own sake. This work orientation means that men are likely to value extrinsic aspects of a job more than they value intrinsic aspects of a job. For women on the other hand, intrinsic aspects of a job are more important on average. Other authors overlap the discussion of job values and work orientations with the discussion of preferences. Hakim (2000) argues that women have strong preferences around work/life balance, and this leads them to be either career-oriented, home-oriented or adaptive (by which she means they have no clear orientation/strategy). She suggests that preferences explain more about choices about whether to work full-time, part-time, or not at all, than contextual constraints do. In her argument, preferences are distinct from values and attitudes—values and attitudes indicate what people believe is best for society in general, for instance, whether or not it is acceptable for mothers to have a full-time job, whereas preferences indicate what individuals think is best for them, for instance, I can believe simultaneously that it is acceptable for mothers to have a full-time job and also prefer not

to work whilst a mother myself. However, the way that job values are asked about in most surveys makes them more similar to Hakim's 'preferences'; people are asked, "when looking for a future job, what is important *to you*?" Therefore, job values are linked directly to the individual and their future choices. There are numerous criticisms of Hakim's theory, for instance that the limited number of work orientations is an oversimplification of work/life preferences, which assumes that preferences are stable over the life course and understates the influence of constraints on work decisions, such as the cost and availability of childcare or flexible work and prevailing cultural norms around childcare (Crompton & Lyonette, 2005; Ginn et al., 1996; McRae, 2003). Part of the confusion in distinguishing between values, attitudes, preferences and behaviours is because of endogeneity; under the cognitive dissonance argument, individuals adapt their attitudes and preferences to their choices, as well as having choices influenced by attitudes and preferences (Baxter, Buchler, Perales, & Western, 2015; Schober & Scott, 2012; Zhou, 2017). Whilst it is unlikely that work/family preferences explain the entirety of women's work choices, as in Hakim's theory, it is nonetheless plausible that the job values of an individual are important for occupational aspirations, choices and work satisfaction.

Recent studies of other advanced industrial societies show that this is the case for young people (age<21). Wang and Kenny (2014) show that among 17- and 18-year olds in the US, support for altruistic or social job values leads young people away from STEM careers, which are perceived to be less people-oriented. In Germany, 17-year-olds who have higher social job values are more likely to aspire to female-dominated occupations, and women with higher extrinsic job values are more likely to aspire to male-dominated occupations (Busch-Heizmann, 2015). Job values also affect how likely young people are to *achieve* a certain social status or earnings position; Ashby and Schoon (2010) show

that, “young people for whom it was important to have a job that enabled them to get ahead earned more money in adulthood, compared to their less ambitious peers” (2010 p.357). These studies show that differences in job values can explain differences in occupational attainment and therefore contribute to explaining inequalities in later life. Thus, it is worth understanding differences in job values at an early age. I explore further associations with young people’s job values in Chapters 3 and 4.

2.2.2 Why would job values differ between groups?

There are several explanations for why job values might differ by gender and parental education and these depend on how and when authors think that job values are formed. I discuss selection, socialisation, anticipatory socialisation, and rational choice explanations, and how these would lead to group differences. These aren’t tested here but provide theoretical justification for why group differences are anticipated.

Kalleberg and Marsden (2013) suggest there are two phases of job value formation; (1) selection prior to entry into the labour market, where group membership socialises people into values and norms held by that group, and (2) socialisation after entry into the labour market, where work experience influences what workers value in their current job.

In the case of selection prior to entry into the labour market, there may be differences by gender in job values due to gendered socialisation. For instance, if men are more likely to value extrinsic aspects of a job, this could be due to cultural norms around men as breadwinners, whereas women are more likely to value intrinsic aspects of a job, if a job is seen as secondary to their ‘main’ role as homemaker, or they may value altruistic aspects of a job due to cultural norms around women as carers. Other authors point to essential differences between men and women and argue that men have a greater interest in job attributes in the dimension of ‘things’, such as working with machinery or physical

objects, whereas women have a greater interest in job attributes in the dimension of 'people', including both social aspects, such as positive relationships with colleagues and employers, opportunities to socialise outside of work, and altruistic aspects, such as helping others (Geary & Stoet, 2018).

Alternatively, in the case of socialisation after entry into the labour market, workers may adjust their job values to increase their view of the importance of the job attributes that they have missed out on. This is called the 'problematic rewards' hypothesis: workers in well-paid and secure jobs will be less likely to place a high value on extrinsic rewards and more likely to value intrinsic aspects, such as a job that is interesting, or a job that contributes to society. This is because once their desires for job pay or job security have been satiated, they are more focussed on the alternative values. Workers who are unemployed or are in very insecure jobs will conversely value what they do not yet have; high income and job security. If this is the case, job values would differ between groups only *after* different labour market experiences—higher parental education individuals are more likely to end up in secure, well-paid jobs and therefore have higher intrinsic values as compared to lower parental education individuals.

Kalleberg and Marsden's (2013) research suggests that young people's differences in job values will only be as a result of selection if they have not yet transitioned into the labour market. However, other authors suggest that socialisation can be anticipatory (Levine & Hoffner, 2006). Young people learn about the labour market and the attributes of occupations that are realistic for 'people like them' before they enter the labour market, from a combination of influences from parents, educational institutions, part-time jobs, friends and from the media. For instance, parents influence their children's gender attitudes by their attitudes and behaviours (Platt & Polavieja, 2016), therefore it makes sense that they also influence the way that children perceive work (Levine & Hoffner,

2006). Literature on working class culture often emphasises that working class children have different group norms around 'cool' educational or occupational behaviours, as compared to middle class children (MacLeod, 2004; Willis, 1980). Jablin (2000) also shows how peers provide feedback on the desirability of various occupations; children from different parental backgrounds, schools, jobs or social groups will have different job values due to the different information that they receive about work from their sources.

Lastly, Halaby (2003) argues that young people form preferences for different aspects of a job based on a trade-off between risk and reward. The 'reward' of a job is its mean financial pay-off and the risk is the variance in pay-off. Advantaged individuals (those from high parental education backgrounds or privileged groups, such as men, or those who are white) favour an 'entrepreneurial' strategy; high risk, high reward occupations that have attributes such as high pay and high autonomy. For example, a 'high risk, high reward' strategy would be working as a trader with an investment bank. This provides a mean salary well-above average, but also a high probability of losing your job. Less advantaged individuals (those from low socio-economic backgrounds, ethnic minorities, women) favour 'bureaucratic' strategies; low risk, low reward jobs, with lower pay but higher job security and training opportunities, such as teaching or administration. In some ways this is similar to the problematic rewards hypothesis, except that here people are undervaluing what they *assume* they will receive in the labour market rather than what they actually have received. Alternatively, in the rational choice narrative, children from different groups have different costs, perceived benefits and probabilities of success and therefore could develop different job values based on matching characteristics to jobs that they expect to receive, just as the rational choice framework explains why they make different educational and occupational choices (Breen & Goldthorpe, 1997; Eccles, 1994; Polachek, 1981).

2.2.3 Previous empirical evidence of group differences

It is difficult to make generalised statements about empirical group differences in job values because there is great variation in the job values authors choose to study, as well as in the time period, country, age group and categorisation of key characteristics, like socio-economic background. The most commonly studied contrast in job values is between men and women, and whether they value extrinsic or intrinsic values, and there is mixed evidence on this. In the UK, Zou (2015) uses the UK 2006 Skills Survey, which surveys men and women aged 20 to 60 who are either employed or self-employed, and finds that men value extrinsic job values more than women but also value *some* intrinsic job values more than women. On the other hand, women think that social relations and flexible work are more important than men do. Within the gender groups they also find differences by work status; women part-timers differ on almost every aspect compared to women full-timers. Sortheix et al (2013) finds some similarities to the UK among Finnish men and women at age 23, but some differences too; women have more intrinsic values than men, but also want more stable jobs (an extrinsic value) while Finnish men want higher pay. Gallie et al (2012) on the other hand, use the same UK data as Zou (2015) but find *no* gender differences in intrinsic job values once education is taken into account. They do find differences by early parental interest in progress and an individual's own occupational level; greater occupational status is associated with a greater emphasis on intrinsic job values (in line with the problematic rewards hypothesis), and find for women, that more support from parents is associated with more intrinsic values. Looking outside of the UK, Hajdu and Sik (2015) find that among men and women aged 18 to 40 across Europe, women value job pay (extrinsic) significantly less than men, and value flexible hours and a job that is useful for society (an altruistic value) significantly more. There are no significant differences on job security or having an interesting job (an

intrinsic value). Overall, the back and forth between studies suggests that gender differences in job values are not as clear cut as is often assumed; there is only mixed evidence of a gendered extrinsic/intrinsic job values divide. Additionally, these studies all focus on adults, or a wide age range including both youth and adults, so differences could either be due to selection, anticipatory socialisation or socialisation after entry into the labour market.

There are a small number of studies researching job values at an earlier age in Europe. The European Policy Centre report (2011) provides an overview of job values in 2004/5 across Europe for individuals from age 15 upwards (detailed analysis of the UK is not provided). Gender differences are not examined, but they find that those who are highly educated are less likely to highly value job pay or job security (extrinsic values) when compared to those with less education and are more likely to value opportunities to seek their initiative (intrinsic values). This provides further support for the problematic rewards hypothesis (Kalleberg & Marsden, 2013). Busch-Heizmann (2015) does cover gender differences among young people, focusing specifically on 17-year-olds in Germany. She finds no gender differences in the value placed on work/life balance but does find that women place more importance on social job values, and men place more importance on extrinsic job values. It is in the US that job values research has been most prolific—Jin and Rounds' (2012) systematic review of the literature identifies 110 longitudinal papers on job values. Most US papers find that among high school seniors, girls are more likely to value intrinsic values, and some (but not all) find that boys are more likely to value extrinsic values (Johnson, 2001b, 2002; Marini, Fan, Finley, Beutel, & Marini, 1996; Wray-Lake, Syvertsen, Briddell, Osgood, & Flanagan, 2011).

Therefore, the empirical evidence to date on gender differences in job values suggests that the gender distribution is more complex than an extrinsic/intrinsic divide. Empirical

evaluation of differences by socio-economic background is less common, but in general, there is support for Kalleberg and Marsden's (2013) problematic rewards hypothesis; groups who disproportionately end up in low-paying, insecure jobs (those from low socio-economic backgrounds) are more likely to value extrinsic aspects.

2.3 Data

In this section, I outline the data used to begin to address the gap in knowledge on young people's job values in the UK. I use two nationally representative UK household panel studies; the British Household Panel Survey (BHPS) and Understanding Society (UKHLS), and the European Social Survey (ESS) for cross-national comparison.

2.3.1 UK household studies

The UKHLS is an annual longitudinal household study which began in 2009 and is still ongoing, initially following 40,000 UK households. The same individuals are re-interviewed each wave and each have a personal identifier, which means they can be matched across waves. The survey design oversamples ethnic minorities and individuals from Northern Ireland in order to achieve sufficient sample sizes from these subsections. BHPS is the predecessor to UKHLS, which ran from 1994 to 2008. It uses a nationally representative sample of more than 5,000 households in the UK. Both surveys include a Youth Panel, focusing on children aged 11-15. UKHLS includes a specific Young Adults Module focusing on people aged 16-21.

Seven job values are included in UKHLS and six in BHPS;

The survey asks;

"When thinking about an occupation, how important is… Future job security? High income? Time for leisure? A job that interests you? A job that benefits society? Time for family life? A job that helps others?"

This question is not asked in every wave of the survey, but is asked consistently in the Youth Panel, in years 2002, 2003 and 2007 (waves 12, 13 and 17) , to ages 14-15, and in the Young Adults module in 2010-2012, 2012-2014 and 2014-2016 (waves 19,20 and 22), to ages 16-21.[8] Each aspect is rated individually on a scale of 1 to 4, where 1 is very important and 4 is not at all important.[9] Respondents can answer that numerous job values are 'very important'—they do not explicitly rank the job values against one another, but there is an *implicit* ranking based on whether they respond that each job value is 'very important' or not. In percentage terms, 92% of children and 89% of young adults who had an opportunity to answer job values questions gave at least one valid response. In this chapter, I analyse the BHPS and UKHLS surveys separately, creating two separate pooled datasets, by pooling data across waves of the same survey (i.e. 2002, 2003 and 2007 for BHPS, and 2010-2012, 2012-2014, and 2014-2016 for UKHLS). Because the survey is longitudinal, this means that there are some repeated observations of individuals in the pooled datasets, as the same individuals are interviewed again. Therefore, in the descriptive statistics, I present standard errors which are clustered at the individual level to correct for correlations within individuals over the repeated waves. Overall, there are just under 2,800 total observations of around 2,250 individuals of people aged 14 to 15, and 12, 700 observations of 7,800 individuals aged 16 to 21, although this varies somewhat across job values. Total detail of sample size shown in

[8] Job values are also asked in three earlier waves of the BHPS youth module but the wording of the questions is different, so it cannot be assumed that respondents interpret the questions the same way in both sets of questions.

[9] In UKHLS, there is an option of saying 'I do not know'. Less than 0.5% of respondents choose this option. There is no option to say 'I do not know' in BHPS therefore I do not use the 'I do not know' responses in UKHLS as otherwise the two surveys are not comparable. For robustness, estimates were also conducted including these responses and results did not change.

Table 1. Proxy interview responses are excluded. I analyse both the average score on the 1 to 4 scale (for average ratings), and the proportion of young people who give the job value its top rating; very important.

The job values correspond broadly to the following themes:

Extrinsic: Job pay/high income, job security

Intrinsic: A job that interests you

Altruistic: A job that helps others, a job that contributes to society

Work/life balance: Time for leisure, time for family

Whilst I make reference to these groups of job values in the descriptive statistics, I analyse each job value separately, as the previous country case studies have shown that the groupings chosen can affect the gender differences found.

Gender and age are available in all waves, where 0 = male, 1 = female. Socio-economic background is measured using parents' highest educational attainment, using the dominance principle, where either the father's or mother's education is used, whichever is higher, as per Erikson and Goldthorpe's method for measuring social class (Erikson & Goldthorpe, 1992). Individuals can be matched to their parents using the parental personal identifier, as long as their parents remain in the survey and they lived in the same household at some point during the survey, even if the individual subsequently moved out. Parental educational attainment is coded to 4 categories; higher or first degree, upper secondary education, lower secondary education or lower/no qualification.

2.3.2 European Social Survey

For the cross-national comparison, I use the European Social Survey (ESS).[10] This is a cross-national survey of attitudes and behaviour, including 23 EU member countries and a number of 'guest' countries. Respondents are selected using probability sampling of all individuals over the age of 15 (1 year older than the UKHLS/BHPS sample used for job values).

I use two waves of the survey; 2004 and 2010. These two waves are selected because they include questions on five job values, within the Family, Work and Well-Being Module. It should be noted that the location of these questions within this module could mean that questions on job values in the ESS are interpreted differently by respondents to the questions on job values in UKHLS and BHPS. Given that the question specifically focuses on the relationship between family, work and well-being, and the importance of work-family balance, respondents are primed to consider the relationship between these aspects. This priming is not apparent to the same extent in the UK-only surveys, where the job values questions are presented within the main survey.

The ESS survey asks;

"For you personally, how important do you think each of the following would be if you were choosing a job? A job that enabled you to use your own initiative? A secure job? High income? A job that allowed you to combine work/family? A job that offered good training opportunities?"

Each aspect is rated individually on a scale from 1 to 5, where 1 is not at all important and 5 is very important. I compare the three job values that are also asked in the UK datasets only.

[10] The European Values Survey also has questions on job values, in four other waves; 1981, 1990, 1999 and 2008. However, this is only for older members of the group, as respondents are only included from age 18 upwards, therefore it is not included.

Overall, there are 30 countries with available data on these questions for young people aged 15 to 21. I pool the data for 2004 and 2010. The sample sizes are small—for the full age group, each country must secure a sample size of at least 1500, or, 800 for countries with a population of less than 2 million. Once the sample size is reduced to youth, overall, there are 8,796 observations of 15-21-year-olds who answer questions on job values. I exclude countries with less than 30 individuals per comparison group, detailed in the results section. The survey is cross-sectional, therefore, unlike in BHPS and UKHLS, observations are not repeated across the same individuals and clustering is not required. However, weights are applied to table percentages quoted, to correct for selection probabilities, as instructed by the data owners.[11]

As in the UK data, I analyse both the average score on the 1-5 scale (for average ratings), and the proportion of young people who give the job value its top rating; very important (for differences between groups).

The job values correspond broadly to the following themes:

Extrinsic: Job pay/high income, job security

Work/life balance: Time for family

Gender and age are available in all waves. Socio-economic background is measured using parents' highest educational attainment, using the dominance principle, where either the father's or mother's education is used, whichever is higher, as per Erikson and Goldthorpe's method for measuring social class (Erikson & Goldthorpe, 1992)., coded to the same four categories.

[11] ESS guidance states, "when comparing data from two or more countries but without reference to statistics that combine data from more than one country, only the design weight or the poststratification weight need be applied. When comparing data of two or more countries and with reference to the average (or combined total) of those countries, design or post-stratification weight in combination with population size weights should be applied."

2.4 Descriptive statistics for gender differences

2.4.1 UK data

Table 1 shows that for girls aged 14-15 (BHPS, 2002-2007) the most important job value on average is 'a job that is interesting', followed by 'job security' and a high income, referred to hereafter as 'job pay'[12]. The least important characteristics for girls are 'time for leisure' and 'a job that contributes to society'. For boys, the ranking overall is similar to the girls, with the exception that boys rate 'time for leisure' higher than either of the altruistic values. Boys' ratings are generally lower than girls, with statistically significant differences in the means of 'job pay', 'a job that helps others' and 'time for leisure'. Both boys and girls aged 16-21 (UKHLS, 2010-2016) also rate 'a job that is interesting' the highest, followed by 'job security'. The least important values for girls are 'time for leisure' and 'a job that contributes to society'. For boys, as before, the ratings are similar except that 'a job that helps others' is less important. According to the standard deviations, ratings for 'a job that helps others', 'a job that contributes to society' and 'time for leisure' are more diverse than ratings for 'a job that is interesting' or 'job security'. Boys and girls have similar variation in responses and their means are significantly different on all job values, though in all cases the size of the difference is less than 1 unit—less than a shift from 'very important' to 'important'.

[12] Of course, a limitation of this measure is that there could be ambiguity in how an individual interprets the question around job pay or high income – for instance, do they care about the absolute amount, or do they care about its stability over time?

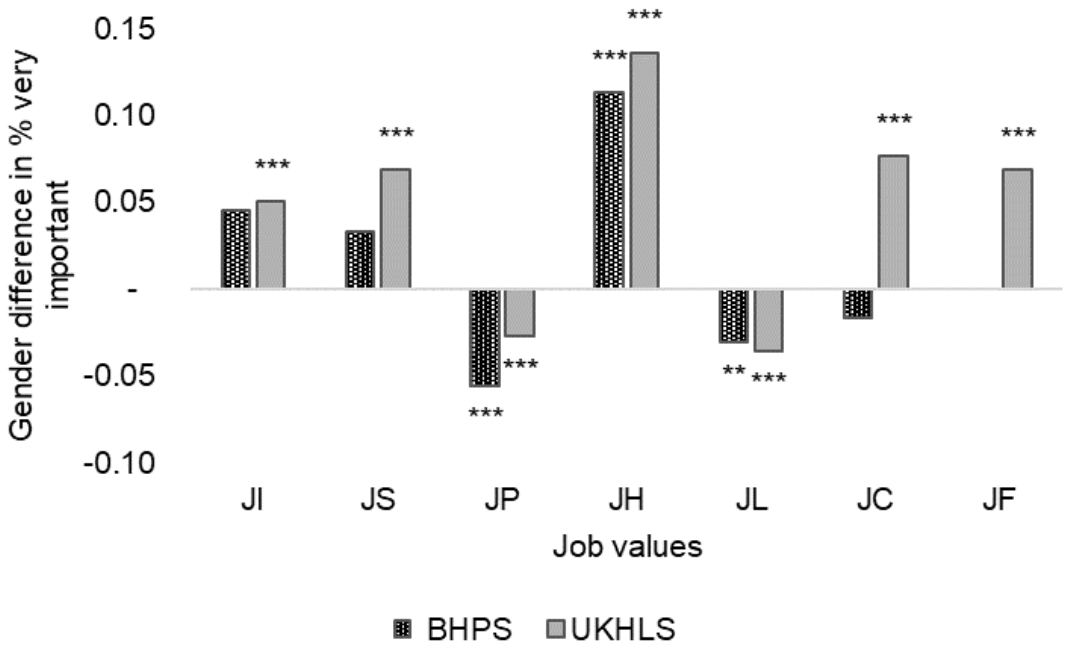
Table 1: Average job value ratings for boys and girls by wave, response scale ranging from 1 (not at all important) to 4 (very important).

	BHPS Girls		*BHPS Boys*					
Job value	N	Mean	N	Mean	Gender coefficient	SE	*	N (clusters)
A job that is interesting	1,067	3.76	1,014	3.71	0.02	0.03		2,258
Job security	1,024	3.41	987	3.37	0.00	0.03		2,215
Job pay	1,058	3.38	1,013	3.45	- 0.11	0.03	***	2,250
A job that helps others	1,026	3.18	940	2.89	0.29	0.04	***	1,593
Time for leisure	1,034	2.91	995	3.00	- 0.09	0.03	**	2,220
A job that contributes to society	980	2.84	938	2.76	0.06	0.04		2,149

	UKHLS Girls		*UKHLS Boys*					
Job value	N	Mean	N	Mean	Gender coefficient	SE	*	N (clusters)
A job that is interesting	6,723	3.68	5,918	3.62	0.06	0.01	***	7808
Job security	6,712	3.61	5,911	3.54	0.07	0.01	***	7799
Time for family	6,718	3.36	5,915	3.25	0.11	0.01	***	7806
A job that helps others	6,709	3.20	5,915	2.94	0.26	0.01	***	7800
Job pay	6,718	3.15	5,915	3.19	- 0.04	0.01	**	7804
A job that contributes to society	6,694	3.01	5,905	2.80	0.21	0.01	***	7793
Time for leisure	6,708	2.74	5,913	2.83	- 0.10	0.01	***	7798

Notes: Ordered by girls' mean score. Data from UKHLS (age 16-21) and BHPS (14-15) shown separately. BHPS (three waves, from 2002-2007), UKHLS (three waves, 2010-2016). 'Time for family' is not asked in BHPS. Gender coefficient presented for pairwise comparison of girls' and boys' observations, with standard errors clustered by individual to correct for correlation within individual over waves, with N (clusters) presenting the total number of clusters (girls + boys). Stars indicate p-value; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 1: Gender differences in the percentage of respondents answering that a job value is 'very important', by gender



Notes: JI: A job that is interesting, JS: job security, JP: job pay, JH: a job that helps others, JL: time for leisure, JC: a job that contributes to society, JF: time for family. Proportion averaged across waves for each dataset, BHPS (age 14-15, 2002-2007) and UKHLS (age 16-21, 2010-2016). 'Time for family' is not asked in BHPS. 'Very important' is the top rating. Stars indicate which gender differences are statistically significant; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

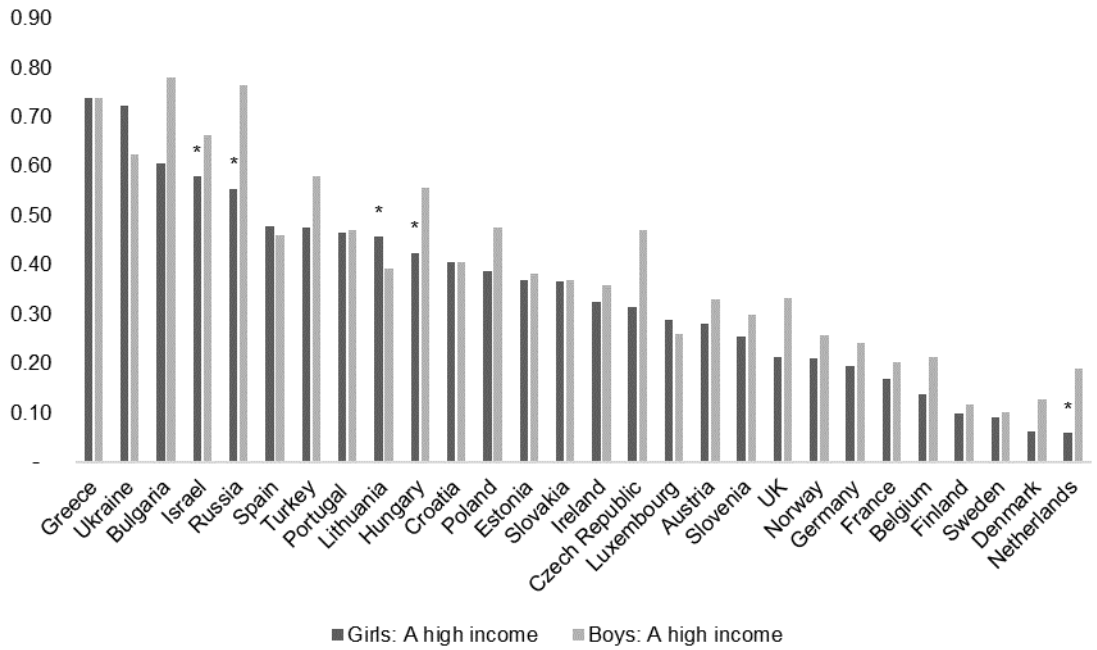
The main difference in the scores is whether an individual rates the job value as 'very important' or gives another response. Figure 1 shows the gender differences more clearly by comparing the percentage of boys and girls who answered that a job value was 'very important'. In BHPS, the percentage of girls giving the highest rating is greater than for boys on 'a job that is interesting', 'job security' and 'a job that helps others', whilst for UKHLS, there are also higher girls' ratings on 'a job that contributes to society' and 'time for family'. Boys have higher ratings on 'job pay' and 'time for leisure'. The largest difference is on a job that helps others, with an 11 percentage point difference in the BHPS dataset, and a 14 percentage point difference in UKHLS. Girls and boys are more

similar on the other job values; the next biggest differences are an 8 percentage point difference in the proportion of UKHLS girls who say that 'a job that contributes to society' is very important (23%) versus boys (15%), and a 7 percentage point difference on 'time for family' and 'job security'. These differences are statistically significant on all job values in UKHLS, and on 'job pay', 'a job that helps others' and 'time for leisure' in BHPS. Overall, there is less evidence for an extrinsic/intrinsic divide than there is for an altruistic divide, since girls and boys are fairly similar on 'job pay' (extrinsic) and 'a job that is interesting' (intrinsic).

2.4.2 ESS data

Figures 2 to 4 show the percentage of girls and boys saying that a job value is 'very important', for 'job pay', 'job security' and 'time for family', split out by country.

Figure 2: Percentage of respondents answering that high income is 'very important', by gender by country



Notes: Proportion averaged across ESS rounds, 2004 and 2010. 'Very important' is the top rating. Weights applied to correct for sampling probability. Stars indicate which gender differences are statistically significant, within countries; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 3: Percentage of respondents answering that a secure job is 'very important', by gender, by country

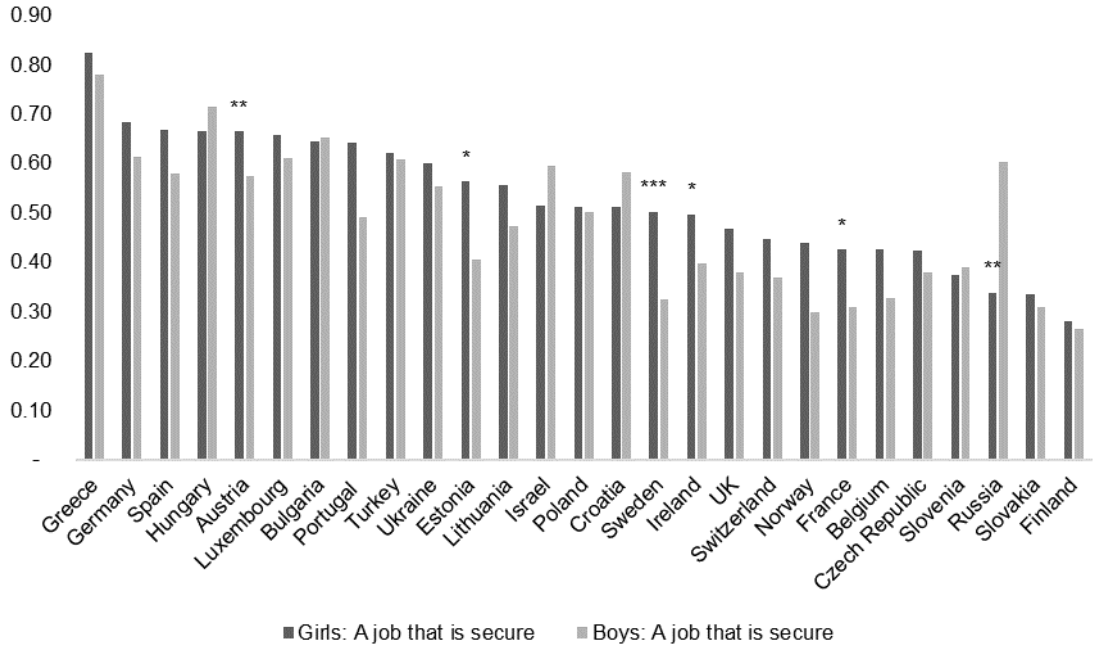
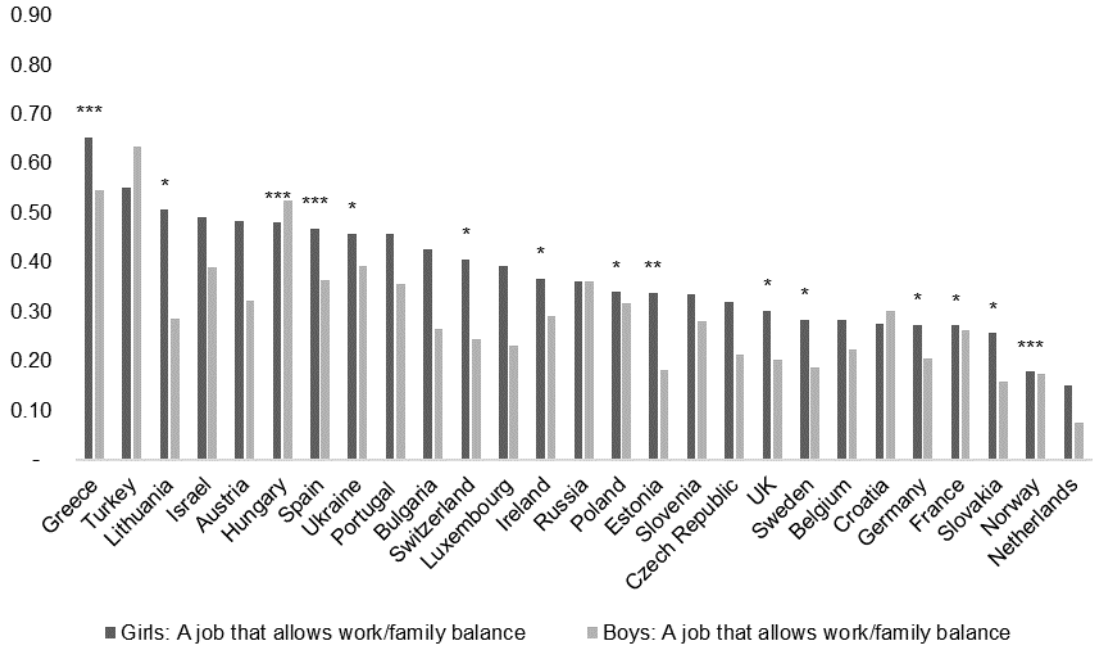


Figure 4: Percentage of respondents answering that a work/family balance is 'very important', by gender, by country



Notes for Figures 3 and 4: Proportion averaged across ESS rounds, 2004 and 2010. 'Very important' is the top rating. Weights applied to correct for sampling probability. Stars indicate which gender differences are statistically significant, within countries; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In most countries, boys value ‘job pay’ more than girls, as is the case in the UK, but the size of the gender differences varies—the largest difference is in Russia, where 77% of boys say that ‘job pay’ is very important compared to 55% of girls. The exceptions are Spain, Lithuania, Luxembourg and the Ukraine, where girls value ‘job pay’ more than boys. Girls value ‘job security’ more than boys, with the exceptions of Russia, Croatia, Hungary and Ukraine where girls value ‘job security’ less. The largest gender difference (where girls value ‘job security’ more than boys) is found in Sweden, where 50% of girls say that ‘job security’ is very important, compared to 32% of boys. Lastly, in most countries, girls value work/family balance more than boys, with the exceptions of Croatia, Hungary and the Ukraine. The biggest difference on work/family balance is found in Lithuania, where 51% of girls say this is very important compared to 29% of boys.

Compared to the average, the gender gaps in the UK are consistent with the general trend; girls value ‘job security’ and work/family balance more, and ‘job pay’ less, than boys, but this is only a significant difference for work/family balance. In size, UK gender differences are larger than the ESS country average.

2.5 Descriptive statistics for differences by parental education

2.5.1 UK data

Figure 5 shows the proportion answering ‘very important’ for the different job values by parental education. In BHPS, there are statistically significant differences between the proportions from the highest parental education background, as compared to lower educational backgrounds, for ‘job pay’, ‘a job that is interesting’, ‘a job that contributes to society’ and ‘a job that helps others’. The biggest differences by size are on ‘job pay’ (extrinsic) and ‘a job that is interesting’ (intrinsic). For ‘job pay’, 44% of 14-15-year-olds

from the highest educational background (parents have a first degree or higher) say it is very important, compared to 52% from the lowest educational background (parents have a qualification below lower secondary level, or no qualification). For 'a job that is interesting', 78% of those from the highest educational background say this is very important compared to 63% those from the lowest educational background.

Figure 6 shows the UKHLS proportions; differences in proportions between the highest parental education background group and all others are statistically significant for 'a job that is interesting', 'job security', 'time for family', 'job pay', 'a job that contributes to society' and 'time for leisure', 'job security'. For 'job pay', 25% from the highest educational background say 'job pay' is very important, compared with 37% from the lowest educational background. 'Job security' has a different pattern in the UKHLS and the BHPS datasets—in UKHLS, those from the lowest educational background value it more highly, whilst the reverse is found in BHPS. Consistent with BHPS, for 'a job that is interesting'; 75% from the highest educated backgrounds say this is very important compared to 62% from the lowest educational background. There are smaller differences on the remaining job values. Overall, this is in line with the problematic rewards hypothesis *but* these young people have not yet entered the labour market, therefore, any socialisation mechanism that is proposed to explain differences would need to be anticipatory (prior to labour force entry). The mean job value ratings are shown in the section 7.1 Appendix: Chapter 2, Table 1, including standard errors for significance tests with clustering to correct for repeated observations of individuals.

Figure 5: BHPS Percentage of respondents answering that job values are 'very important', by parental education

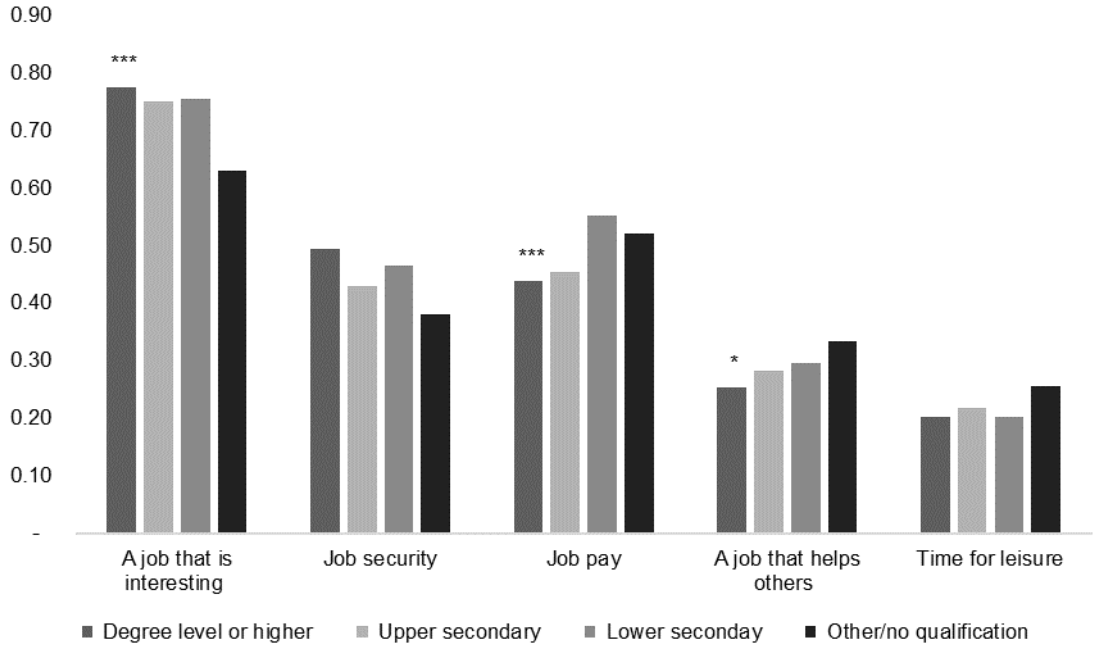
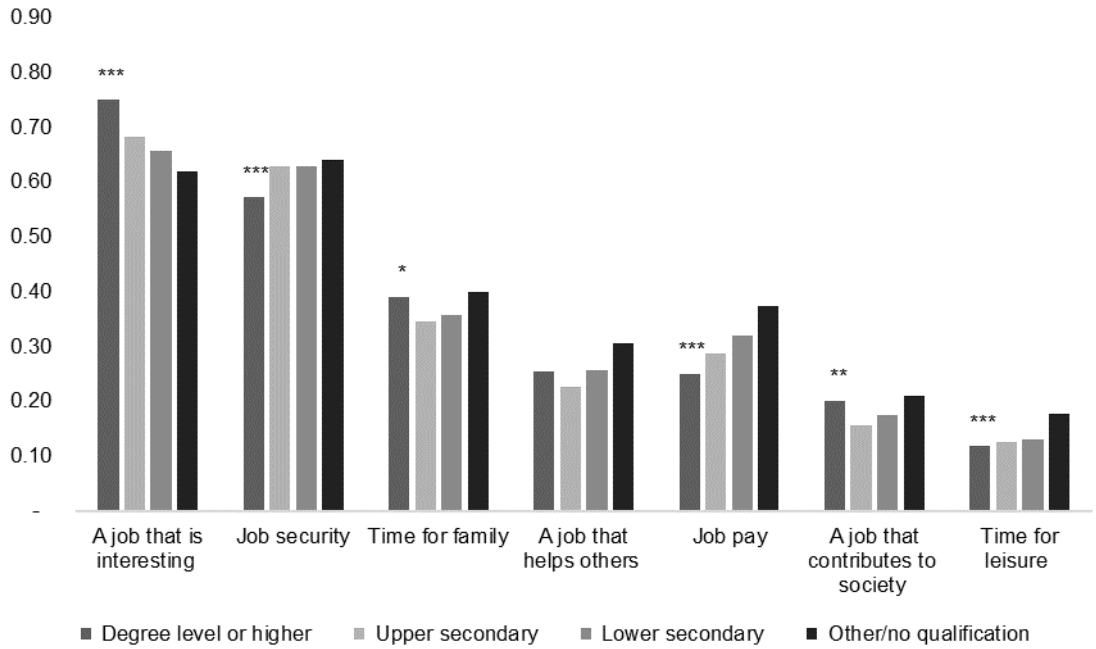


Figure 6: UKHLS Percentage of respondents answering that job values are 'very important', by parental education



Notes for Figures 5 and 6: Proportion averaged across waves for each dataset, BHPS (age 14-15, 2002-2007) and UKHLS (age 16-21, 2010-2016). 'Time for family' is not asked in BHPS. Stars indicate whether difference between highest parental education background and all lower parental education backgrounds grouped together is significant; * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

2.5.2 ESS data

Figure 7: Difference in percentage of respondents answering that job security is 'very important', between parental education, by country

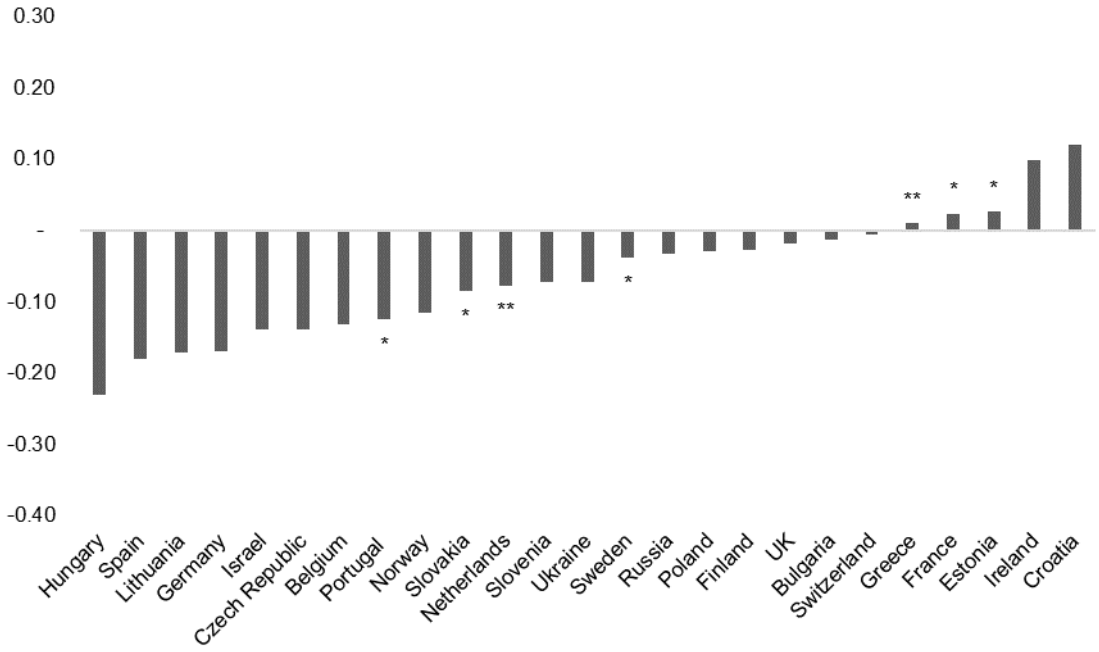


Figure 8: Difference in percentage of respondents answering that job pay is 'very important', between parental education, by country

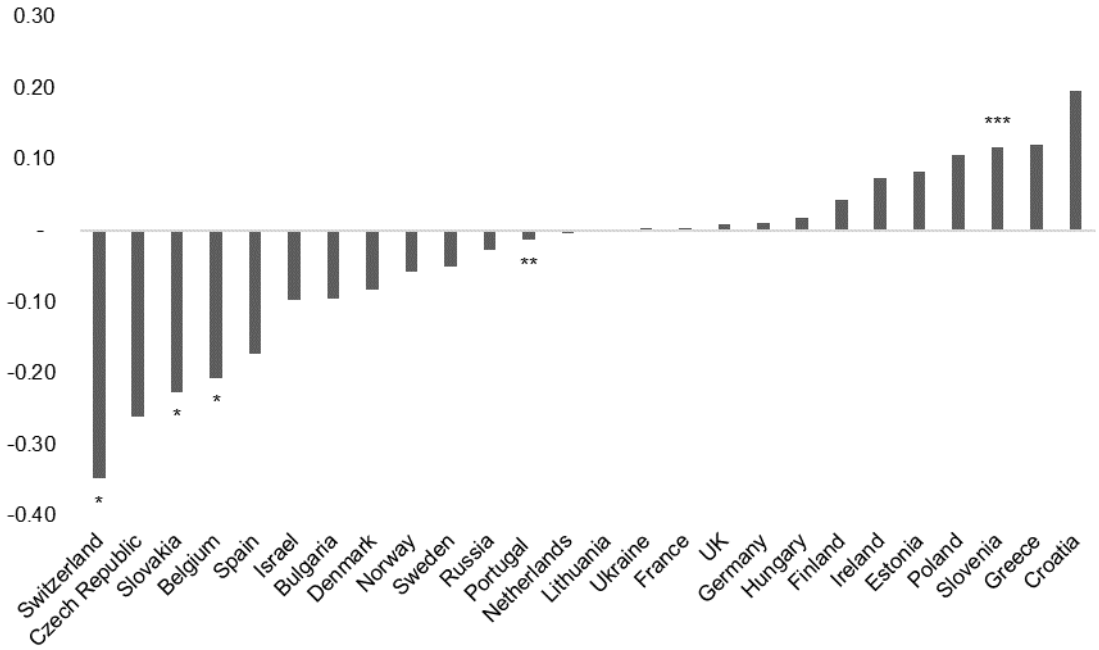
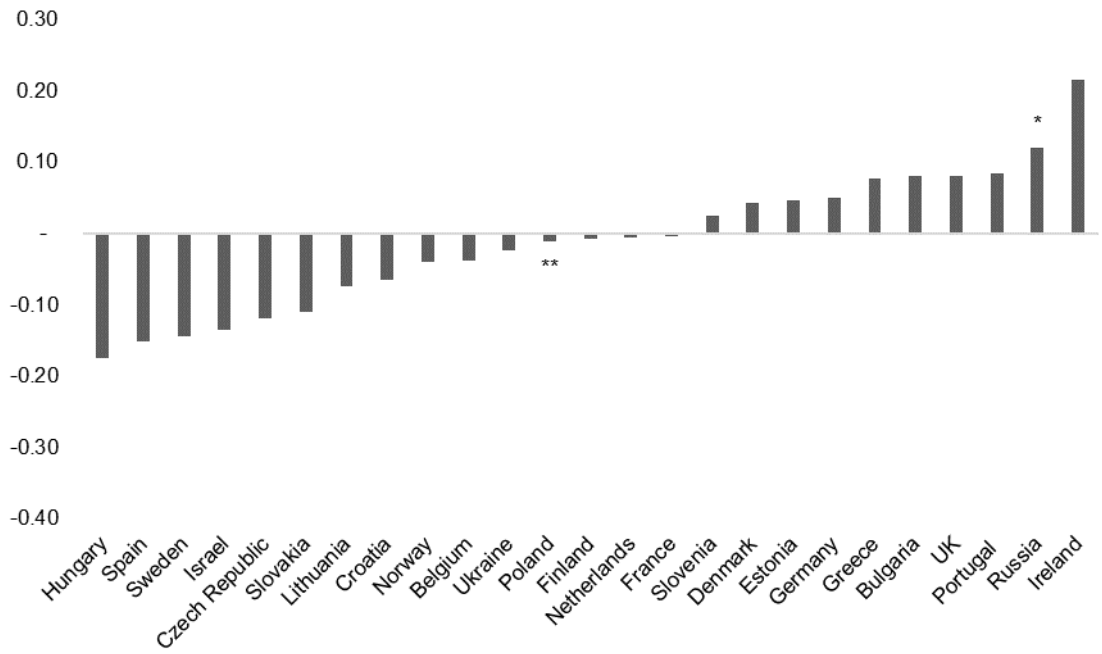


Figure 9: Difference in percentage of respondents answering that work/family balance is 'very important', between parental education backgrounds, by country



Notes for Figures 7 to 9: Proportion averaged across ESS rounds 2004 and 2010. Socio-economic background categories compared: degree or higher education versus below degree education. Countries excluded if group sizes below 30. Stars indicate which parental education differences are statistically significant, within countries; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

For the ESS data, the parental education categories are aggregated into a binary comparison; degree level or above and below degree level education, as otherwise the group sizes within each country for each parental education background fall below 30. Even so, Cyprus and Iceland are excluded for all three job values because of small sample sizes (N<30) in this cross-tabulation, Denmark is excluded for 'job pay', and Switzerland is excluded for 'time for family'.

Figures 7 to 9 show the difference between those whose parents have a degree, and those who do not, in percentage saying the job value is 'very important'. For 'job security', in about half of the countries, those from a parental background of degree or higher are less likely to say that 'job security' is very important compared to those from lower education

backgrounds. Switzerland has the greatest difference, with a contrast of 60% from the lower background versus 26% from the highest background. The other half of countries, including the UK, have either a zero difference between the two groups, or those from a higher educational background value 'job security' *more*. Croatia has the greatest difference here, whilst the UK has no real difference, in contrast to the UKHLS distribution.

There is a more common trend between countries for 'job pay'; in most countries but not all, those with high parental education backgrounds value 'job pay' less than those from low parental education backgrounds, and this is most pronounced in Hungary, Spain and Lithuania. The UK is not significantly different to the general trend.

For work/family balance, high parental education and low parental education individuals are the most similar of all three job values. The UK has a significant difference between those from high and low parental education; 30% of high parental education individuals say this is very important compared to 22% of low parental education individuals, but this is smaller than the country average difference by parental education. Overall, differences in the UK by parental education are smaller than the ESS country average.

2.6 Discussion

Therefore, differences by gender and parental education in job values do exist in the UK but, with reference to the job value formation theories, they are smaller than might be expected. Girls in both UK datasets (i.e. both age groups and in both time periods) are more likely to highly value altruistic job values, such as 'a job that helps others', and 'job security' as compared to boys, and less likely to highly value 'job pay'—though significant, these differences are substantively small. Gender differences in the value of 'time for family' are only significant in the ESS data. Differences by parental education

agree broadly with Kalleberg and Marsden's problematic rewards hypothesis; individuals from low education backgrounds value 'job pay' more and 'a job that is interesting' less than their peers from high education backgrounds. However, it should be noted that the problematic rewards hypothesis is based on adaptation of job values *after* one has entered the labour market when respondents start to wish for job values that they do not have. The UK has greater than average gender differences compared to the ESS countries, and below average differences by parental education on work/family balance.

This description is limited by the number of job questions available in the surveys. Most pertinently, the surveys do not adequately capture the 'things' dimension, or the social aspect of the 'people' dimension, instead only covering altruistic aspects. This means that the hypothesised gender difference between boys and girls in an interest in 'people' versus 'things' is not captured here. Other job attributes would also be of interest, such as 'a job that is esteemed', opportunities for promotion, and so on.

Many of the observed differences seem marginal; individuals are saying either a job value is 'very important' or 'important' and therefore they appear easy to dismiss. However, this is partly a limitation of the way that the question is asked in both surveys, as job values are rated rather than ranked, therefore the ranking of job values is implied rather than explicit. Even marginal differences in job values may have important influences on occupational preferences if two jobs are similar in terms of one attribute—such as 'job pay', but differ widely on other attributes, such as 'a job that helps others'. If 'a job that helps others' is ranked higher than 'job pay', even marginally, then this will influence the choice between the two. In terms of gender, all individuals may think that 'job pay' is very important, but if girls are more likely to think 'a job that helps others' is very important, this could lead to segregation in preferences. Chapters 3 and 4 consider these potential associations of job values with occupational preferences in detail.

Chapter 3: Gender differences in job values and aspirations for Science, Technology, Engineering and Maths occupations

3.1 Introduction

Women remain significantly underrepresented in Science, Technology, Engineering and Maths (STEM) occupations in the UK and this is changing very slowly. In 2017, women were 46.5 percent of the total labour force, but only 23 percent of the core STEM workforce (The WISE Campaign, 2017; The World Bank, 2017). Within STEM, some fields are desegregating but other fields remain stable over time. One contributing factor is early gender differences in aspirations; girls are less likely to aspire to STEM careers from an early age, and the gender gap gets larger with age, as girls drop their STEM aspirations more frequently than boys (Bagnoli et al., 2014:331). Insofar as this unequal representation reinforces stereotypes, restricts occupational choice and hinders diversity of thought within the sector, this is a puzzle worth explaining.

What accounts for gender differences in STEM aspirations? Important potential explanations include (i) gender stereotyping of occupations and occupation-relevant skills, or (ii) gender differences in the components of individual rational choice calculations. Despite the vast literature on STEM aspirations, some potential explanations require further empirical exploration. In addition, the concept of 'STEM' as a coherent group of occupations is increasingly unrealistic as some STEM fields, like medicine and biological sciences have experienced significant desegregation, whilst others, like economics, physics or IT, have been much slower to change (Cheryan, Ziegler, Montoya, & Jiang, 2017; The WISE Campaign, 2017).

One explanation often referenced but not often tested empirically is the influence of gender differences in job values. Eccles' expectancy-value framework argues that a

crucial part of the 'benefit' in an individual's rational choice calculation is whether the attributes of a job match what they value, such as job security, time for family or a job that helps others. This chapter tests whether differences in how girls and boys value aspects of a job can explain gender differences in aspirations for STEM occupations in the UK, both in aggregate, but also *between* STEM fields, e.g. aspirations for Science and Engineering, as compared to IT, Business or Finance *or* fields outside of the professional and associate-professional occupational groups that still require maths- and science-intensive skills.

I study aspirations of 14-21-year-olds in the UK, using the British Household Panel Survey (BHPS) and Understanding Society (UKHLS), from 2006 to 2016. The UK is an interesting case-study because for STEM, it is particularly segregated—the UK has the lowest percentage of female engineering professionals in Europe at less than 10 percent (Perkins, 2014). I consider the importance of seven job values; 'job pay', 'a job that helps others', 'a job that contributes to society', 'time for leisure', 'a job that is interesting', 'a secure job' and 'time for family'. I show that there are clear associations between certain job values and specific STEM fields. With regard to the gender difference, the most pertinent job values are 'a job that helps others' and 'a job that contributes to society'; these are both valued more highly by girls than boys *and* have more of an influence for girls' STEM aspirations.

The following section summarises the common theoretical arguments for the STEM gender gap and evaluates competing definitions of STEM. I discuss four exploratory research questions for the relationship between job values and STEM aspirations. Following this, I present the data, models and empirical results. Implications and limitations are discussed.

3.2 Theoretical explanations

There is no 'one' explanation for the gender gap in STEM aspirations. The formation of occupational preferences is part of a larger cumulative process of interrelated educational and occupational preferences and choices. In the UK, the path to a scientific career includes subject choices made in grade 9 (ages 13-14) for GCSE-level, then in grade 11 (age 15-16) for AS/A-level, college qualifications, apprenticeships or traineeships, or part-time education, the choice of an undergraduate degree (age 17-18) and a postgraduate degree (age 21+). At each educational transition point, there are significant gender differences in STEM-related choices (Alper, 1993; Codiroli, 2015; The WISE Campaign, 2016). I outline two groups of theoretical explanations below.

3.2.1 Gender stereotyping of STEM occupations and skills

There is abundant evidence for stereotypes about STEM occupations and skills (Accenture, 2017; Cheryan et al., 2017). Existing studies on STEM careers suggest that in aggregate, in the UK, young people perceive STEM careers to be:

- Not very people-oriented (Faulkner, 2007:332; Ming-Te Wang & Kenny, 2014)
- Oriented towards working with things (Faulkner, 2007)
- High-paying (Department for Business Innovation and Skills, 2014:56)
- Demanding/stressful (Department for Business Innovation and Skills, 2014:52)
- Difficult to combine with family life (Bagnoli et al., 2014:339; Ming-Te Wang & Kenny, 2014)
- Not oriented towards communal goals/helping others (Diekman, Clark, Johnston, Brown, & Steinberg, 2011)
- Oriented to make an impact/contribute to society/important for the future (Chow & Salmelo-Aro, 2014; Jenkins & Pell, 2009)

- For ‘geeks, nerds and weirdos’ (Department for Business Innovation and Skills, 2014:58)

There is some evidence for perceptions of specific STEM fields:

- Science: Difficult/challenging, stressful, makes an impact, contributes to society.
- Technology: Interesting, lonely, low social status, less intellectually demanding, creative, future-proof/cutting-edge.
- Engineering: Difficult, for boys only, associated with objects not people. Practical, collaborative, good pay.
- Maths: Intellectually demanding, not relevant, boring, appeals to the logically minded.
- Medical sciences/Healthcare: Associated with financial rewards, a job that helps others, people-oriented

(Cheryan et al., 2017:10; Department for Business Innovation and Skills, 2014:53-71)

Notably, many of these characteristics are negative. The same authors suggest that STEM careers are not well-understood and their ‘image’ problem discourages girls’ aspirations (Bagnoli et al., 2014; Faulkner, 2007). Girls are more likely than boys to hold negative views about STEM or have a narrow view of what STEM occupations involve, e.g. science and technology must involve ‘working in a laboratory’ and ‘wearing a white coat’ (Accenture, 2017).

Gender stereotypes about STEM skills are also pervasive; although girls achieve similar, if not better, academic results in maths and science subjects as compared to boys on average, they are *perceived* to be weaker in these subjects, both by their teachers (Campbell, 2015) and in their own self-assessments (Correll, 2001; Ming-Te Wang & Kenny, 2014). Gender stereotypes also exist about values and goals; women are seen as

more likely to prioritise a work/family balance (Bagnoli et al., 2014) and to value intrinsic or altruistic job attributes (Johnson, 2002), while men are seen as more likely to value extrinsic aspects of a job, such as job pay, promotion and esteem (Halaby, 2003; Johnson, 2002). These various stereotypes lead young people to align their preferences with gender expectations (Ginn et al., 1996; Wu, 2017), either through explicit acknowledgement of what is gender-appropriate, or through internalisation of gender essentialist beliefs (Cech, 2013).

The extent of adherence to gender-role stereotypes is importantly influenced by parental role-models; mother and father's occupation, gender attitudes and the gender division of household labour influence the occupations that individuals deem suitable (Dryler, 1998; Låftman, 2008; Platt & Polavieja, 2016). The challenges for the theoretical argument based on gender stereotyping is that it is difficult to explain the persistence of occupational stereotypes amidst the overall liberalisation of gender attitudes or to measure the precise influence of the internalisation of, or socialisation into, gender roles.

3.2.2 Gender differences in rational choice calculations

Jonsson's gendered rational choice theory (1999) suggests that young people make educational and occupational choices based on a cost-utility calculation of their perceived probability of success, benefits and costs. Perceived probability of success depends on relative academic strength; whilst girls do as well as boys in science and maths, they also outperform boys significantly in most countries in more 'female' subjects, like languages. If encouraged to choose a career based on where their relative strengths lie, this dissuades girls and encourages boys into STEM (Jonsson, 1999; Stoet & Geary, 2018; M.-T. Wang et al., 2013). Anticipated future success varies by gender; women are less likely to be

promoted than men within science, even holding constant their qualifications and experience (Moss-Racusin et al., 2012).

Expected benefits differ by gender and depend on the outside options; Stoet and Geary suggest that in less developed countries with higher economic risks and fewer economic opportunities, STEM careers are relatively high-paying and an attractive option, whereas in developed countries, with lower risks and many economic opportunities, STEM careers are only one of many potential paths (Stoet & Geary, 2018:2). Men and women may also differ in how they receive utility from a job—Goldthorpe (1968) stresses that, "satisfaction from work cannot be usefully considered…until one knows what meaning work has for them [the workers]" (Goldthorpe 1968:38). Marginal differences in job values therefore may lead to starkly different occupational choices. Eccles (1994) expectancy-value framework builds on the model of rational choice, she expands 'expectation of benefits' to include "the importance or value the individual attaches to the options perceived by the individual as available" (Eccles, 1994). This includes not only the value of the job itself, but the value of the educational or occupational choice relative to other choices. Case studies of the US, Germany, Finland and Switzerland show that gender differences in job values are persistent, most frequently in terms of altruistic and social values (Busch-Heizmann, 2015; Johnson, 2001a; Sortheix et al., 2015; Tschopp et al., 2015) but these have not yet been explicitly linked to STEM in the UK. Other authors emphasise gender differences in 'people' versus 'things' attributes of jobs, and hypothesise that individuals (generally boys) interested in 'things' are more likely to aspire to STEM, whilst those interested in 'people' (generally girls) will not aspire to STEM (Geary & Stoet, 2018). Various elements of the Eccles expectancy-value framework have been tested empirically and have been shown to influence STEM preferences, such as academic self-concept (P. Parker et al., 2014; Philip David Parker et

al., 2014), prior maths and science achievement relative to other subjects (Ming-Te Wang & Kenny, 2014) and the importance of maths and science as subjects relative to other subjects (Lauermann et al., 2015). To the best of my knowledge, differences in non-subject specific job values have not yet been studied in the UK in relation to STEM occupational preferences.

3.3 What is STEM anyway?

Using an aggregate group of occupations in an explanation of gender differences is useful only if there is something that unites these occupations, both in terms of their objective characteristics, and in predicting whether girls or boys aspire to them. There are challenges to using the STEM category on both these counts; definitions differ and there are divergent trends in gender segregation between occupations. In any definition, it is important to avoid defining STEM in a post-hoc way; e.g. medicine is feminised, therefore it is not a STEM occupation.

The main points of contention in defining STEM are whether to (i) differentiate between 'hard' and 'soft' sciences, (ii) include health-related occupations, or (iii) include skilled trades. First, and most commonly, STEM is defined as occupations within the Standard Occupational Classification (SOC) categories of science, technology and information communication technology professionals and associate professionals. The International Standard Classification of Occupations (ISCO), bases this on STEM skills required for these occupations, defined as skills "expected to be held by people with a tertiary-education level degree in the subjects of science, technology, engineering and maths" (European Commission, 2017). This is an intuitive definition, matched by media and think-tank representations of STEM careers (The WISE Campaign, 2016). The disadvantage is that it does not include all occupations requiring scientific and technical

training either within the professional group, such as healthcare, teaching or business and finance professionals, or, outside of professional and associate professional categories, such as computer engineers or electrical engineers.

Other authors consider only maths-intensive occupations, or 'hard' sciences, including physical sciences, technology, engineering and maths, and excluding 'softer' sciences i.e. less maths-intensive sciences, like biology and chemistry (Gabay-Egozi et al., 2014; Jerrim & Schoon, 2014; Lauermann et al., 2015; Mann & DiPrete, 2013). Lauermann et al (2015) use information about the required level of knowledge of mathematics and English for each occupation to create their definition of maths-intensive occupations. This includes occupations like architects, engineers, mathematicians and economists. The advantage of this definition is that it is based on an objective measure of skills required, but it does not consider maths content relative to other skills, only *absolute* maths-content, which again confines the definition to professional-level occupations.

Lastly, some authors take a broader view of STEM by considering all occupations that require some scientific or technical training, not necessarily at degree-level. Bagnoli et al (2014) suggest two definitions; a wide STEM skills definition, including healthcare occupations, and a strict STEM skills definition that does not. This avoids unintentionally defining STEM as an elite occupational group, by recognising scientific and technical skills at lower qualification levels. The disadvantage is that it includes some occupations that are only tenuously linked to STEM and would not intuitively be included, for instance building and construction trades, or midwifery.

I consider both the most commonly used ISCO definition of STEM (STEM traditional), and the strict STEM skills and wide STEM skills definitions, as used by Bagnoli et al (2014). Additionally, I use occupation-level analysis at the 3-digit SOC 2000 level (minor

group) to consider the following six 'fields': Business and Finance; Science and Engineering; Healthcare; Information, Communication and Technology (ICT); Skilled Metal/Electrical work and Skilled Construction work. These six fields are chosen because they all include technical skill requirements, under the wide STEM skills definition, apart from Business and Finance. Business and Finance occupations are included because these have a strong maths component, as defined by the 'maths-intensive' definition. The 4-digit SOC code occupations included in each definition are outlined in the Appendix. One further limitation to this method of coding STEM is that accurate coding of occupations is dependent on interviewer reliability – children can state any occupation they like, and it is the role of the interviewer to fit this as closely as possible into a SOC classification, which allows for some coding error. Furthermore, transferring between SOC classifications, for instance, SOC2000 and SOC2010, leaves further room for deviation, as again, it is down to the judgement of the interviewer whether or not an occupation coded in SOC 2000 transfers to the same, or a different category in SOC 2010. For this, reason, I confine my analysis to coding using only SOC 2000. I also note the need for qualitative research, and analysis of the original text from surveys, to supplement coded analyses.

3.4 Research questions

I consider four main questions;

1: To what extent does gender still predict aspirations for STEM occupations, both on aggregate and for specific STEM fields?

2: To what extent do job values mediate between gender and aspirations?

- First, purely as a prediction exercise, does controlling for job values improve the prediction of aspirations?

- Secondly, to what extent does including job values mediate for the association with gender?

3: Which job values are the most important in explaining STEM aspirations *or* in mediating for gender?

4: What are the gender differences in the importance of job values for STEM aspirations?

As noted from the previous literature, there are mixed predictions about the job values that are associated with STEM, therefore the analysis is exploratory rather than a test of specific hypotheses.

3.5 Data

I use two nationally representative UK household panel studies; the UK Household Longitudinal Study, Understanding Society (UKHLS) and its predecessor, the British Household Panel Survey (BHPS). I pool waves of the two surveys from 2006 (wave 16 of BHPS) up to 2014- 2016 (wave 23 of UKHLS) to create a cross-sectional dataset covering 10 years.[13] [14] BHPS finished in 2008, and UKHLS began in 2009. The majority of remaining respondents in BHPS in 2008 moved into the UKHLS sample in 2010-2012 (wave 2), so wave 2 of UKHLS is effectively wave 19 of BHPS and studies can be appended. This means that there are repeated observations of the same individuals across waves, as the same individuals are followed over time. My analysis uses the panels as repeated cross-sections, rather than as a longitudinal panel, therefore I use clustering by individual throughout, to correct for serial correlation in observations within individual over waves. Both studies include a youth panel, for respondents aged 11-15 (referred to

[13] BHPS comprises 18 waves, from 1991 to 2008. I use the 3 latest waves, 2006-2008, because this is when occupational preferences are coded consistently with UKHLS, using SOC 2000.
[14] Waves for UKHLS are annual, but data collection takes place over two years, hence the longer time period for each wave. However, each individual is surveyed at the same, annually, therefore there is no seasonal variation within individuals. See survey timeline on https://www.understandingsociety.ac.uk/documentation/mainstage/survey-timeline

as ‘children’ hereafter), and a youth module for individuals aged 16-21[15] (referred to as ‘young adults’). Pooling waves

3.6 Construction of variables

Gender

Individuals self-declare their gender and this is available in all waves. In the waves used, this is a binary classification, 1=female, 0=male.

Occupational Preferences

Children are asked, ‘what job would you like to do once you leave school, finish your training or finish full-time education?’ in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016 (waves 16, 17, 18, 20 and 22).

Young adults are asked the same question in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016 (waves 16, 17, 18, 20, 21, 22 and 23) if they are in full-time education or training (just over 60 percent of young people in these waves are eligible).

For all respondents, the question is open-ended and responses are coded using 3-digit SOC 2000 categories. I recode this into the three definitions; (1) Traditional STEM, (2) Strict STEM skills and (3) Wide STEM skills. I also create the six disaggregated STEM fields; Business and Finance, Healthcare, Science and Engineering, ICT, Skilled Metal and Electrical work and Skilled Construction work.

Job Values

Both UKHLS and BHPS ask;

[15] In BHPS, some questions are asked to 16-22-year-olds. For consistency with UKHLS I exclude those over the age of 21.

"When thinking about an occupation, how important is… Job pay? A job that helps others? A job that is interesting? A secure job? A job that contributes to society? Time for family?[16] Time for leisure?"

This question is asked of children aged 14-15 in 2007 (wave 17) and of young people in 2010-2012, 2011-2013 and 2013-2015 (waves 19, 20 and 22). Answers are coded such that 1=not at all important and 4=very important.

Individual Gender Liberalism Scores

Girls who have more traditional gender attitudes may be less likely to aspire to STEM if they perceive it to be a job for boys. Similarly, boys who are more traditional may be more likely to aspire to STEM. Two questions on gender attitudes are asked consistently throughout the period to children and young adults. These follow a Likert scale response of how strongly a respondent agrees with the following statements;

1) (Do you personally agree or disagree...) All in all, family life suffers when the woman has a full-time job
2) (Do you personally agree or disagree...) A husband's job is to earn money, a wife's job is to look after the home and family

These are recoded so that 1; the least liberal response, and 5; the most liberal response.

These are asked of children in 2008 (wave 18) and of young adults in 2007, 2010-2012 and 2012-2014 (waves 17, 19, 21).

These two variables are positively correlated; the Spearman's correlation coefficient is 0.52, a moderate positive correlation. I calculate an average gender attitude for each

[16] 'Time for family' not asked in BHPS.

individual, using the average of the two variables across an individual's available responses, standardised with mean 0 and variance 1.

Socio-demographic characteristics

Individuals from higher parental education backgrounds are more likely to aspire to STEM *and* less likely to aspire to gender-typical fields or occupations (Polavieja & Platt, 2014; Van De Werfhorst, 2017). I control for an individual's parental education background, using highest parental educational attainment of either the mother *or* the father, coded to 4 categories; higher or first degree, upper secondary education, lower secondary education and other qualification/no qualification.

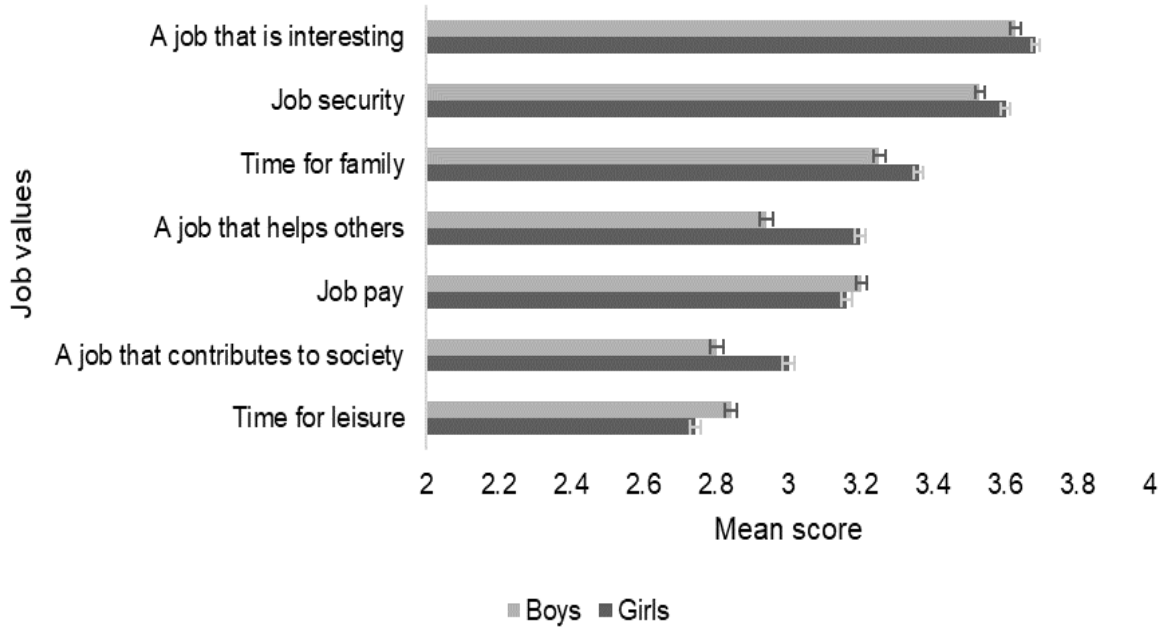
I also control for an individual's age and the year of survey, available in all waves and measured concurrently with occupational aspirations. For all analysis that follows, cross-sectional weights are applied to correct for the oversampling of certain population groups and non-response bias.

The key questions concern the association between job values and occupational preferences, therefore I only use observations where job values and occupational preferences are measured concurrently. This reduces the sample size significantly because the job values questions are only asked to specific age ranges, and the job values questions are often asked in different waves to the questions about gender attitudes and occupational preferences. The total sample with complete information is 2,063 individuals (1,111 girls and 952 boys). For robustness, I also estimate the models using within-individual mean job values scores with a larger sample, calculated across all their observations of job values across the survey, instead of measuring job values concurrently. Results are consistent and available on request.

3.7 Description of job values and occupational preferences

Figure 1 summarises mean job value ratings by gender. The most important job value for both genders is 'a job that is interesting'. Ratings between genders are overall very similar, with the exception of 'time for leisure', 'a job that helps others' and 'a job that contributes to society'. Girls rate 'a job that helps others' and 'a job that contributes to society' more highly than boys. Boys rate 'time for leisure' as more important than girls. The size of these differences is small, however they result in gender differences in the overall ranking of job values.

Figure 1: Mean job value scores, by gender

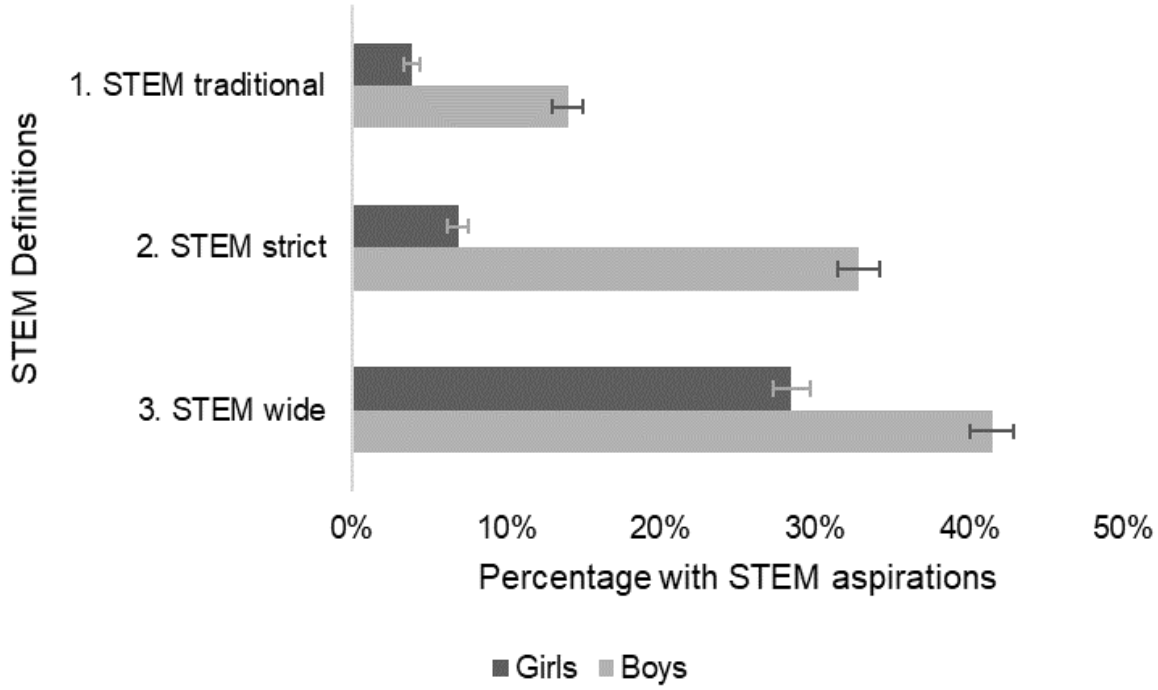


Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Figure 2 shows that, under each STEM definition, there is a significant gender gap in aspirations. As the definitions of STEM become less restrictive and include more occupations, the percentage aspiring to STEM increases. Using the STEM traditional definition, 14 percent of boys aspire to STEM, compared to 4 percent of girls. In the strict

STEM skills definition, including occupations requiring STEM skills below degree-level, 33 percent of boys aspire to STEM, compared to 7 percent of girls. Under the wide STEM skills definition, including both below degree-level STEM and healthcare professions, 41 percent of boys aspire to STEM and 28 percent of girls aspire to STEM.

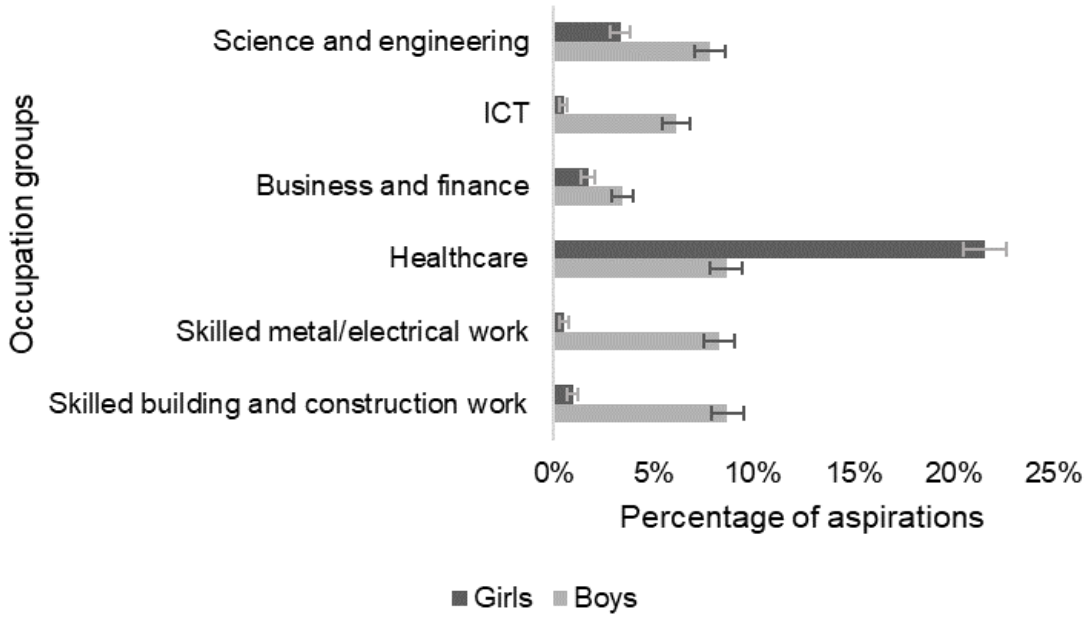
Figure 2: Percentage of STEM aspirations for each STEM definition, by gender



Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Figure 3 shows the gender gap by STEM fields. The biggest gaps are for fields *not* included in the traditional STEM definition; Healthcare (9 percent of boys' aspirations, 22 percent of girls), Skilled Metal/Electrical work (9 percent of boys, 1 percent of girls) and Skilled Construction work (10 percent of boys, 1 percent of girls). For traditional STEM fields, the gender gap is biggest for ICT (6 percent of boys, 1 percent of girls).

Figure 3: Percentage of STEM aspirations by STEM field, by gender



Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

3.8 Results: STEM at the aggregate-level

I estimate a series of linear probability models to investigate; (i) gender differences in aspirations, (ii) all job values together as a mediator, (iii) job values individually as mediators, and (iv) gender differences in the association of individual job values with job aspirations. I begin with a base model (Model 1**)** that estimates the gender difference in aspirations for STEM, where the dependent variable is the binary variable for STEM aspirations; 1 if an individual aspires to a STEM occupation, and 0 otherwise. Next, I add all of the job values together to the base model (Model 2**).**

I then add each of the seven job values to the base model separately, first as mediator variables and second, as moderating variables for the association with gender (Models 3-7**)**. I apply weights to correct for non-response bias and unequal sampling probability. Standard errors are robust and clustered by individual to correct for serial correlation within individual across waves. I estimate these models analogously for the three

different definitions of STEM; traditional STEM, strict STEM skills and wide STEM skills**.** Throughout, I control for age and year of survey.

In addition, I first estimate the set of Models 1 to 7, without including parental education or individual gender attitudes, as these have some associations with job values and occupational aspirations (see Chapters 2 and 4 for more in-depth discussion of these relationships), and therefore could obscure the overall association between job values and occupational aspirations. Next, I estimate the set of Models 1 to 7 whilst including parental education and individual gender attitudes, to test whether there is any association with job values even after these are accounted for. Models including parental education and individual gender attitudes and without these variables in the Appendices, 7.2 Appendix Chapter 3, Table numbers corresponding to the Table numbers in the main article (i.e. Table 1 corresponds to Appendix Chapter 3, Table 1 etc). There are no substantive differences between these two sets of models –the coefficients are in the same direction, and of the same significance. The main difference is that the first set of models (without individual gender attitudes or parental education) has marginally larger associations shown between job values and occupational aspirations. This suggests that there is some confounding between these additional variables and job values/occupational aspirations, but that this is not substantive.

3.8.1 Gender differences in aspirations

Base model 1, in Table 1, shows that girls are less likely than boys to aspire to STEM under any of the three definitions; 11 percent less likely for traditional STEM, 26 percent less likely for strict STEM skills and 14 percent less likely for wide STEM skills.

3.8.2 All job values

Model 2, in **Table 1** shows that including all job values together increases the proportion of variance explained, but only by ~1-2 percentage points. I test whether the difference between the models, or between the gender coefficients in each model, is statistically significant, using the Wald test for linear hypotheses, at the 0.05 significance level. Model 2 under the strict STEM definition is significantly different to the base model on the gender coefficient, and under the wide STEM skills definition, both as a whole model, and on the gender coefficient. The reduction in the gender coefficient is substantively small however; 0.5 percentage points for the STEM traditional definition and 0.9 percentage points for the STEM skills definition. Controlling for job values under the wide STEM skills definition *increases* the gender coefficient by 2 percentage points; once boys and girls have the same job values, girls are even less likely to aspire to wide STEM skills occupations.

When all job values are included together, 'a job that helps others' is significantly negatively associated with STEM traditional and strict STEM skills occupations; a 1 unit increase in the rating, for instance, from 'important' to 'very important' is associated with a 5-7 percentage point decrease in the probability of aspiring to STEM, all else being equal. For wide STEM skills, 'a job that helps' is positively associated with STEM aspirations. For strict STEM skills only, there is a significant positive association for 'a job that contributes to society'. However, these job values are likely to be correlated, therefore holding one constant and varying the other might be misleading.

3.8.3 Relative importance of job values

Table 2 shows the estimated coefficients comparing the base model to models including each job value separately as a mediator (model specifications 3 to 9), and then as a moderator (models 3a to 9a). Column 1 shows the different model specifications and the

subsequent columns show the coefficients of interest only. Model specifications are in brackets in the following discussion.

Using the Wald test, the models including ‘a job that helps others’ (5) and ‘a job that contributes to society’ (6) have gender coefficients that are significantly different to the base model (1); including ‘a job that helps others’ reduces the gender association for aspirations for strict STEM skills (~1 percentage point reduction), whilst including ‘a job that contributes to society’ or ‘a job that helps others’ *increases* the gender association for wide STEM skills (~1-2 percentage point increase). The other job values do not significantly change the gender coefficient.

For either gender, job values are not significantly associated with traditional STEM occupations. For strict STEM skills, job values are associated with STEM in the same pattern as before, with the exception of ‘time for family’, now positively associated with aspirations. The associations are larger, and significant for ‘a job that helps others’, which is associated with a 3.5 percent decrease in the likelihood of aspiring to strict STEM. For wide STEM skills, including the Healthcare occupations makes a key difference; the rating of ‘a job that helps others’ is now significantly positively associated with aspirations for STEM, as is ‘a job that contributes to society’, a 1-unit change in rating is associate with a 6-8 percent increase in the likelihood of aspiring to wide STEM.

3.8.4 Gender differences in the association of job values with aspirations

There is a significant additional negative association for girls’ aspirations for traditional STEM and ‘a job that contributes to society’; girls who highly value this are *more* unlikely to aspire to traditional STEM than boys who highly value this. Another interpretation of this is that there is a wider gender gap for girls and boys who highly rate ‘a job that contributes to society’.

Table 1: Linear probability model estimated coefficients for probability of aspiring to STEM: base Model and all job values

	STEM traditional		Strict STEM skills		Wide STEM skills	
Model specifications	**1**	**2**	**1**	**2**	**1**	**2**
Female	-0.110***	-0.105***	-0.256***	-0.248***	-0.144***	-0.166***
	(0.016)	(0.016)	(0.02)	(0.021)	(0.025)	(0.025)
Job pay		-0.003		0.005		0.012
		(0.012)		(0.016)		(0.020)
Time for leisure		0.006		0.009		-0.009
		(0.011)		(0.015)		(0.018)
A job that contributes to society		0.025		0.040*		0.033
		(0.014)		(0.017)		(0.021)
A job that helps others		-0.046**		-0.065***		0.050*
		(0.016)		(0.019)		(0.022)
A job that is interesting		0.019		0.014		0.035
		(0.016)		(0.022)		(0.026)
A job that is secure		0.022		0.019		0.013
		(0.013)		(0.018)		(0.021)
N (observations)	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063

Notes for Table 1:

(i) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

(ii) Standard errors in parentheses, robust and clustered by individual.

*(iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

(iv) Control variables not shown: Age, year of survey, parental education, individual gender liberalism score. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Table 2: Linear probability model estimated coefficients for probability of aspiring to STEM: base model and separate job values

	STEM traditional			Strict STEM skills			Wide STEM skills		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.110***			-0.256***			-0.144***		
	(0.016)			(0.020)			(0.025)		
3. Job pay	-0.110***	0.001		-0.256***	0.008		-0.143***	0.011	
	(0.016)	(0.012)		(0.097)	(0.027)		(0.118)	(0.029)	
3a. Job pay x female	-0.144	-0.005	0.011	-0.227*	0.013	-0.009	-0.138	0.012	-0.002
	(0.076)	(0.021)	(0.023)	(0.097)	(0.027)	(0.030)	(0.118)	(0.029)	(0.037)
4. Time for leisure	-0.110***	0.005		-0.255***	0.008		-0.143***	0.004	
	(0.016)	(0.011)		(0.020)	(0.014)		(0.025)	(0.018)	
4a. Time for leisure x female	-0.015	0.022	-0.035	-0.124	0.031	-0.048	-0.035	0.023	-0.039
	(0.063)	(0.019)	(0.022)	(0.081)	(0.024)	(0.028)	(0.099)	(0.026)	(0.034)
5. A job that helps others	-0.104***	-0.024		-0.247***	-0.036*		-0.163***	0.076***	
	(0.016)	(0.013)		(0.021)	(0.015)		(0.025)	(0.018)	
5a. A job that helps others x female	0.030	-0.004	-0.043	-0.185*	-0.026	-0.020	-0.293*	0.056*	0.042
	(0.080)	(0.018)	(0.024)	(0.094)	(0.023)	(0.029)	(0.116)	(0.024)	(0.036)
N (observations)	2516	2516	2516	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063	2063	2063	2063

Table 2 Continued

	STEM traditional			Strict STEM skills			Wide STEM skills		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female	Gender	Job value	Job value x female
6. A job that contributes to society	-0.111***	0.004		-0.257***	0.006		-0.156***	0.066***	
	(0.016)	(0.011)		(0.021)	(0.013)		(0.025)	(0.017)	
6a. A job that contributes to society x female	0.008	0.022	-0.040*	-0.243**	0.008	-0.005	-0.309**	0.043	0.052
	(0.062)	(0.017)	(0.020)	(0.078)	(0.022)	(0.026)	(0.103)	(0.024)	(0.034)
7. A job that is interesting	-0.111***	0.015		-0.256***	0.008		-0.147***	0.058*	
	(0.016)	(0.015)		(0.020)	(0.021)		(0.025)	(0.025)	
7a. A job that is interesting x female	-0.093	0.017	-0.005	-0.413**	-0.010	0.042	-0.327	0.038	0.048
	(0.103)	(0.025)	(0.028)	(0.145)	(0.035)	(0.038)	(0.180)	(0.036)	(0.048)
8. A job that is secure	-0.112***	0.018		-0.257***	0.016		-0.146***	0.032	
	(0.016)	(0.013)		(0.020)	(0.017)		(0.025)	(0.021)	
8a. A job that is secure x female	-0.112	0.018	0.000	-0.314**	0.009	0.016	-0.104	0.038	-0.012
	(0.089)	(0.022)	(0.025)	(0.115)	(0.029)	(0.032)	(0.148)	(0.031)	(0.041)
9. Time for family	-0.117***	-0.016		-0.259***	-0.007		-0.148***	0.019	
	(0.016)	(0.014)		(0.021)	(0.017)		(0.026)	(0.020)	
9a. Time for family x female	-0.097	-0.014	-0.006	-0.252*	-0.006	-0.002	-0.231	0.008	0.025
	(0.087)	(0.023)	(0.026)	(0.107)	(0.028)	(0.032)	(0.131)	(0.029)	(0.039)
N (observations)	2516	2516	2516	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063	2063	2063	2063

Notes for Table 2:

(i) Standard errors in parentheses, robust and clustered by individual.

(ii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(iii) Control variables not shown: Age, year of survey, parental education, individual gender liberalism score. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

3.9 Results: disaggregated STEM fields

The differences between STEM definitions highlight the need for a more disaggregated analysis. I estimate linear probability models with binary variables, 0/1 for the comparison between each of the six STEM fields against all other occupations (including other STEM fields)[17]. As before, I first estimate a base model, with only gender and the control variables (Model 1), then include all job values (Model 2), then include job value ratings separately, first as a mediator (Model 3-9), then as a moderator variable (Model 3a-9a). The estimated coefficients are shown in **Tables 3 to 6.**

3.9.1 Gender differences in aspirations

Girls are most likely to aspire to Healthcare as compared to boys (11 percentage points more likely). Girls are less likely than boys to aspire to all the other STEM fields, and least likely to aspire to Skilled Metal/Electrical work as compared to boys (7 percentage points less likely).

3.9.2 All job values

Model 2, in **Table 3** shows that including all job values together improves the model most for Healthcare, where the proportion of variance explained increases from 3 percent

[17] I also estimate linear probability models for the six binary comparisons of each STEM fields against non-STEM occupations only. However, this means that the samples are not nested, so models between fields are not comparable. Results available on request.

to 8 percent. Using the Wald test, the difference between the gender coefficients between models 1 and 2 is significant for all of the STEM fields except for Science and Engineering and Skilled Construction. Again, this makes the most substantive difference for Healthcare; including all job values decreases the gender coefficient by 3 percentage points. Part of the greater likelihood of girls aspiring to Healthcare is due to gender differences in job values.

When all job values are included together, 'a job that helps others' is significantly positively associated with Healthcare aspirations, a 1 unit increase in the rating is associated with an 11.5 percentage point increase in the probability of aspiring to this field. 'A job that helps others' is significantly negatively associated with aspirations for ICT and 'a job that is interesting' is significantly negatively associated with Business and Finance occupations.

3.9.3 Relative importance of job values

Tables 4 to 6 show the relative importance of each job value for aspirations for the STEM fields.

- *Business and Finance*: Aspirations are significantly positively associated with 'job pay' (3), and negatively associated with 'a job that helps others' (5), 'a job that contributes to society' (6) and 'a job that is interesting' (7). The gender coefficients in the models for 'a job that contributes to society' and 'a job that helps others' are significantly reduced, compared to the base model, but the coefficient remains small.
- *Science and Engineering*: Aspirations are *not* significantly associated with any job values. There are no significant differences between the base model and the mediator job value models.

- *Healthcare*: Aspirations are significantly positively associated with ‘a job that helps others’ (5), ‘a job that contributes to society’ (6) and ‘a job that is interesting’ (7). The reduction in the gender coefficient as compared to the base model is significantly different for the models including ‘a job that helps others’ (~3 percentage point reduction on ‘female’), ‘a job that contributes to society’, ‘a job that is interesting’ and ‘time for family’.

- *ICT:* Aspirations are negatively associated with ‘a job that helps others’ (5). The gender difference is not substantively reduced by any of the job values.

- *Skilled Metal/Electrical:* Aspirations are not significantly associated with any job values. Again, the gender difference is not greatly changed by the job values but most reduced by ‘a job that helps others’ and ‘a job that contributes to society’; these models are significantly different on the gender coefficient to the base model.

- *Skilled Construction:* Aspirations are not significantly associated with any job values as mediators.

3.9.4 Gender differences in the association of job values with job aspirations

There are significant gender interactions with job values for aspirations for Science and Engineering, Healthcare and Skilled Construction. For Science and Engineering, there is a significant additional negative association for girls’ ratings on ‘a job that contributes to society’ or ‘a job that helps others’. Girls who rate these job values highly are less likely to aspire to Science and Engineering than boys who rate these job values highly. The mirror image of this association is found in aspirations for Healthcare; there is an additional positive association for girls’ ratings on these two job values. Lastly, there is

an additional negative association between aspirations for Skilled Construction and girls' ratings on 'job pay'.

Table 3: Linear probability model estimated coefficients for probability of aspiring to STEM fields: base model and all job values

STEM subfield	Business and Finance		Science and Engineering		Healthcare		ICT		Skilled Metal/Electrical		Construction	
Model coefficients/specification	1	2	1	2	1	2	1	2	1	2	1	2
Female	-0.018*	-0.013	-0.052***	-0.052***	0.112***	0.081***	-0.058***	-0.053***	-0.074***	-0.070***	-0.069***	-0.069***
	(0.007)	(0.007)	(0.013)	(0.014)	(0.018)	(0.018)	(0.010)	(0.009)	(0.010)	(0.010)	(0.011)	(0.011)
Job pay		0.004		-0.006		0.007		0.003		-0.007		0.016
		(0.004)		(0.010)		(0.014)		(0.008)		(0.009)		(0.008)
Time for leisure		0.002		-0.006		-0.018		0.013		0.009		-0.006
		(0.007)		(0.009)		(0.013)		(0.008)		(0.008)		(0.008)
A job that contributes to society		-0.010		0.019		-0.007		0.006		-0.006		0.005
		(0.006)		(0.011)		(0.016)		(0.009)		(0.008)		(0.010)
A job that helps others		-0.007		-0.026		0.115***		-0.020*		-0.012		-0.003
		(0.006)		(0.014)		(0.016)		(0.010)		(0.008)		(0.010)
A job that is interesting		-0.028*		0.021		0.022		-0.002		0.002		-0.001
		(0.012)		(0.012)		(0.017)		(0.011)		(0.012)		(0.013)
A job that is secure		0.006		0.018		-0.006		0.004		0.004		-0.011
		(0.006)		(0.011)		(0.015)		(0.008)		(0.010)		(0.009)
N (observations)	2516	2516	2516	2516	2516	2516	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063	2063	2063	2063	2063	2063	2063

Table 4: Linear probability model estimated coefficients for probability of aspiring to Business and Finance and Science and Engineering: base model and separate job values

	Business and finance			Science and Engineering		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.018*			-0.052***		
	(0.007)			(0.013)		
3. Job pay	-0.018*	0.007*		-0.052***	-0.006	
	(0.007)	(0.003)		(0.013)	(0.010)	
3a. Job pay x female	-0.035	0.004	0.005	-0.076	-0.010	0.008
	(0.021)	(0.005)	(0.006)	(0.062)	(0.016)	(0.019)
4. Time for leisure	-0.018*	0.001		-0.053***	-0.007	
	(0.007)	(0.007)		(0.013)	(0.009)	
4a. Time for leisure x female	-0.016	0.001	-0.001	-0.019	-0.001	-0.012
	(0.040)	(0.013)	(0.014)	(0.052)	(0.014)	(0.018)
5. A job that helps others	-0.014*	-0.016**		-0.049***	-0.010	
	(0.007)	(0.006)		(0.014)	(0.011)	
5a. A job that helps others x female	-0.047	-0.020*	0.011	0.146*	0.020	-0.063**
	(0.038)	(0.009)	(0.011)	(0.071)	(0.015)	(0.022)
6. A job that contributes to society	-0.015*	-0.017**		-0.053***	0.008	
	(0.007)	(0.006)		(0.013)	(0.009)	
6a. A job that contributes to society x female	-0.045	-0.021*	0.010	0.077	0.028*	-0.044**
	(0.035)	(0.009)	(0.010)	(0.051)	(0.014)	(0.017)
7. A job that is interesting	-0.016*	-0.033**		-0.053***	0.020	
	(0.007)	(0.012)		(0.013)	(0.012)	
7a. A job that is interesting x female	-0.153	-0.048*	0.036	0.006	0.027	-0.016
	(0.080)	(0.019)	(0.021)	(0.078)	(0.018)	(0.021)
8. A job that is secure	-0.018*	0.003		-0.053***	0.015	
	(0.007)	(0.006)		(0.013)	(0.011)	
8a. A job that is secure x female	-0.052	-0.001	0.010	-0.069	0.013	0.004
	(0.038)	(0.010)	(0.010)	(0.073)	(0.018)	(0.021)
9. Time for family	-0.020*	0.003		-0.058***	-0.001	
	(0.008)	(0.006)		(0.014)	(0.011)	
9a. Time for family x female	0.024	0.009	-0.013	0.027	0.011	-0.026
	(0.037)	(0.010)	(0.011)	(0.071)	(0.017)	(0.021)
N (observations)	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063

Table 5: Linear probability model estimated coefficients for probability of aspiring to Healthcare and ICT: base model and separate job values

	Healthcare			ICT		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	0.112***			-0.058***		
	(0.018)			(0.010)		
3. Job pay	0.112***	0.003		-0.058***	0.007	
	(0.018)	(0.013)		(0.010)	(0.008)	
3a. Job pay x female	0.089	-0.001	0.008	-0.068	0.005	0.003
	(0.085)	(0.016)	(0.026)	(0.050)	(0.015)	(0.016)
4. Time for leisure	0.112***	-0.004		-0.057***	0.012	
	(0.018)	(0.012)		(0.010)	(0.007)	
4a. Time for leisure x female	0.089	-0.008	0.008	0.004	0.023	-0.022
	(0.072)	(0.014)	(0.025)	(0.037)	(0.013)	(0.014)
5. A job that helps others	0.084***	0.111***		-0.055***	-0.015*	
	(0.018)	(0.013)		(0.009)	(0.007)	
5a. A job that helps others x female	-0.108	0.083***	0.061*	-0.116**	-0.024*	0.020
	(0.082)	(0.015)	(0.027)	(0.041)	(0.011)	(0.012)
6. A job that contributes to society	0.102***	0.060***		-0.058***	-0.005	
	(0.018)	(0.013)		(0.010)	(0.006)	
6a. A job that contributes to society x female	-0.066	0.034*	0.057*	-0.069	-0.006	0.004
	(0.081)	(0.016)	(0.027)	(0.037)	(0.012)	(0.012)
7. A job that is interesting	0.110***	0.051**		-0.058***	-0.005	
	(0.018)	(0.017)		(0.010)	(0.010)	
7a. A job that is interesting x female	0.086	0.048**	0.006	-0.100	-0.010	0.011
	(0.126)	(0.018)	(0.034)	(0.069)	(0.018)	(0.019)
8. A job that is secure	0.111***	0.016		-0.059***	0.004	
	(0.018)	(0.015)		(0.010)	(0.008)	
8a. A job that is secure x female	0.210	0.029	-0.028	-0.044	0.006	-0.004
	(0.109)	(0.016)	(0.030)	(0.054)	(0.015)	(0.015)
9. Time for family	0.111***	0.026		-0.059***	-0.016	
	(0.019)	(0.013)		(0.010)	(0.010)	
9a. Time for family x female	0.021	0.014	0.027	-0.124*	-0.024	0.020
	(0.094)	(0.015)	(0.028)	(0.059)	(0.017)	(0.017)
N (observations)	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063

Table 6: Linear probability model estimated coefficients for probability of aspiring to Skilled Metal/Electrical and Skilled Construction: base model and separate job values

	Metal/Electrical			Construction		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.074***			-0.069***		
	(0.010)			(0.011)		
3. Job pay	-0.074***	-0.004		-0.069***	0.011	
	(0.010)	(0.007)		(0.011)	(0.008)	
3a. Job pay x female	-0.079	-0.004	0.001	0.027	0.027	-0.031*
	(0.048)	(0.014)	(0.014)	(0.046)	(0.014)	(0.015)
4. Time for leisure	-0.074***	0.006		-0.069***	-0.003	
	(0.010)	(0.007)		(0.011)	(0.008)	
4a. Time for leisure x female	-0.040	0.012	-0.012	-0.042	0.002	-0.010
	(0.040)	(0.014)	(0.014)	(0.046)	(0.014)	(0.016)
5. A job that helps others	-0.071***	-0.014		-0.069***	-0.002	
	(0.010)	(0.007)		(0.011)	(0.006)	
5a. A job that helps others x female	-0.130**	-0.023	0.019	-0.081*	-0.003	0.004
	(0.044)	(0.014)	(0.014)	(0.039)	(0.011)	(0.012)
6. A job that contributes to society	-0.072***	-0.011		-0.069***	0.002	
	(0.010)	(0.007)		(0.011)	(0.007)	
6a. A job that contributes to society x female	-0.131**	-0.020	0.020	-0.118**	-0.006	0.017
	(0.043)	(0.014)	(0.014)	(0.039)	(0.012)	(0.013)
7. A job that is interesting	-0.074***	-0.002		-0.069***	-0.002	
	(0.010)	(0.011)		(0.011)	(0.012)	
7a. A job that is interesting x female	-0.089	-0.003	0.004	-0.114	-0.007	0.012
	(0.067)	(0.018)	(0.018)	(0.085)	(0.020)	(0.022)
8. A job that is secure	-0.074***	0.000		-0.068***	-0.008	
	(0.010)	(0.009)		(0.011)	(0.008)	
8a. A job that is secure x female	-0.083	-0.001	0.003	-0.126*	-0.015	0.016
	(0.058)	(0.017)	(0.017)	(0.062)	(0.016)	(0.017)
9. Time for family	-0.078***	-0.001		-0.062***	0.011	
	(0.011)	(0.009)		(0.011)	(0.008)	
9a. Time for family x female	-0.062	0.001	-0.005	-0.079	0.008	0.005
	(0.053)	(0.015)	(0.016)	(0.048)	(0.013)	(0.015)
N (observations)	2516	2516	2516	2516	2516	2516
N (individuals)	2063	2063	2063	2063	2063	2063

Notes for Tables 3 to 6:

(i) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

(ii) Standard errors in parentheses, robust and clustered by individual.

(iii) * p < 0.05, ** p < 0.01, *** p < 0.001.

(iv) Control variables not shown: Age, year of survey, parental education, individual gender liberalism score. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

3.10 Discussion and limitations

Overall, these results show that *some* job values are significantly associated with *some* specific STEM aspirations, for both boys and girls, but that there is limited evidence for an association with any coherent STEM group. For both boys and girls, the altruistic values of 'a job that helps others' and 'a job that contributes to society' were important in aspirations for Business and Finance and Healthcare, and 'job pay' was important for Business and Finance. Differences in job value ratings between boys and girls are notable in reducing the gender difference in aspirations for Healthcare; the greatest reduction in the gender coefficient is found in using 'a job that helps others' as a mediator variable. There are also significant gender differences in the relative importance of job values for specific STEM aspirations; girls who highly rate 'a job that helps others' or 'a job that contributes to society' are especially likely to aspire to Healthcare occupations and especially *unlikely* to aspire to Science and Engineering occupations as compared to boys with the same values. Girls who highly value 'job pay' are especially unlikely to aspire to Skilled Construction, compared to boys. In terms of explaining the aggregate-level STEM results, the Science and Engineering field is driving the female-specific importance of 'a job that helps others' and 'a job that contributes to society' in the 'traditional STEM

definitions' model, whilst Healthcare occupations explain the positive association with these values in the wider STEM skills definition.

These associations could be for several reasons; first, they could confirm the finding that girls are more likely than boys to have stereotypical and negative perceptions of STEM and therefore do not think that Science and Engineering occupations help other people or contribute to society. Alternatively, this could reflect gendered expectations for Science and Engineering and Healthcare occupations; only girls who have *very* strong preferences for certain job values will defy the gender norm and aspire to STEM, rather than more 'female' occupations like Healthcare. Alternatively, it could indicate gender differences in occupational preference formation, if boys place less emphasis on job values than girls, regardless of their ratings.

There are a number of limitations to the current analysis. First, the data is associational, and does not use consider changes in job values or occupational preferences within individuals over time. Job values are asked in abstraction from the specific job chosen. Therefore, whilst there is clearly an association between job values and occupational preferences, a causal claim is not supported. It is likely that the relationship is endogenous. Secondly, it is not possible to isolate the exact cause for the gender difference in the relative association between job values and STEM. Even within the STEM fields, there is considerable gender segregation between occupations, for instance, within Healthcare, some occupations will be male-dominated and others will be female-dominated but further disaggregation is not possible with the sample size available. Thirdly, the model does not control for other aspects of the Eccles' expectancy-value framework, such as relative STEM ability compared to ability in other subjects. This is not available in sufficient detail across the period studied in the dataset. Finally, the results are limited by the job values questions asked in the survey, there are plausibly

other job values associated with STEM aspirations, which have gender differences, such as on the ‘people’ and ‘things’ dimensions.

The tentative conclusions that can be made from these associations are that job values do matter, especially for some STEM fields, and that there are gender differences in how young people link their job values to occupational aspirations. Whilst there are only small gender differences in absolute job value ratings, girls’ higher rating of altruistic job values have a disproportionate association with their underrepresentation in aspirations for traditional STEM, and overrepresentation in aspirations for Healthcare occupations. Future research on gender diversity in the pursuit of STEM careers can unpack this discrepancy more and further investigate gender differences in perceptions of occupations.

Chapter 4: Parental education and gender-typical occupations. Evidence from the UK

4.1 Introduction

Occupational gender segregation in the UK varies across occupational classes; professional and managerial occupations are more equal, in terms of the proportion of men and women employed, than are other occupational classes (Office for National Statistics, 2015). Consensus remains that gender segregation in the adult labour market has negative impacts (Busch, 2017). One proximate cause of segregation is differences in occupational preferences; gender differences appear at a young age and significantly influence adult occupational outcomes (Ashby & Schoon, 2010; Polavieja & Platt, 2014). Differences in aspirations by socio-economic backgrounds also influence adult occupational attainment (Breen & Jonsson, 2005; Erikson & Jonsson, 1996). Socio-economic background is highly relevant for studies of occupational gender segregation—young people from lower socio-economic backgrounds are more likely to have gender-typical occupational preferences, when compared to young people from higher socio-economic backgrounds (Busch-Heizmann, 2015; Leuze & Helbig, 2015; Polavieja & Platt, 2014). However, explanations for this association have not yet been well-researched. Is variation by socio-economic background explained by the same factors that explain gender differences? I consider four explanations for why gender-typicality may vary by socio-economic background in the UK; differences in parental role-modelling, gender attitudes, job values, or the occupational class aspired to.

The UK is a useful case study because in some ways it is a 'typical' European country, with average levels of overall gender segregation (Blackburn, Jarman, & Racko, 2016:242), yet, in others it is extreme—for instance, in 2007 the UK had the lowest

percentage of female engineering professionals in the European Union at less than 10% of all engineers (Perkins, 2014). This chapter focuses on occupational preferences between the ages of 14-21, an important time for young people in the UK. Upper secondary education in the UK has a narrow, specialised focus, and early choices affect eligibility for tertiary-level education and adult occupations. Therefore, occupational preferences within this age period are important for future adult occupational outcomes, due to their influence on educational choices.

4.2 Background

Gender influences preferences such that boys aspire to jobs typical for men, and girls aspire to jobs typical for women (Polavieja & Platt, 2014). This leads to persistent gender gaps in the UK in aspirations for, and occupational attainment in, much-publicised fields like science, technology, maths and engineering (Schoon, Martin, et al., 2007), but also in apprenticeships and human services work (Beck et al., 2006). Socio-economic background influences the occupations that individuals aspire to and attain, both directly, and indirectly through educational aspirations and decisions. Young people from a lower socio-economic background in the UK are less likely to attend university, or to aim for, or be accepted at, elite universities, compared to equally qualified peers (Boliver, 2013). At occupation-level, they are less likely to aspire to, or attain, professional-level jobs (Ashby & Schoon, 2010). Polavieja and Platt show that the likelihood of aspiring to a gender-typical occupation also differs between socio-economic classes (Polavieja & Platt, 2014:54).

4.3 Theoretical explanations

I present four theoretical explanations that would (a) vary by socio-economic background *and* (b) are associated with gender-typicality, in order to identify mediators of the

relationship between socio-economic background and gender-typical occupational preferences. Hypotheses are presented after the review.

4.3.1 Parental characteristics and role-modelling

Specific parental characteristics influence young people's preferences through role-modelling attitudes and behaviours to children. Parental gender attitudes directly affect children's gender attitudes (Platt & Polavieja, 2016), as does occupational behaviour, often strongest through same-sex dyads—daughters are more likely to aspire to gender-atypical occupations if they have mothers in a gender-atypical occupation, whilst boys are influenced by fathers (Polavieja & Platt, 2014). Dryler (1998) disaggregates this to specific educational fields—for Swedish teenagers, a parent's occupational field is associated with child's educational programme choice at upper secondary school.

Male-dominated and female-dominated occupations are more frequent in low and intermediate occupational classes, as compared to high occupational classes (Office for National Statistics, 2015), therefore children from low socio-economic backgrounds are more likely to have mothers or fathers in gender-segregated and gender-typical occupations. Gender attitudes differ by education and earnings, with women who have higher wages more likely to have egalitarian attitudes when they are mothers (Schober & Scott, 2012, therefore children from low socio-economic backgrounds are more likely to have more traditional parents.

4.3.2 Individual gender attitudes

As socio-economic background influences socialisation, there is also likely to be a gradient by socio-economic background in an individual's own attitudes towards gender, which influence preferences independently of parents. For Inglehart and Norris (2003), a wide variety of gender role attitudes tap a single dimension of gender egalitarianism, on

the scale of traditional to liberal. However, more recent work, both from the US (Knight & Brinton, 2017), and specific to the UK (Scott & Clery, 2012), demonstrates that not all gender role attitudes vary together, and that there are (at least) three distinct components. First, egalitarianism—the belief that men and women are equal, as opposed to male primacy, which suggests men are more suited for leadership roles (Charles & Grusky, 2004). Second, gender essentialism—the belief that men and women have distinct gender roles or competences and therefore caring occupations like nursing or teaching are 'feminine', whereas 'masculine' occupations involve management, responsibility or physical labour (Charles & Grusky, 2004). Third, the normative imperative—the belief that men and women *should* take on certain roles, either traditional or non-traditional, hence women are expected to take time off work to care for family (Stier, Lewin-Epstein, & Braun, 2001:1744).

Young people learn these attitudes not only from parents, but also through expectations of siblings, teachers, peers and the media (Campbell, 2015). These influence occupational preferences if individuals see a job as more suitable because of their gender, if it fits with normative gendered life-course plans, or influences self-evaluations (Philip D. Parker et al., 2012). The influence of gender attitudes may be more important for boys than girls; across socio-economic classes, in the US, it is more acceptable for girls to take on male-dominated jobs and traits than vice versa; "when boys… take on 'female' activities they often suffer disrespect, but under some circumstances, girls gain respect for taking on 'male' activities." (Paula England, 2010:156). This is evidence in the UK too - boys especially worry about being teased if they 'cross the gender line' (Beck et al., 2006 p.283-284). The effect of gender attitudes may also differ by socio-economic class. Nixon studies low-skilled female-dominated jobs in 21st Century Britain to argue that these provide a greater challenge to 'masculine' stereotypes than female-dominated

professional/managerial jobs do, because the former require stereotypically feminine attitudes, like subservience and deference to authority that female-dominated professional/managerial jobs may not (Nixon, 2009). In purely numerical terms, female-dominated or male-dominated jobs in lower classes are likely to be more segregated as compared to gender-dominated professional or managerial jobs, which are still segregated, but to a lesser degree (Office for National Statistics, 2015).

Puzzlingly though, segregation persists despite liberalising gender attitudes, such as in Scandinavian countries, where egalitarian gender attitudes coincide with extremely high segregation. This could be because, cross-nationally, the various components of gender attitudes change at different rates, and also affect occupational classes differently (Charles & Grusky, 2004; Levanon & Grusky, 2016). Additionally, occupation provides a limited picture of gendered behaviour; for instance, in the US, some individuals enact traditional gender norms by 'doing gender' at home, to counter gender-atypicality in the labour force (Gerstel & Clawson, 2014), whilst institutional constraints can inhibit individuals from enacting egalitarian ideals (Gerson, 2002; D. S. Pedulla & Thebaud, 2015).

4.3.3 Job values

Socio-economic background may be associated with different job value ratings and rankings, which are in turn, related to male-dominated or female-dominated occupations. The classic distinction in job values is made by gender, between extrinsic and intrinsic job values—boys are assumed to value extrinsic aspects, like job pay, job security and time for leisure, whilst girls are assumed to value intrinsic, social and altruistic aspects, like a job that helps others, a job that is interesting, and time for family, (Busch-Heizmann, 2015). Therefore, individuals who have typically 'male' or 'female' job

values are more likely to aspire to gender-typical jobs, either because (a) these occupations have attributes typically associated with being masculine or feminine, or (b) these occupations are *assumed* to involve male- or female-typed attributes because they are dominated by one gender, regardless of whether they do or not—see for instance, perceptions of engineering in an ethnographic field study of the UK as being about things, not people, versus the reality of the job (Faulkner, 2007).

Moreover, differences in job values by socio-economic background are plausible, for instance, due to differences in the anticipated receipt of rewards from occupations, either monetary or non-monetary. Kalleberg and Marsden (2013) expect that once an individual has received a reward, e.g. job security, they no longer prioritise this, and shift their interest towards intrinsic aspects. Conversely, if an individual is in an insecure, low-paid position, they will likely prioritise extrinsic aspects of a job not yet attained. This 'problematic rewards' hypothesis suggests job values will differ only after exposure to the labour market, but alternatively, individuals may undergo anticipatory socialisation based on their perception of future labour market rewards (Levine & Hoffner, 2006). Lower socio-economic children would be more likely to develop preferences for extrinsic aspects of a job, whereas those from higher socio-economic backgrounds would be more likely to value intrinsic, social or altruistic aspects of a job, as the latter anticipate that their extrinsic needs will undoubtedly be met.

If it is the case that lower socio-economic backgrounds value extrinsic values more highly than intrinsic values, and that extrinsic values are associated with male-dominated occupations, then differences in job values will explain the socio-economic background association with boys' aspirations for male-dominated occupations.

4.3.4 The structural explanation

Alternatively, an association between gender-typical occupational preferences and socio-economic background could be solely due to differences in occupational class aspired to, and the distribution of gender-typical occupations between classes. If more children from a higher socio-economic background aspire to professional and managerial occupations than do children from lower socio-economic backgrounds, either due to reproduction of parental occupations, or because they are more 'ambitious' (Ashby & Schoon, 2010; Polavieja & Platt, 2014), then this could account for differences by socio-economic background in gender-typical occupational preferences, if there are fewer gender-typical occupations in the high classes. In this case, there is no difference between socio-economic classes in terms of their preference for whether an occupation is gender-typical or not, only differences in occupational class preferences. Alternatively, if individuals do have gender-typical preferences, they should aspire to gender-typical occupations regardless of what class they are in.

Again, this could be gendered, if occupational class preference explains gender-typicality of girls' choices, but not boys. It has been argued that male-dominated occupations are available in both high and low classes, whereas female-dominated occupations are concentrated outside of the professional and managerial class (Paula England, 2010; Polavieja & Platt, 2014). In the US, England (2010) argues that women want to move up in the occupational hierarchy, but prefer gender-typical jobs. Hence, girls from a lower socio-economic background won't aspire to gender-atypical jobs at the bottom of the occupational hierarchy (like blue-collar trades) if they can move upwards and maintain gender-typicality by aspiring to clerical or teaching work (intermediate occupations). In contrast, women who start from an intermediate socio-economic position and move upwards end up moving into previously male-dominated occupations.

4.4 Hypotheses

For each of the four potential explanations, the hypotheses can be summarised as the following; (i) factor varies by socio-economic background, (ii) factor is associated with gender-typical aspiration, and therefore mediates the association of socio-economic background with gender-typical occupations. The direction of the predicted associations are shown in **Table 1**.

Table 1: Hypotheses

Explanation:	(a) SES difference*:	(b) Influence on gender-typical aspirations:	(c) Interaction with gender/SES
H1. Parental role-modelling	More traditional parents, in attitudes and behaviour.	More traditional parents positively associated with gender-typical aspirations.	Mothers influence daughters, fathers influence sons.
H2. Gender attitudes	More traditional gender attitudes as individuals.	More traditional gender attitudes positively associated with gender-typical aspirations.	Gender attitudes explain more for boys than for girls. Gender attitudes more important for lower SES.
H3. Job values	More likely to have extrinsic rather than intrinsic job values.	Extrinsic values positively associated with male-dominated occupations, negatively associated with female-dominated occupations.	Job values explain association for boys only.
H4. Structural explanation	More likely to aspire to occupations in low or intermediate classes.	Low and intermediate occupational class more likely to have gender-segregated occupations than high class occupations.	Occupation class preference explains more of gender-typicality for girls than boys.

*SES: socio-economic status. Comparison is lower socio-economic backgrounds versus higher socio-economic backgrounds.

4.5 Data and key variables

Analysis is based on a combined dataset of two nationally representative UK household panel studies; Understanding Society (UKHLS) and its predecessor, the British Household Panel Survey (BHPS), covering the period 2006-2016; effectively waves 16 to 23 of the combined survey.[18] This combines the youth panel, for respondents aged 11-15 (referred to as 'children' hereafter), and the young adults module, for individuals aged 16-21[19] (referred to as 'young adults'). Discussion refers to both age groups together, as 'young people'. Respondents are matched to their parents in the survey.

Occupational preferences

Children, aged 11-15, are asked, 'what job would you like to do once you leave school, finish your training or finish full-time education?' in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016[20] (waves 16, 17, 18, 20 and 22).

Young adults, aged 16-21, are asked the same question in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016 (waves 16, 17, 18, 20, 21, 22 and 23), if they are in full-time education or training (just over 60% of young people in these waves are eligible).

For all respondents, the question is open-ended with responses coded using the Standard Occupational Classification 2000 (SOC 2000). As in other papers, I use an external source to create an index for the level of segregation in each occupation (Busch-Heizmann, 2015; Polavieja & Platt, 2014). Following the Office for National Statistics

[18] BHPS comprises 18 waves, from 1991 to 2008. Only the 3 latest waves, 2006-2008, have occupational preferences coded consistently with UKHLS. The UKHLS follows on from BHPS, with the majority of BHPS participants added in 2010-12. Thus wave 2 of UKHLS is effectively wave 19 of BHPS.
[19] In BHPS, some questions are asked to 16-22-year-olds. For consistency, over 21s are excluded.
[20] Data collection for each wave in UKHLS is over a period of two years, because the survey is so much larger than BHPS. However, within this, individuals are always interviewed at the same time every year. See survey timeline on https://www.understandingsociety.ac.uk/documentation/mainstage/survey-timeline

analysis of Employment by Occupation, I pool the April–June quarter of the UK Labour Force Survey (LFS), for each year of the combined dataset. This gives the proportion of men and women in each 3-digit SOC 2000 occupational category, from a combined sample of 498,423 working adults, over 81 SOC 2000 3-digit occupations. The average percentage of women in each 3-digit occupation over this time period is assigned as a score to each respondent's occupational preference.

Occupations are coded as: (i) male-dominated if at least 70% of those in the occupation were male, (ii) female-dominated if at least 70% were female, and (iii) gender-neutral otherwise.[21] An occupational preference is gender-typical if a girl aspires to a female-dominated occupation, or a boy aspires to a male-dominated occupation. According to these criteria, in the adult labour market between 2006-2015, 27% of individuals worked in jobs that were male-dominated jobs, 28% were in female-dominated jobs and 45% were in gender-neutral jobs. Gender-typical occupational preferences in the sample are stable over the panel; if you aspire to a gender-typical occupation in one wave, there is an 81% chance you will aspire to a gender-typical occupation in the next wave,[22] (transition tables in Appendix).

Socio-economic class of occupational preference is measured using the National Socio-Economic Classification (NS-SEC), the 5-class version. This is aggregated further into three categories; 'high' including professional/managerial occupations, 'intermediate' including intermediate occupations and small employer/own account workers, and 'low' including lower supervisory and technical occupations and semi-routine and routine occupations.

[21] The boundaries of 30%/70% are used to be consistent with, and easily comparable against, other prominent papers in the literature. For robustness, models were also estimated using a continuous variable for the proportion of individuals in an occupation who are the same gender. Results remain consistent.
[22] Preferences are significantly related to adult occupational attainment, results presented in Appendix.

Gender attitudes

Five questions on gender role attitudes are asked to children, young adults and their parents throughout the period, albeit not at every wave of the survey. I label these GA1 – GA5, with question text detailed below. GA1, GA4 and GA5 are asked in 2007, 2010-2012 and 2012-2014 (waves 17, 19 and 21), to those older than age 16 only. GA2 and GA3 are asked in 2007, 2010-2012 and 2012-2014 (waves 17, 19 and 21) to those older than age 16, and in 2008 (wave 18) to 11-15-year-olds;

GA1: (Do you personally agree or disagree...) A pre-school child is likely to suffer if his or her mother works

GA2: (Do you personally agree or disagree...) All in all, family life suffers when the woman has a full-time job

GA3: (Do you personally agree or disagree...) Both the husband and wife should contribute to the household income

GA4: (Do you personally agree or disagree...) A husband's job is to earn money, a wife's job is to look after the home and family

GA5: (Do you personally agree or disagree...) Employers should make special arrangements to help mothers combine jobs and childcare

These follow a Likert scale response of how strongly a respondent agrees with the following statements. Responses are recoded so that 1; the most traditional response, and 5 the most liberal response, and then standardised with mean 0 and variance 1.

This limited number of gender role attitudes does not measure egalitarianism or essentialism well, they primarily relate to normative expectations—i.e. if certain gender roles ‘should’ be fulfilled or provide the best outcome for family and children. In terms of

the theoretical mapping, GA1, GA2 and GA4 are closest to the normative imperative for traditional gender roles—they include 'should' and imply that traditional gender roles are the best possible outcome. GA3 and GA5 are closest to the normative imperative for non-traditional roles—again, they include 'should' but promote non-traditional gender roles.

Principal component analysis (PCA) visualises the relatedness of the variables; component loadings are shown in **Table 2**.

Table 2: Rotated component loadings using principal component analysis; all five gender attitude variables

Variables*	Component 1	Component 2
GA1: A pre-school child suffers if their mother works	**0.597**	-0.029
GA2: The family suffers if the woman works full-time	**0.614**	-0.015
GA3: The husband and wife should both contribute to household income	0.047	**0.684**
GA4: The husband should earn; the wife should stay at home	**0.513**	0.053
GA5: Employers should help mothers combine jobs and childcare	-0.045	**0.727**
Eigenvalue	2.147	1.181
Proportion of total variance explained	0.430	0.236
Cronbach's Alpha of component	0.796	0.303

**Variables measured on a Likert scale, 1 to 5, then standardised with mean 0 and variance 1. Emboldened numbers show highest component loadings.*

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Two components have an eigenvalue greater than 1. GA1, GA2 and GA3 have the highest loadings onto component 1, which explains 43% of the variance, with an eigenvalue of 2.147. Cronbach's Alpha for these three variables is 0.796—they map the same dimension, and a combined measure will be internally consistent. GA3 and GA5 both map onto the second component, which explains 24% of the variance, with an eigenvalue of 1.181. However, Cronbach's Alpha for these two attitudes is 0.303; they are not highly correlated, and this is an 'unacceptable' consistency score (George & Mallery, 2003). Dropping GA3 and GA5 improves overall consistency; component loadings and squared multiple correlations shown in Appendix.

Therefore, I include two distinct gender attitude measures in the analysis; a combined measure for normative traditional gender role attitudes (GA1, GA2, GA4), predicted from the first component of PCA, and a measure for normative non-traditional gender role attitudes (GA3). Both are averaged over each individual's available responses, to maximise the number of individuals with complete observations on both gender attitudes and occupational preferences. GA5 is dropped because it does not map the same dimension as GA3, and, theoretically does not fit as well with Knight and Brinton's components as GA3 does. It instead taps attitudes towards corporate or government intervention. Gender attitudes are stable within individuals between waves, shown in the Appendix.

Job values

Various groupings of job values have been proposed, for instance, extrinsic, intrinsic, social, altruistic and work/life balance components (Busch-Heizmann, 2015), or work orientations which favour high risk (low job security) and high reward (high job pay/bonuses) versus those that do not (Halaby, 2003). The combined UK surveys have individual ratings for six different job values.

Both UKHLS and BHPS ask;

"When thinking about an occupation, how important is… Job pay? A job that helps others? A job that is interesting? A secure job? A job that contributes to society? Time for leisure?" [23]

This question is asked of children aged 14-15 in 2007 (wave 17)[24] and of young people in 2010-2012, 2011-2013 and 2013-2015 (waves 19, 20 and 22). Answers are coded such

[23] The value of 'time for family' is asked in UKHLS but not in BHPS, therefore is omitted.
[24] The question is also asked earlier in BHPS, but I only use the period from BHPS where occupational preferences are coded using SOC2000, which excludes earlier waves.

that 1=not at all important and 4=very important, and subsequently standardised with mean 0 and variance 1.

In theory, extrinsic values include 'job pay' and 'job security', intrinsic values include 'a job that is interesting', altruistic values include 'a job that helps others' and 'a job that contributes to society'. 'Time for leisure' could be extrinsic—valuing work as a means to an end. To test interrelatedness, principal component analysis is shown in **Table 3**. Squared multiple correlations are shown in the Appendix.

There are two components with eigenvalues greater than 1, with the first component with high loadings from 'a job that is interesting', 'a job that contributes to society' and 'a job that helps others', and the second component with high loadings from 'job security', 'job pay' and 'time for leisure'. Cronbach's Alpha for these components is lower than for the gender role attitudes analysis; at 0.643 and 0.446 respectively, and therefore is 'questionable' (George & Mallery, 2003).

Table 3: Rotated component loadings using principal component analysis; six job values

Variables	Component 1	Component 2
Job security	0.153	**0.424**
A job that is interesting	**0.438**	-0.033
A job that contributes to society	**0.630**	-0.038
A job that helps others	**0.616**	0.007
Job pay	-0.082	**0.710**
Time for leisure	0.049	**0.560**
Eigenvalue	1.831	1.414
Proportion of total variance explained	0.304	0.236
Cronbach's Alpha of component	0.643	0.446

Notes: Variables measured on a scale from 1 to 4, where 1 is not at all important and 4 is very important, then standardised with mean 0 and variance 1. Emboldened numbers show highest component loadings.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Theoretically, the component loading could support an intrinsic (component 1)/extrinsic (component 2) divide, but it is not clear that 'a job that is interesting' would map the

same dimension as ‘a job that helps others’, nor that ‘time for leisure’ would map with ‘job pay’, and they are not sufficiently interrelated. Consequently, each job value is analysed separately. Again, to maximise available data, individual mean scores are used. Scores are sufficiently stable between waves; transition tables shown in the Appendix.

Socio-demographic and parental characteristics

Gender and age are available in all waves. Parental characteristics are measured using parents’ own responses.

Socio-economic background is measured by highest parental educational attainment. This is measured using the dominance principle (Erikson & Goldthorpe, 1992), as the highest educational attainment of either the mother or the father, coded to 4 categories; higher or first degree, upper secondary education, lower secondary education and other qualification/no qualification.

Parental gendered behaviour and attitudes are measured separately for mother and father, using;

(i) mother’s and father’s gender attitudes; measured with the same questions and method as for their children,

(ii) whether the mother or father is in a male-dominated or female-dominated job, as compared to being either outside the labour force, or in a gender-neutral job. This is a categorical variable coded from self-declared job status and occupation. For instance, coded as: 1: mother employed in a male-dominated job, 2: mother employed not in male-dominated job, 3: mother outside the labour force.

Parental characteristics (other than gender attitudes which are measured as within-individual means) are measured concurrently with the observation of the occupational

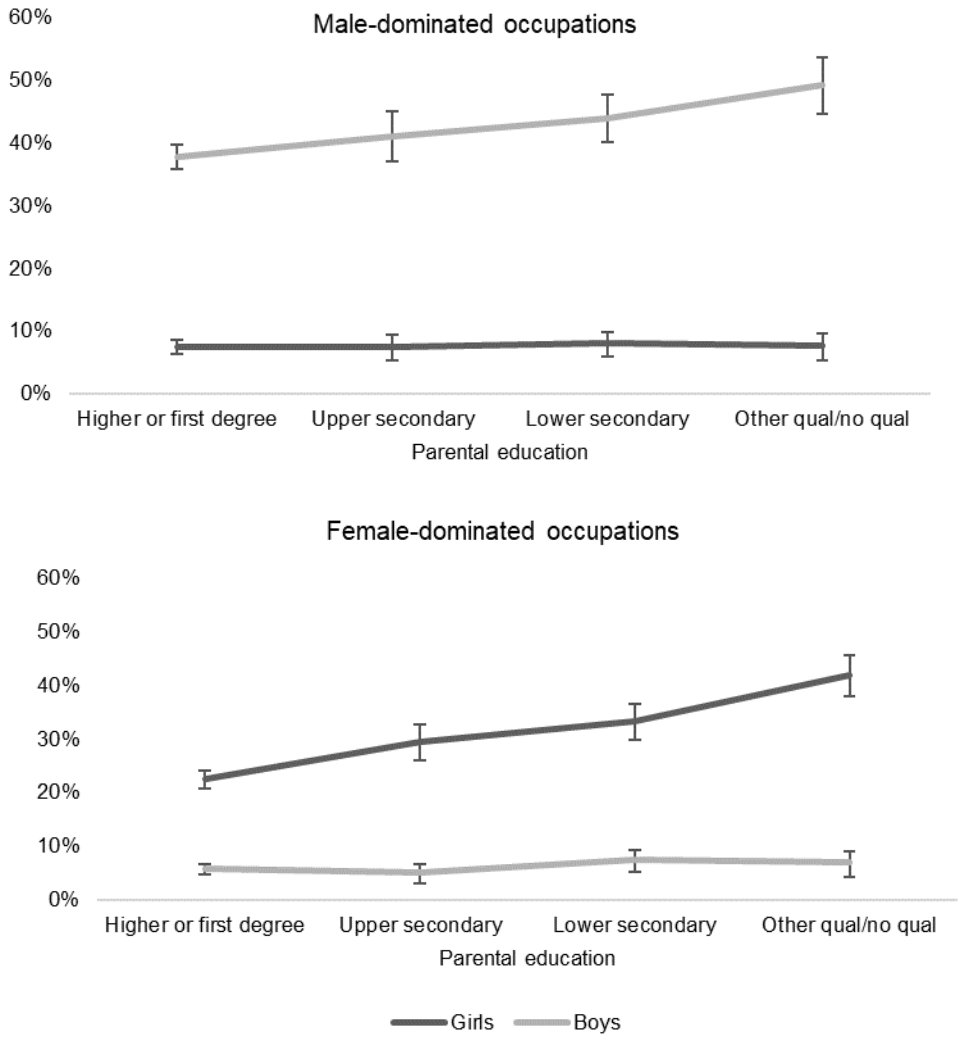
preference where possible. If missing, then the observation from the previous year is used. The sample with complete information on age, gender, occupational preferences, gender attitudes, job values and parental characteristics is 1,434 observations of 1,152 individuals.

4.6 Distribution of key variables

Overall, 28% of all girls and 40% of all boys aspire to a gender-typical occupation. **Figure 1** shows the distribution of occupational preferences between male-dominated and female-dominated occupations, by parental education and gender.

For both boys and girls, those with parents with lower levels of education are more likely to aspire to gender-typical occupations; 49% of boys and 42% of girls from an 'other qualification/no qualification' background, aspire to male-dominated and female-dominated occupations respectively, as compared to 38% of boys and 22% of girls from a 'higher or first degree' background, in line with England's (2010) findings that boys are more likely to make gender-typical choices.

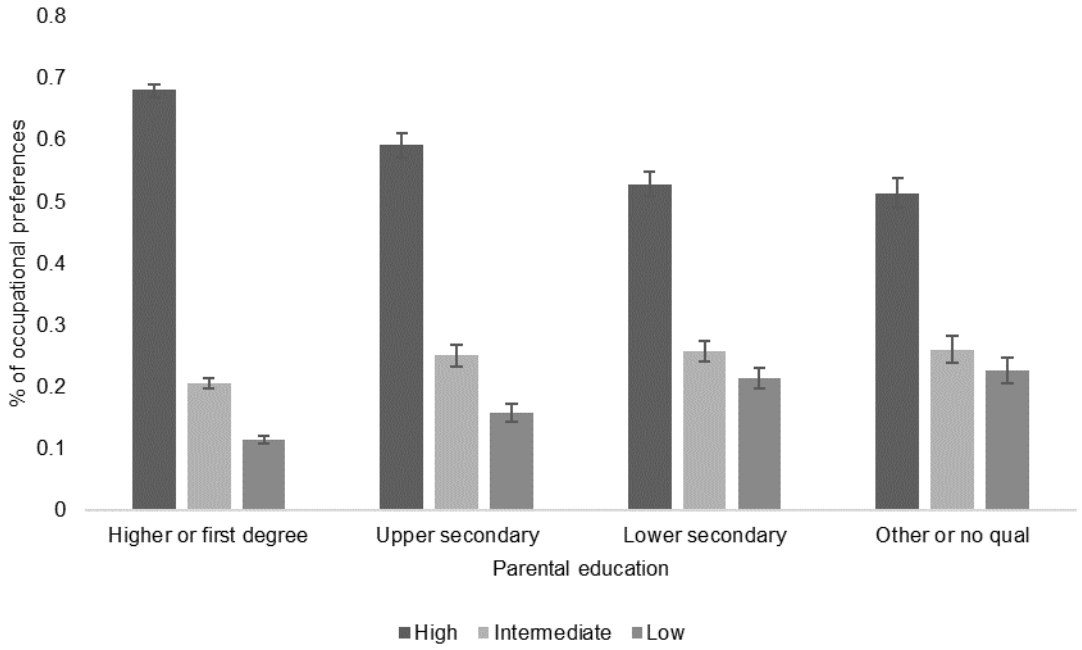
Figure 1: Percentage of girls and boys aspiring to male-dominated and female-dominated occupations, by parental education group



Note: Error bars show 95% confidence intervals.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Figure 2: Distribution of occupational preferences by NS-SEC class, by parental education groups

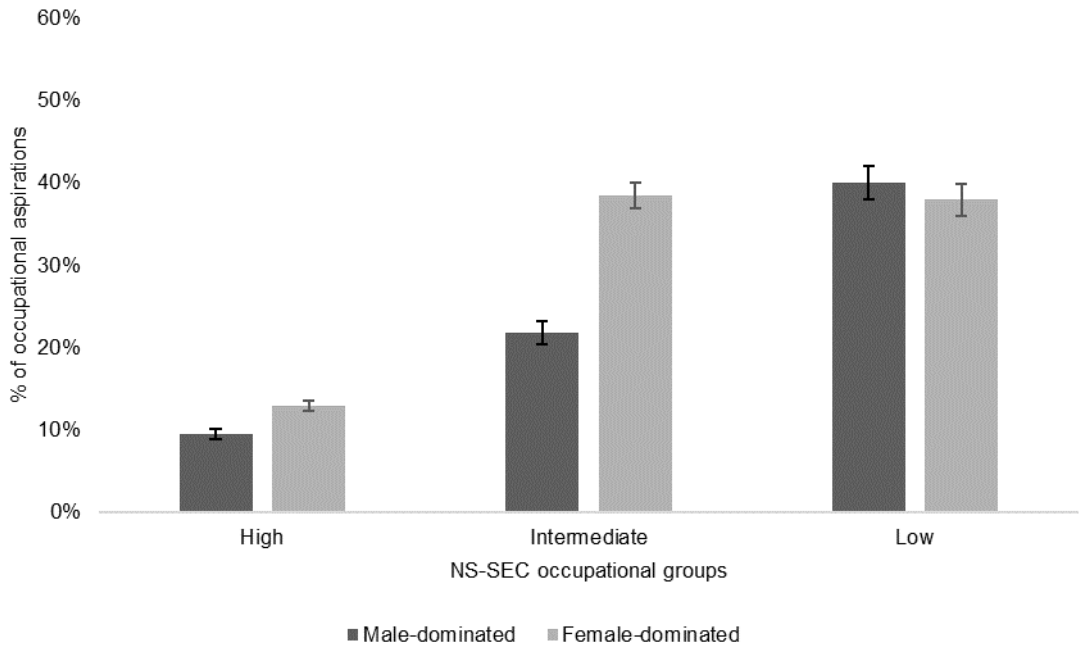


Note: Error bars show 95% confidence intervals. Base: gender-neutral occupations.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Figure 2 shows preferences, by occupational class and parental education. Young people are much more likely to aspire to professional and managerial occupations - high occupations - than occupations from any other class, regardless of parental education, but the proportion aspiring to high occupations decreases as parental education decreases.

Figure 3: Distribution of preferences for male-dominated and female-dominated occupations *within* NS-SEC classes



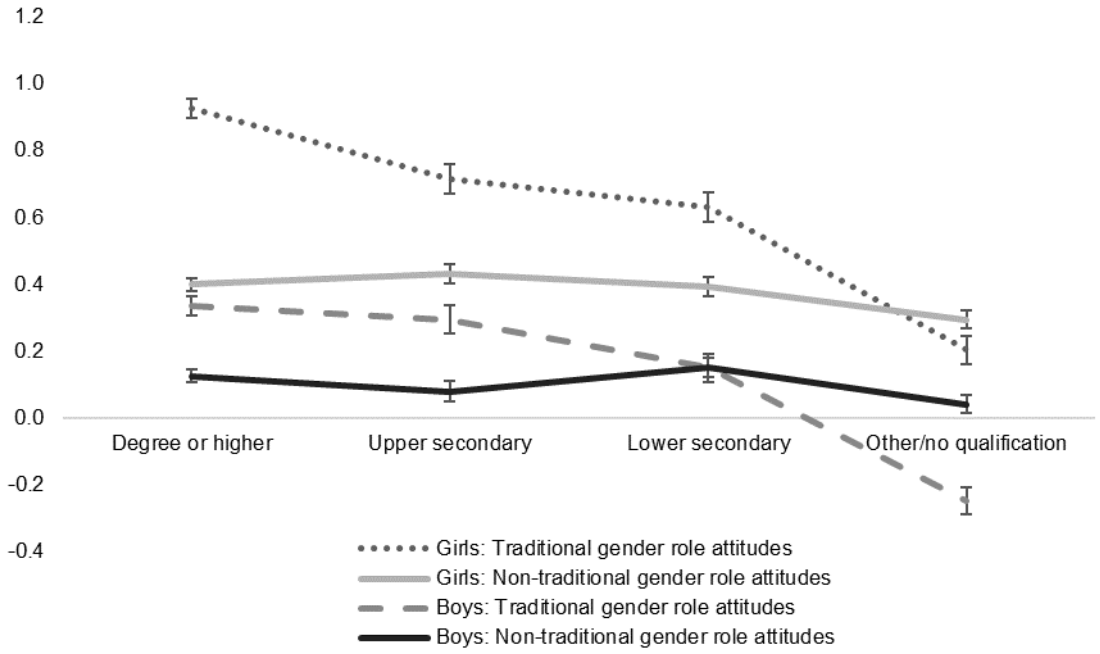
Note: Error bars show 95% confidence intervals. Base: gender-neutral occupations.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Figure 3 shows the distribution of preferences for gender-typical jobs, separated by male-dominated and female-dominated jobs, within occupational classes. Of those aspirations for high occupations, 13% are for female-dominated occupations and 9% are for male-dominated occupations. The proportion of aspirations for both male-dominated and female-dominated occupations increases substantially within intermediate and low occupations, highest for female-dominated in intermediate occupations and for male-dominated in low occupations.

Figure 4 shows that girls have more liberal gender attitudes than boys, at all parental education backgrounds. For both boys and girls, as parental education increases, support for traditional gender roles decreases. Support for non-traditional gender roles does not have a clear trend by parental education.

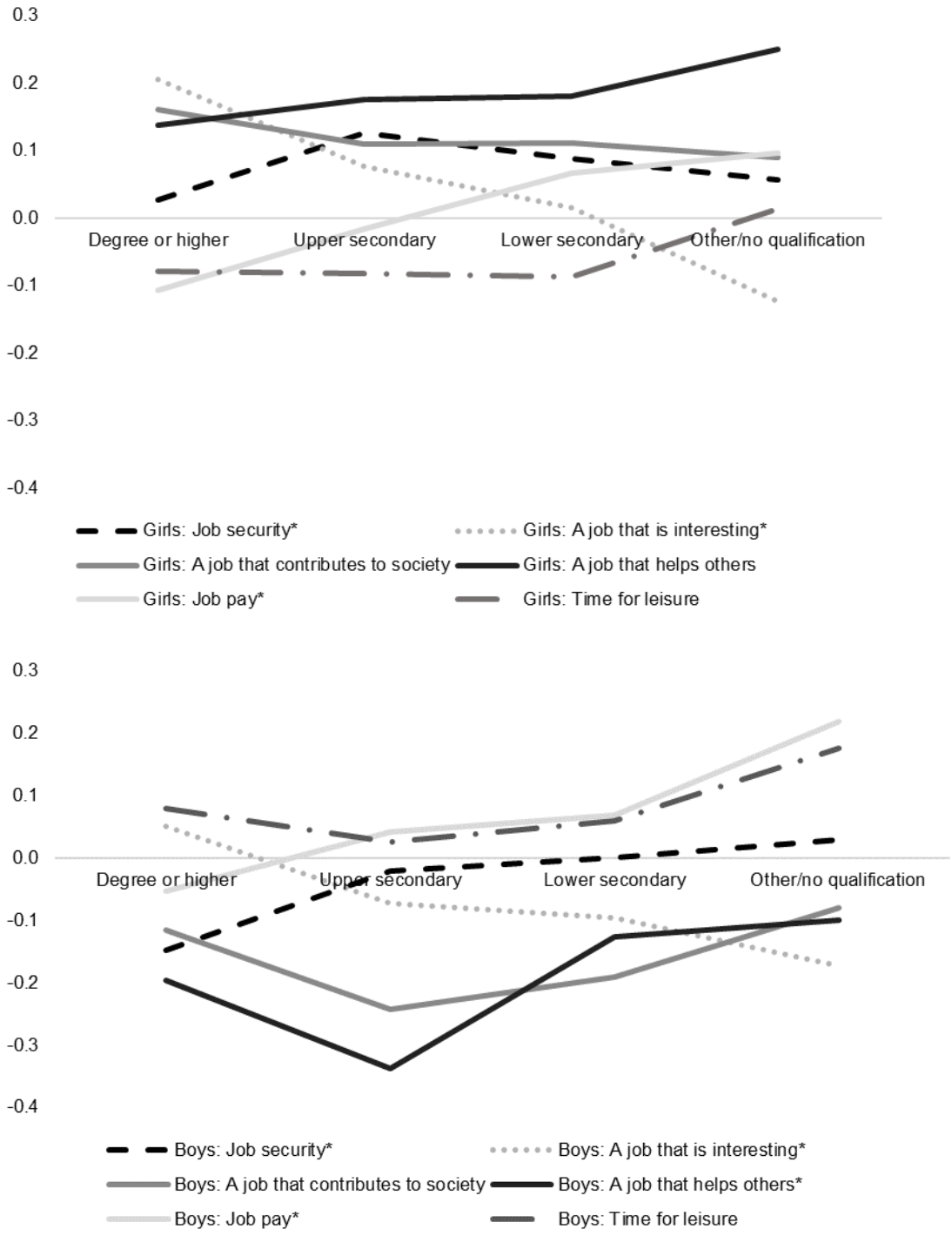
Figure 4: Distribution of mean gender attitude scores, by gender and parental education



Notes: Error bars show 95% confidence intervals. Variables are standardised with mean 0 and variance 1. Attitudes are increasing in liberalism.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Figure 5: Distribution of job values, by gender and parental education

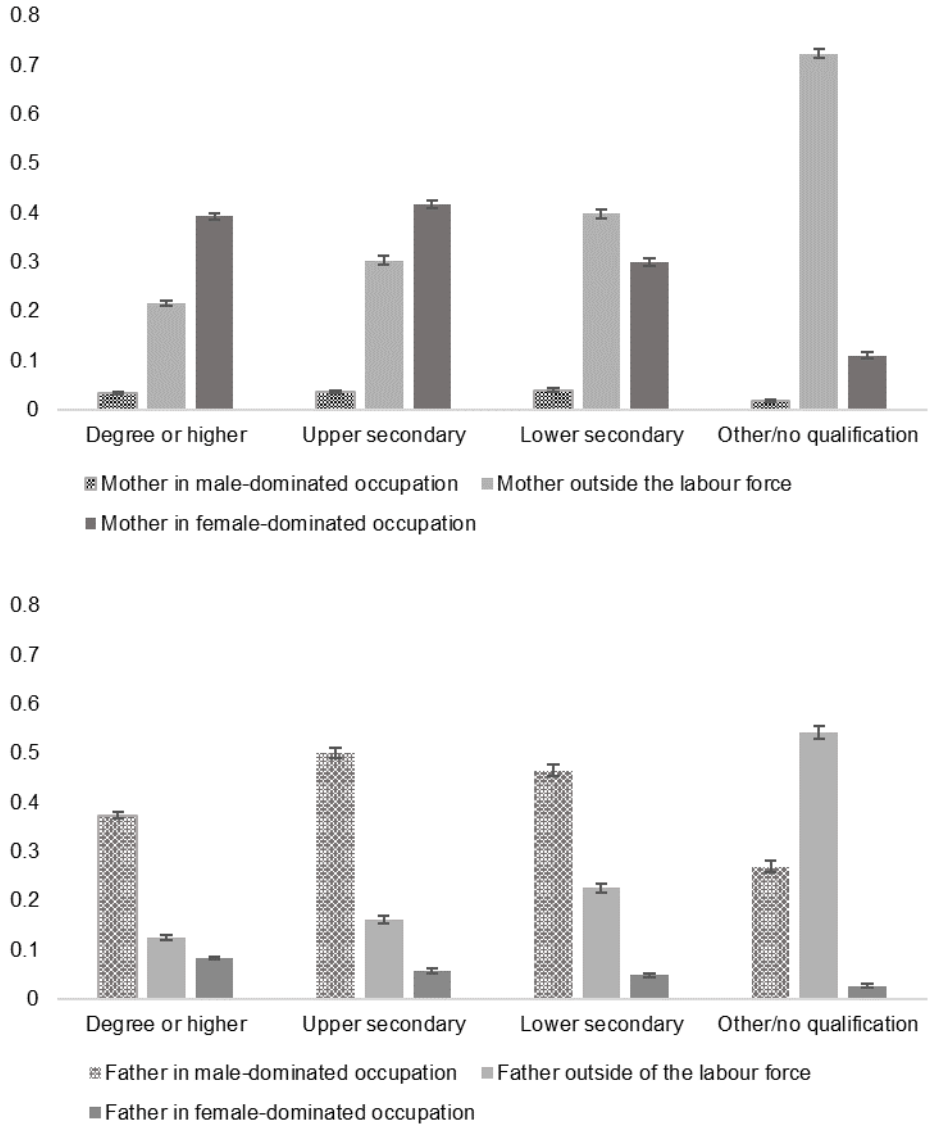


Notes: Variables are standardised with mean 0 and variance 1. Values scores are increasing in importance. Stars on labels indicate that differences between parental education groups are statistically significant; p<0.05. Source: BHPS (2006-2008) and UKHLS (2010-2016).

Figure 5 demonstrates trends by parental education for job value ratings (stars indicate statistically significant differences between parental education, as confidence intervals are not easily interpretable on this graph). There does appear to be a divide between extrinsic and intrinsic values by parental education, to an extent—scores on job security and job pay increase as parental education decreases, scores on a job that is interesting decrease as parental education decreases. There is no trend for time for leisure or a job that contributes to society, therefore they are excluded from the regression analyses. There is an additional unpredicted association between parental education and 'a job that helps others'.

Figure 6 shows the distribution of parental occupation by parental education. The highest proportion of mothers in female-dominated occupations is found in the degree-level and upper secondary parental education. The highest proportion of mothers outside of the labour force is for those from the lower parental education background—the proportion increases linearly as parental education decreases. The highest proportion of fathers in male-dominated occupations is found in upper secondary parental education backgrounds, followed by lower secondary and then those with a degree or higher. The highest proportion of fathers outside of the labour force is for those with other/no qualification education.

Figure 6: Distribution of parental occupation, by gender and parental education



Notes: Error bars show 95% confidence intervals. Variables indicate proportions in male-dominated or female-dominated occupations, as compared to other employment, or outside the labour force status. Proportion in gender-neutral occupations not shown. Source: BHPS (2006-2008) and UKHLS (2010-2016).

Parental gender attitudes differ by parental education, mirroring the distribution for young people's own attitudes. As anticipated, lower parental education is associated with higher support for traditional gender roles, from both mothers and fathers, and differences between classes are statistically significant. Conversely, those from lower parental

education backgrounds are more likely to have both mothers and fathers who strongly support non-traditional gender roles in terms of sharing the household contribution between husbands and wives. Statistics omitted for brevity but available on request.

4.7 Methods and model selection

4.7.1 Model selection

The dependent variable is binary; where y = 1 if a preference is gender-typical and 0 otherwise, therefore if using the linear regression function;

$$y_{it} = \beta_1 + \beta_2 x_{it} + \cdots + \beta_K x_{Kit} + c_i + u_{it}$$

$$y_{it} = x_{it}\beta + c_i + u_{it}$$

The probability that y equals one can be modelled using the binary response model:

$$\Pr(y_{it} = 1 | x_{it}, c_i) = x_{it}\beta + c_i,$$

$$\Pr(y_{it} = 0 | x_{it}, c_i) = 1 - (x_{it}\beta + c_i).$$

Where,

x_{it} is the vector of observed explanatory variables, including a constant, age, gender, year of survey, parental education, occupation and gender attitudes, an individual's gender attitude score, job value scores and occupational class of preference.

β is a vector of parameters on these observed explanatory variables.

c_i is an unobserved time invariant individual effect.

u_{it} is a zero-mean residual uncorrelated with all the terms on the right-hand side.

The model testing an association between the gender-typicality of an occupational preference and parental education can be estimated using the pooled OLS linear

probability model (LPM). Because there are multiple observations per individual, the residual will be heteroscedastic, as observations within individuals over time are serially correlated. To account for this, robust standard errors are estimated, clustered by individual.

An alternative specification is to use the random effects (RE) panel model, which allows for serial correlation in the unobserved factors determining y_{it}, i.e. in $(c_i + u_{it})$. There are several problems with the interpretation of the parameters in the nonlinear probability models, namely in the comparison of coefficients between same-sample nested models and the comparison of coefficients across groups (Breen, Karlson, & Holm, 2018). Contrastingly, the LPM is easier to interpret, because it "simply models the probability of the outcome as a linear function of the covariates and therefore consistently recovers the conditional expectation of the outcome" (Breen et al., 2018:20). Even so, both the LPM model and the RE model assume that the unobserved time invariant individual effect is uncorrelated with the other explanatory variables in the model, a restrictive assumption which implies that any subsequent conclusions are associational, rather than causal. This limitation is discussed further in the conclusions.

The base model includes individual characteristics of age, gender and parental education only (model 0), to test the association between gender-typicality and parental education. Next, I test each of the hypotheses from **Table 1**, to see which of the four explanatory variables - parental role-modelling, gender attitudes, job values or structural factors - can account for the association between gender-typicality and parental education. First, for H1, to assess whether parental role-modelling accounts the following variables are included separately; mother and father gender-typical behaviours and attitudes (models 1 and 1a), for H2, gender attitudes, (model 2, 2a, 2b), for H3, job values (model 3 and 3a), and for H4, socio-economic class of occupational preference (model 4 and 4a), where

models with ‘a’ or ‘b’ include interactions. Lastly, all explanatory variables are included together, to assess associations when controlling for other explanatory variables (model 5). Control variables throughout include age, gender and year of survey. Weights for unequal selection probability and non-response bias are present in all models.

4.7.2 An alternative model of occupational class preference

The risk with including occupational class preference (to test H4) as an independent variable (models 4, 4a, 5) is that the same variable is coded in two different ways and included as both a dependent and an independent variable. As an alternative method, I create a dependent variable coding occupational aspirations into six categories. This corresponds first to whether to occupation is high, intermediate or low, and second, to whether the preference is gender-typical or not gender-typical. The six categories are; high/gender-typical, high/not gender-typical, intermediate/gender-typical, intermediate/not gender-typical, low/gender-typical, low/not gender-typical, distribution shown in **Table 4.** Linear probability models are estimated with this combined variable as the dependent variable (model 6). Control variables and weights are as before.

Table 4: Distribution of girls’ and boys’ occupational preferences using NS-SEC of preference and gender-typicality

NS-SEC group/gender-typicality	Boys	Girls
High/gender-typical	15%	11%
High/not gender-typical	45%	54%
Intermediate/gender-typical	12%	8%
Intermediate/not gender-typical	11%	14%
Low/gender-typical	13%	9%
Low/not gender-typical	4%	4%

Source: BHPS (2006-2008) and UKHLS (2010-2016).

4.7.3 An alternative model for male-dominated and female-dominated occupations

Another risk with the initial model selection is that the dependent variable is different for boys and girls, because 'gender-typical occupations' refers to a different set of occupations for girls - female-dominated occupations – than it does for boys – male-dominated occupations. When boys and girls are regressed in the same equation, the observed and unobserved factors are associated differently with different sets of occupational preferences, not necessarily reflecting gender typicality in preferences. Therefore I also estimate separate models for girls' and boys' preferences for male-dominated preferences and female-dominated preferences, so that the dependent variable is consistent.

4.8 Results

4.8.1 Associations between parental education and gender-typicality

Coefficients for the association between parental education and gender-typical aspirations are shown in **Tables 5 to 8** for each of the models, 0 to 4, including interactions labelled as 1a, 2a etc. Models were also estimated separately for aspirations for male-dominated and female-dominated occupational preferences, results in the Appendix. I test the difference between all models and base model 0, comparing the means of the overall model, the mean coefficient on parental education, and each of the coefficients on the parental education comparisons (e.g. upper secondary versus degree-level), with p-values in the Appendix.

The base model 0, in **Table 5,** confirms the association between parental education and gender-typical occupational preferences, the coefficients for young people from any educational background less than degree-level parental education are positive. The biggest difference is between those from the lowest and highest educational backgrounds;

with a 24 percentage point difference (Model 0, Table 5) in the probability that an individual will aspire to a gender-typical occupation.

4.8.2 Explanatory variables

To test H1, in Models 1 and 1a include parental occupation and parental gender attitudes, with interactions with gender included in Model 1a, with results presented in **Table 5**. As hypothesised, this reduces the coefficient on parental education –this is is a significant reduction for the contrast between upper secondary/degree-level parental education, in model 1a. Individuals who have gender-typical parents are more likely to aspire to gender-typical occupations themselves (either if mothers in female-dominated occupations, or fathers in male-dominated occupations) (as per H1b). However, the coefficient for mother's occupation is close to zero. A larger positive association is found if mothers are outside of the labour force, as opposed to if they are in a gender-typical occupation. This still fits with expectations, as for mothers, opting out of the labour force is still a 'gender-typical' choice.

There is a significant father/son association—sons with fathers in a male-dominated occupation are 12.4 percentage points (Model 1b, Table 5) more likely to aspire to a gender-typical occupation than if fathers are employed elsewhere, whereas for girls, this association nets to zero. The coefficients on mother/daughter interactions are again close to zero. There are no significant associations with parental gender attitudes, and coefficients are insubstantial. H1c predicted that mothers would influence daughters and fathers would influence sons, so this is partially supported only.

To test, H2, gender attitudes are included in Models 2, 2a and 2b, with results presented in **Table 6.** Including gender attitudes does reduce the coefficients on parental education, but by less than the parental characteristics model. This is statistically significant for the

contrast between lower secondary and degree-level, and other/no qualification and degree-level. Both having less support for traditional gender roles, or more support for non-traditional gender roles is negatively associated with aspiring to gender-typical occupations, though again, the size of the association is small (attitude scores are increasing in liberalism). This supports H2b; a one standard deviation increase in support for traditional gender roles equates to a 1.7 percentage point (Model 2, Table 6), increase in the probability of gender-typical aspirations. H2b hypothesised that gender attitudes would explain more for boys than girls, but there is little evidence gender difference in the role of gender attitudes (Model 2a, Table 6), but there was some evidence for differences by parental education (Model 2b, Table 6)—having more liberal gender attitudes significantly reduces the likelihood of aspiring to gender-typical occupations for those from a degree-level background (3.1 percentage point decrease), but this decreases for those from lower parental education backgrounds.

For H3, including job values does not significantly change the association between parental education and gender-typicality (Model 3, Table 7). The most significant job value is 'a job that helps others', which is positively associated with girls' aspirations for gender-typical occupations, and negatively associated with boys' aspirations for gender-typical occupations—this makes sense as female-dominated jobs are predominantly those that help other people. However, the differences by parental education are not large enough to explain any overall association with gender-typicality, and other values do not have significant associations. Separating out by gender (Model 3a) shows that any associations with these job values are likely gendered—boys' coefficients are in the opposite direction to girls'—but these are not substantive.

For H4, including occupational class of preference in Models 4 and 4a (Table 8) significantly reduces the coefficients on parental education and this is the most

substantive reduction of all four explanations. Both girls and boys who aspire to intermediate or low occupations are more likely to aspire to gender-typical occupations—a 42.6 percentage point increase (Model 4, Table 8) for those aspiring to low occupational classes as compared to high. The gender interaction suggests that association is greater for boys than for girls, but this difference is not significant. This is counter to previous research, and counter to H4c.

Including all explanations together in model 5 reduces the coefficient on the parental education contrast between individuals from an other/no qualification and those from a degree-level background to a 12.5 percentage point increase (Appendices, 7.3 Appendix Chapter 4, Table 2), and it becomes non-significant. The only significant explanation for gender-typicality, once controlling for other explanations, is the occupational class preference.

4.8.3 Alternative model for occupational class preference: joint occupational preference and gender-typicality analysis

In the alternative test for H4, **Table 9** reports the coefficients for the probability of aspiring to each of the six constructed NS-SEC /gender-typicality categories. In general, those from a parental education lower than degree-level are less likely to aspire to *either* a gender-typical or a non-gender-typical high class occupation, but the contrast is much greater for non-gender-typical high class occupations—those from an other/no qualification background are 24 percentage points less likely (Model 'High/not GT', Table 9) to aspire to a 'high/not GT' occupation, as compared to 4 percentage points more likely to aspire to a 'high/GT' occupation . The coefficients for intermediate aspirations indicate the same trend, albeit not significant—those from a lower secondary or other/no qualification background are more likely to aspire to an intermediate

occupation than those from a degree-level background, but more likely to aspire to an intermediate/gender-typical occupation within this class. For low occupations, individuals from a lower secondary background are more likely to aspire to these than those from a degree-level background, and this is equally likely to be gender-typical or not gender-typical.

To test H1 for this alternative specification of the association between parental education and gender-typicality, I include parental characteristics (Table 9 as before). Father's male-dominated occupation is positively associated with gender-typicality in the low and intermediate categories, whilst the more significant contrast for mothers is again, whether they are in the labour force, as compared to in a female-dominated occupation—individuals with mothers outside the labour force are less likely to aspire to 'intermediate/not GT' jobs. This is in line with H1b.

Mother's support for non-traditional gender roles is negatively associated with aspiring to 'intermediate/GT' jobs—more liberal mothers mean less gender-typical choices within the intermediate class. In contrast, more liberal fathers are positively associated with aspiring to high/GT jobs, counter to expectations. Testing H2, similarly, an individual's own gender attitudes are not in line with expectations in this specification—more liberal individuals are more likely to aspire to high/not GT jobs, which suggests that the previous model was showing associations between liberal gender attitudes and having high aspirations, rather than any association with gender-typicality per se. Testing H3, lastly, individuals who value a job that helps others are significantly more likely to aspire to high/GT jobs, and significantly less likely to aspire to intermediate/not GT jobs.

4.8.4 Alternative model for male-dominated and female-dominated occupational preferences

The same models are estimated separately for aspirations for male-dominated and female-dominated occupational preferences. Tables for these results are shown in the Appendices, 7.3 Appendix Chapter 4, Tables 3 to 6. In the following discussion, I compare these results to the results discussed in 4.8.1 - 4.8.2, with the latter referred to as the main paper.

Appendix Table 3 presents the base models for girls' and boys' aspirations for female-dominated and male-dominated occupations. The base model 0 confirms an association between parental education and gender-typical preferences, as in the main paper, but this is most substantial for girls' aspirations – girls from any parental education background lower than degree-level are significantly more likely to aspire to female-dominated occupations than those from degree-level parental education backgrounds. The greatest contrast is between girls from other/no qualification backgrounds and degree-level backgrounds, with the former 37 percentage points more likely to aspire to female-dominated backgrounds than the latter. For boys' aspirations for male-dominated occupations, only the contrast between other/no qualification backgrounds and degree-level backgrounds has a positive coefficient—other/no qualification background boys are 12 percentage points more likely to aspire to male-dominated occupations. This is not significant in this model specification, but this could be a function of the smaller sample (separating out between boys and girls *and* separating out between male-dominated and female-dominated occupations). However, this is also in line with the findings of Polavieja and Platt (2014), who show that there is only a contrast between boys from the highest and lowest parental education background. Separating out between male-dominated and female-dominated occupations is also interesting because it highlights potential associations between parental education and gender-*a*typical aspirations. Although none of these associations are significant, it remains interesting that for girls'

aspirations for male-dominated occupations, all of the coefficients on parental education below degree-level are negative—therefore girls from lower parental education background are less likely to aspire to male-dominated occupations than those from the highest parental education background. For boys, the pattern is not as clear.

Explanations for the association between parental education and gender-typicality

Next, I test whether any of the potential explanations included in Models 1 – 4 significantly change the association between parental education and occupational aspirations shown in base model 0. I compare the overall means of the coefficients, the coefficients for parental education, and the comparisons between each of the parental education variables below degree-level, with the degree-level parental education, between the models 1 – 4 against the base model 0. I also discuss the associations of these explanatory variables with male-dominated or female-dominated occupations, for both boys and girls.

Parental education (Appendix Table 3)

Including parental characteristics in model 1, as compared to base model 0, significantly changes the association between parental education and boys' aspirations for male-dominated occupations ($p=0.0414$ for the comparison between the parental education coefficient means)—most of this change is from the reduction in the coefficient on boys' aspirations for male-dominated occupations, from an 'other or no qualification' background. The coefficients on the parental education comparisons are also reduced in the other dependent variable/gender categories (boys' aspirations for female-dominated occupations, girls' aspirations) but this is not significant.

For both boys' and girls' gender-typical occupational preferences, same-sex parental gender-typicality in occupation is associated in the direction anticipated. Girls are more

likely to aspire to a female-dominated occupation if their mother is in a female-dominated job, and boys are more likely to aspire to a male-dominated occupation if their father is in a male-dominated occupation, though this is only significant for boys—boys with fathers in a male-dominated occupation have a 14 percentage point increase in their probability of aspiring to a male-dominated occupation, as compared to fathers employed elsewhere. The associations with opposite-sex parent gender-typicality are less clear—both boys and girls are less likely to aspire to gender-typical jobs if their opposite-sex parent is in a gender-typical job, but neither of these associations are significant. Boys are influenced by mothers in aspirations for female-dominated jobs; they are significantly more likely to aspire to female-dominated jobs if their mother is employed in a female-dominated job, as compared to outside of the labour force. This is consistent with the main paper (Table 5), where there is also a significant father/son association.

It was hypothesised that parental gender attitudes would be important—however, the only significant association is that boys with fathers with more traditional gender role attitudes are less likely to aspire to female-dominated occupations. All other associations are close to nil and non-significant, consistent with the main paper.

Gender attitudes (Appendix, Table 4)

Including an individual's own gender attitudes in Model 2 does not significantly change the association between parental education and gender-typicality of preference, as compared to Model 0. Answers are increasing in liberalism, so the higher the response the more liberal the response. Both boys and girls who are more traditional are more likely to aspire to gender-typical occupations, as anticipated, (coefficients are negative on traditional gender role attitudes) but neither of these are significant. However, for girls, support for non-traditional gender roles is significantly associated; a one standard

deviation increase in girls' agreement with non-traditional gender roles results in a 2.7 percentage point increase in the likelihood of aspiring to a male-dominated occupation.

For the interactions between parental education and gender attitudes, again, this does not significantly change the association between parental education and gender attitudes. Of interest is that for boys, holding gender attitudes constant, there is an additional positive association for any parental education lower than degree, and this is a significant contrast for those from an 'other/no qualification' background and those from a degree-level background. There is a less consistent pattern for girls. As compared to the main paper, Table 6 shows that associations with gender attitudes were also small in size, however there is a small difference between the two models, in that including gender attitudes in the grouped model (gender-typical occupations all together), does significantly change the association between parental education and gender-typicality of preference.

Job values (Appendix, Table 5)

Including job values does not significantly change the association between parental education and gender-typical occupational preferences, but there are associations of interest in the direction anticipated by the hypotheses, where higher values indicate a value is more important. A high value on 'a job that helps others' is positively associated with female-dominated aspirations, and negatively associated with male-dominated aspirations, for both boys and girls, and this is significant for girls. 'Job pay' is positively associated with aspirations for male-dominated aspirations, and negatively associated with female-dominated occupations for both boys and girls. 'A job that is interesting' is positively associated with female-dominated aspirations and negatively associated with male-dominated aspirations for girls. However, only the associations with 'a job that helps others' is significant, consistent with the results from the main paper in Table 7.

NS-SEC of occupational preference (Appendix, Table 6)

Including the NS-SEC class of the occupational preferences aspired to (high, intermediate or low), significantly reduces the parental education coefficients for both boys' aspirations for male-dominated occupations and girls' aspirations for female-dominated occupations ($p=0.005$ and $p=0.000$ for comparison of parental education coefficient means in the respective model comparisons). Boys who aspire to intermediate or low occupations are significantly more likely to aspire to male-dominated occupations than those who aspire to high occupations, and girls' aspirations for intermediate occupations are also more likely to be male-dominated. However, boys' intermediate aspirations are also significantly more likely to be female-dominated, whilst girls' low aspirations are significantly more likely to be female-dominated. This reflects the distribution shown in the earlier descriptive statistics—occupations dominated by a single gender are more frequently found in both the intermediate and low categories. There are two points of interest here; first, boys are both more likely to aspire to male-dominated *or* female-dominated occupations if they aspire to intermediate occupations. Second, however, even controlling for occupational class, girls are still more likely to aspire to gender-typical occupations if they are from a lower parental education group, which suggests that even if aspiring to a certain occupational class, girls will opt for the gender-typical occupation, in line with England's predictions about women moving up the occupational ladder, with a preference for female occupations where available (Paula England, 2010). In the main paper results (Table 8), this is also the variable that changes the parental education association the most, and both boys and girls aspirations for intermediate or low occupations are more likely to be gender-typical.

In summary, the results are consistent with the main paper – including occupational class preference makes the most difference to the parental education association, there are

significant associations with parental gender-typicality, and gender attitudes and job values have smaller associations, albeit in the same direction as in the main paper. The main difference is that boys' parental education is no longer significantly associated with gender-typicality once separating out into male-dominated and female-dominated occupations, although the direction of the coefficient suggests that the lowest and highest parental education groups still differ in their preferences in the direction expected.

Table 5: Linear probability model estimated coefficients for the probability of gender-typical aspirations: parental characteristics

Models	0	1	1a
Parental education (Ref: Degree)			
Upper secondary	0.050	0.039	0.032
	(0.039)	(0.040)	(0.040)
Lower secondary	0.091	0.063	0.066
	(0.049)	(0.049)	(0.049)
Other or no qualification	0.240***	0.191**	0.188**
	(0.068)	(0.071)	(0.070)
Mother's occupation (Ref: female-dominated)			
Other occupation		-0.009	0.010
		(0.033)	(0.051)
Outside of the labour force		0.053	0.064
		(0.046)	(0.068)
Father's occupation (Ref: male-dominated)			
Other occupation		-0.061	-0.124*
		(0.034)	(0.050)
Outside of the labour force		0.031	-0.038
		(0.049)	(0.074)
Parental gender attitudes			
Mother: traditional gender role attitudes		-0.007	-0.015
		(0.012)	(0.018)
Mother: support for non-traditional gender roles		-0.011	-0.039
		(0.017)	(0.026)
Father: traditional gender role attitudes		0.016	0.019
		(0.012)	(0.018)
Father: support for non-traditional gender roles		0.009	0.000
		(0.017)	(0.028)
Parental occupation/gender interactions			
Mother: other occupation/female			-0.039
			(0.066)
Mother outside of the labour force/female			-0.024
			(0.087)
Father: other occupation/female			0.123
			(0.065)
Father: outside of the labour force/female			0.133
			(0.095)
Constant	-61.929**	-63.978**	-63.676**
	(21.592)	(21.539)	(21.496)
N (observations)	1434	1434	1434
N (individuals)	1152	1152	1152

Table 6: Linear probability model estimated coefficients for the probability of gender-typical aspirations: gender attitudes

Models	0	2	2a	2b
Parental education (Ref: Degree)				
Upper secondary	0.050	0.049	0.048	0.012
	(0.039)	(0.039)	(0.039)	(0.047)
Lower secondary	0.091	0.084	0.085	0.049
	(0.049)	(0.049)	(0.049)	(0.054)
Other or no qualification	0.240***	0.223**	0.228***	0.153*
	(0.068)	(0.069)	(0.069)	(0.069)
Gender attitudes				
Traditional gender roles		-0.017	-0.018	-0.031*
		(0.012)	(0.018)	(0.015)
Support for non-traditional gender roles		-0.003	-0.029	-0.021
		(0.018)	(0.027)	(0.022)
Gender attitudes/gender interactions				
Traditional gender roles/female			0.001	
			(0.024)	
Support for non-traditional gender roles/female			0.058	
			(0.036)	
Gender attitudes/parental education interaction				
Traditional gender roles/Upper secondary				0.058
				(0.032)
Traditional gender roles/lower secondary				0.030
				(0.039)
Traditional gender roles/other or no qualification				0.004
				(0.043)
Non-traditional gender roles/upper secondary				0.003
				(0.048)
Non-traditional gender roles/lower secondary				0.067
				(0.058)
Non-traditional gender roles/other or no qualification				0.142
				(0.074)
Constant	-61.929**	-62.307**	-64.792**	-61.113**
	(21.592)	(21.542)	(21.667)	(21.519)
N (observations)	1434	1434	1434	1434
N (individuals)	1152	1152	1152	1152

Table 7: Linear probability model estimated coefficients for the probability of gender-typical aspirations: job values

Models	**0**	**3**	**3a**
Parental education (Ref: Degree)			
Upper secondary	0.050	0.049	0.044
	(0.039)	(0.039)	(0.039)
Lower secondary	0.091	0.092	0.094
	(0.049)	(0.049)	(0.049)
Other or no qualification	0.240***	0.235***	0.231***
	(0.068)	(0.068)	(0.067)
Job values			
Job security		0.002	-0.021
		(0.015)	(0.022)
A job that is interesting		0.004	-0.002
		(0.018)	(0.026)
A job that helps others		0.021	-0.021
		(0.015)	(0.023)
Job pay		0.005	0.026
		(0.016)	(0.024)
Job values/gender interactions			
Job security/female			0.047
			(0.030)
A job that is interesting/female			0.012
			(0.036)
A job that helps others/female			0.086**
			(0.030)
Job pay/female			-0.042
			(0.031)
Constant	-61.929**	-61.994**	-61.960**
	(21.592)	(21.587)	(21.369)
N (observations)	1434	1434	1434
N (individuals)	1152	1152	1152

Table 8: Linear probability model estimated coefficients for the probability of gender-typical aspirations: NS-SEC of preference

Models	**0**	**4**	**4a**
Parental education (Ref: Degree)			
Upper secondary	0.050	0.025	0.026
	(0.039)	(0.036)	(0.036)
Lower secondary	0.091	0.008	0.008
	(0.049)	(0.048)	(0.048)
Other or no qualification	0.240***	0.167*	0.167*
	(0.068)	(0.065)	(0.065)
NS-SEC of preference (ref: High)			
Intermediate		0.121**	0.143*
		(0.038)	(0.056)
Low		0.426***	0.438***
		(0.044)	(0.061)
NS-SEC/gender interaction			
Intermediate/female			-0.047
			(0.075)
Low/female			-0.025
			(0.085)
Constant	-61.929**	-42.172*	-42.770*
	(21.592)	(21.267)	(21.202)
N (observations)	1434	1434	1434
N (individuals)	1152	1152	1152

Notes for Tables 5 to 8: All models control for gender, age and year of survey, coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Table 9: Linear probability model estimated coefficients for probability of aspiring to each category; NS-SEC class/gender-typicality

NS-SEC group/gender-typicality	High/GT	High/not GT	Intermediate/GT	Intermediate/not GT
Parental education (Ref: Degree)				
Upper secondary	-0.007	-0.057	-0.004	0.017
	(0.030)	(0.043)	(0.022)	(0.030)
Lower secondary	-0.044	-0.159***	0.024	0.012
	(0.033)	(0.048)	(0.031)	(0.034)
Other or no qualification	0.045	-0.241***	0.044	0.036
	(0.056)	(0.060)	(0.049)	(0.050)
Mother's occupation (Ref: female-dominated)				
Other occupation	-0.018	0.055	0.003	-0.022
	(0.026)	(0.036)	(0.019)	(0.026)
Outside of the labour force	0.013	0.040	-0.008	-0.063*
	(0.033)	(0.046)	(0.025)	(0.030)
Father's occupation (Ref: male-dominated)				
Other occupation	-0.047	0.002	0.029	0.041
	(0.025)	(0.036)	(0.020)	(0.026)
Outside of the labour force	-0.052	-0.053	0.052	0.011
	(0.034)	(0.047)	(0.033)	(0.032)
Parental gender attitudes				
Mother: traditional gender role attitudes	0.008	0.010	-0.012	-0.010
	(0.009)	(0.013)	(0.008)	(0.009)
Mother: support for non-traditional gender roles	0.000	0.008	-0.023*	-0.003
	(0.014)	(0.017)	(0.011)	(0.012)
Father: traditional gender role attitudes	0.002	-0.013	0.008	0.001
	(0.009)	(0.012)	(0.007)	(0.008)
Father: support for non-traditional gender roles	0.027*	-0.032	-0.014	0.020
	(0.013)	(0.017)	(0.011)	(0.012)
Gender attitudes				
Traditional gender roles	0.000	0.030*	-0.005	-0.011
	(0.009)	(0.014)	(0.008)	(0.010)
Support for non-traditional gender roles	-0.007	0.003	0.011	0.003
	(0.013)	(0.018)	(0.013)	(0.013)
Job values				
Job security	0.001	-0.014	-0.012	0.005
	(0.011)	(0.016)	(0.010)	(0.011)
A job that is interesting	0.015	0.009	-0.010	-0.015
	(0.013)	(0.019)	(0.012)	(0.015)
A job that helps others	0.024*	0.012	0.004	-0.021*
	(0.011)	(0.016)	(0.010)	(0.011)
Job pay	0.006	0.012	0.014	-0.014
	(0.012)	(0.016)	(0.010)	(0.012)
Constant	-26.472	77.798***	1.649	-10.349
	(17.794)	(22.928)	(13.960)	(15.581)
N (observations)	1434	1434	1434	1434
N (individuals)	1152	1152	1152	1152

Table 9 continued

NS-SEC group/gender-typicality	Low/GT	Low/not GT
Parental education (Ref: Degree)		
Upper secondary	0.050	0.001
	(0.027)	(0.013)
Lower secondary	0.080*	0.087**
	(0.034)	(0.033)
Other or no qualification	0.092	0.024
	(0.057)	(0.030)
Mother's occupation (Ref: female-dominated)		
Other occupation	0.005	-0.023
	(0.019)	(0.015)
Outside of the labour force	0.041	-0.023
	(0.033)	(0.022)
Father's occupation (Ref: male-dominated)		
Other occupation	-0.044*	0.019
	(0.021)	(0.014)
Outside of the labour force	0.029	0.013
	(0.035)	(0.020)
Parental gender attitudes		
Mother: traditional gender role attitudes	0.002	0.003
	(0.008)	(0.007)
Mother: support for non-traditional gender roles	0.011	0.007
	(0.010)	(0.006)
Father: traditional gender role attitudes	0.008	-0.006
	(0.008)	(0.007)
Father: support for non-traditional gender roles	-0.004	0.003
	(0.013)	(0.007)
Gender attitudes		
Traditional gender roles	-0.011	-0.003
	(0.009)	(0.005)
Support for non-traditional gender roles	-0.011	0.002
	(0.012)	(0.007)
Job values		
Job security	0.012	0.007
	(0.009)	(0.005)
A job that is interesting	0.003	-0.002
	(0.011)	(0.008)
A job that helps others	-0.008	-0.010
	(0.009)	(0.006)
Job pay	-0.017	-0.001
	(0.010)	(0.008)
Constant	-39.132***	-2.494
	(11.667)	(9.254)
N (observations)	1434	1434
N (individuals)	1152	1152

*Notes for Table 9: All models control for gender, age and year of survey, coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * p<0.05, ** p<0.01, *** p<0.001. Source: BHPS (2006-2008) and UKHLS (2010-2016).*

4.9 Limitations

First, these findings are limited by the power of the sample available. Variation by parental education in gender-typicality within the high occupational class could be explained *if* gender-typical occupations are also those lower down within this class, and gender-non-typical occupations are those higher up within the class. Ideally, this would be tested using a more disaggregated definition of occupational class, with variation within each occupational category by gender-typicality, i.e. no occupational category should have only gender-typical occupations. The current sample is too small to disaggregate whilst adhering to these criteria. Second, the measures for gender attitudes does not tap all dimensions, omitting gender essentialism and male primacy. Therefore, conclusions can only apply to the importance of normative beliefs about gender roles. Third, using the pooled OLS model with clusters means a causal relationship between the explanatory variables and gender-typicality cannot be established, the results can only be interpreted as associations. This is further limited by the reliance on mean individual attitude and values; it is not possible to ascertain whether gender attitudes led to occupational preference, whether these were endogenous, or if there was reverse causality. Further research is needed to consider change in individuals over time, to disentangle this. Lastly, the categories of male-dominated and female-dominated occupations are broad, to identify similarities between gender-dominated occupations. However, this means that variation in the factors predicting different types of gender-typical occupation cannot be ascertained.

4.10 Conclusions

This chapter extends the discussion on the association between parental education and gender-typical occupations by testing potential explanations for this relationship. It confirms previous findings that both girls and boys from the lowest parental education background are more likely to aspire to gender-typical occupations than those whose parents are degree-educated (Leuze & Helbig, 2015; Polavieja & Platt, 2014).

The novel contribution is to test how much of this is due to differences *between* socio-economic groups, due to differences in parental role-modelling (H1), gender attitudes (H2), job values (H3), or the occupational class aspired to (H4). I confirm that there are significant differences by parental education on all four factors, and they are associated with gender-typical preferences. In terms of mediation, the most significant explanatory factor is the inclusion of the occupational class aspired to, and this is the case for both genders—both female- *and* male-dominated aspirations are disproportionately located in intermediate and low occupational classes. Parental role-modelling and gender attitudes account for some of the association, especially in the father-son relationship, but these are less important than anticipated. Job values have no significant association. Even after accounting for whether an individual has a preference for a certain occupational classes ('high', 'intermediate' or 'low'), there are persistent differences in gender-typicality between young people from different parental education background; individuals from a lower parental education are more likely to aspire to gender-typical occupations, even *within* aspirations for the highest occupational class. This final point is counter to prior research (Polavieja & Platt, 2014), and to the expectations of H4c.

Why do these conclusions matter? Policy-makers and institutions interested in encouraging girls and boys to consider a wide set of occupations, including those which are gender a-

typical, should be aware that it is unlikely that the gap between parental education backgrounds will be closed solely by changing gender attitudes or job values. Instead, much of the difference between parental education backgrounds is structural, and works through occupational class aspired to, and parental influence. This is self-perpetuating if social mobility is limited—if gender-dominated occupations are primarily found in low or intermediate classes, then children from lower parental education backgrounds are more likely to have gender-typical parents and are more likely to aspire to gender-typical jobs themselves, either due to preferences for gender-typicality *or* for occupational class. Furthermore, preferences are only one part of explaining occupational outcomes, and gender-typicality will also persist when individuals from lower parental education backgrounds have unequal opportunities to access high occupations for other reasons, including educational inequality and discrimination. Further research on the interaction between occupational class preference and gender-typicality preference could disaggregate occupational classes in more detail to ascertain the relative importance of class and gender in the formation of occupational preferences and actual attainment. In this respect, it would be interesting to compare the UK case to other advanced industrial societies, with different rates of social mobility, or different distributions of gender-typical occupations (like the Scandinavian countries), to see if the results are consistent.

Chapter 5: The role of siblings in gender-typical occupational preference formation

5.1 Introduction

The influence of parental characteristics on the formation of young people's gender-typical occupational and educational preferences is well-documented (Dryler, 1998; Låftman, 2008; Polavieja & Platt, 2014). However, many of the theoretical explanations for why parents have an influence on their children are also relevant to other significant individuals with whom children share their home life, for instance, their siblings. Siblings can act as potential role models for either gender, contribute towards norms within the home, form part of an individual's social network, and change the nature of the parental relationship with other children.

In this chapter I test whether sibship compositional factors and specific sibling characteristics are associated with young people's occupational preference formation, focusing on preferences for male-dominated, female-dominated or STEM occupations. I focus on two main research questions; (a) does the number or gender ratio of siblings influence the gender-typicality of an occupational preference, (b) are gender-typical occupational preferences clustered within sibships? Here, the gender ratio of siblings is defined as the number of brothers as compared to the number of sisters, e.g. if an individual has more brothers than sisters, as compared to an equal number of sisters and brothers, or no siblings. I test these using a pooled cross-sectional dataset of Understanding Society and the British Household Panel Survey, observing the occupational preferences of young people between the ages of 11 and 21, from 2006 to 2016.

In the chapter that follows, I first set out the relevant theoretical explanations for sibling influence, as well as a brief review of the empirical evidence to date on sibling associations. Within this, I set out exploratory research questions around the association of sibling

characteristics and/or composition, with occupational preference associations. Next, I lay out the data and modelling strategy, before presenting the results. Finally, I present the main findings of the chapter and their limitations and discuss room for potential further research.

5.2 Theoretical explanations

I present three main theoretical explanations for why siblings may have an influence on whether an individual's occupational preference is gender-typical; socialisation (with a focus on gender-role theory), social network theories, and the dilution of parental resources and influence.

5.2.1 Social learning and gender-role-modelling

Social learning theory and cognitive development theory suggest that children learn about gender-appropriate behaviour by watching a variety of men, women, girls and boys, and learning which behaviours are typically performed by each gender (Rust et al., 2000). In particular, we know that parents act as role models and influence children via their gender-typical behaviour (inside and outside of the home) and their stated gender attitudes (Platt & Polavieja, 2016; Polavieja & Platt, 2014). Siblings, especially older siblings, also provide examples of either same-sex or opposite-sex behaviour, attitudes and preferences. By observing what siblings say and what siblings do (as per Platt and Polavieja's explanation of parental influence), individuals can learn to adopt behaviours and preferences typical for their own gender. This can also be influenced by differences in the way that parents treat or invest in male and female siblings, for instance encouraging or discouraging certain behaviours in line with gender stereotypes, e.g. if boys are discouraged from crying, or girls are encouraged to stay clean and tidy.

However, there are two contrasting directions in which sibling influence could operate. First, if children have a same-sex sibling, they may adopt more gender-typical preferences and

behaviours than if they had an opposite-sex sibling, via reinforcement of gender-typical behaviours through role-modelling (Brim, 1958). This can be especially true for older siblings; girls see how their older sister acts, boys see how their brothers act, and adopt these behaviours as gender-appropriate (Abramovitch, Corter, & Lando, 1979; Rust et al., 2000). Furthermore, siblings can reward or punish other siblings for adhering or deviating to gender norms (Brim, 1958), just as peers do—children are frequently observed remarking, "that's for girls", or "that's for boys" Alternatively, children could become more gender-typical if they have an *opposite*-sex sibling as opposed to a same-sex sibling, following the theory of social differentiation—differentiating by sex or gender provides legitimacy for boys' and girls' aspirations for, or men and women's involvement in, different occupations (Reskin & Bielby, 2005). Therefore, having an opposite-sex sibling may provide an increased awareness of their own gender status and how this contrasts with their sibling—as a girl, I do what my brother does not do, to prove my gender status.

Empirical evidence on sibling influences to date have shown a relationship between various aspects of sibling composition with educational attainment and the ambitiousness of aspirations (Bu, 2014; Choi et al., 2017; Kalmijn & Van De Werfhorst, 2016). Most evidence on the influence on gender-typical behaviour comes from the examination of two-sibling families—sibling dyad relationships—and the influence of older siblings on younger siblings. Rust et al (2000) find that pre-school children in the Avon Longitudinal Study (born between 1991 and 1993) with same-sex older siblings are more gender-typical in behaviours (they are too young to measure this in terms of occupational aspirations) than those without siblings, who are in turn more gender-typical than those with opposite-sex older siblings. Other studies disagree, either finding no variation in gender-typical behaviours between those with opposite-sex siblings and those with same-sex siblings, (Bu, 2014; Vroegh, 1971) or finding the reverse—for instance, that girls with brothers are more gender-typical than those with

sisters (Seegmiller, 1980). There may also be variation by gender—England (2010) argues that, in general, there is a greater propensity for girls to take on 'masculine' activities than for boys to take on 'feminine' behaviours. Rust et al (2000) partially support this, finding that 'masculine' behaviours are more persistent than 'feminine' behaviours; girls with older brothers were more likely to take on more masculine and less feminine behaviours, whilst boys with older sisters *did* take on feminine behaviours but did not reduce their masculine activities.

5.2.2 Siblings as significant others in a social network

Second, siblings may influence one another simply because they are close peers within a social network, acting as friends, companions and foils (McHale, Updegraff, & Whiteman, 2012), and thus may form a family-level cluster of similar occupational preferences. Christakis and Fowler (2008) propose three reasons for the clustering of individuals with similar attributes; homophily, people are close to others who are similar to them, shared environment; individuals who are closely related share external circumstances, or, behaviours, attitudes and norms may be contagious—an individual might change the social norms of a group which could change behaviours or norms of others in that group. A siblings' specific occupational preference—or the combination of several siblings' occupational preferences—might persuade their sibling to imitate or adopt the same preference via changing social norms within the family, regardless of their gender, just as individuals are more similar to others outside of the family to whom they are densely connected (Fowler & Christakis, 2008). This is a different mechanism to sibship composition because we are not observing the influence of the gender of the sibling on the ego's occupational preference, but the influence of a sibling's, or several siblings', specific occupational preference (s) on the ego's occupational preference.

Empirical evidence demonstrates that young people's aspirations are influenced by those close to them; gender differences in aspirations for science, technology, engineering and maths (STEM) careers are partially explained by accounting for peer group differences; boys are more likely to have friends who also aspire to STEM ,whereas girls are less likely to have STEM friends (Gabay-Egozi et al., 2014). Young people can receive direct encouragement and feedback about their aspirations from their siblings, just as they do from their peers (Levine & Hoffner, 2006). Untangling the homophily component from the network contagion component is a continual challenge for this literature—but in the case of siblings, individuals do not *choose* their association, therefore if shared environment can be controlled, then influence is easier to discern than for friends. Siblings *are* likely to be more similar to one another because of shared environment, as they share biological characteristics and a shared habitat (including parents, home life, school, neighbourhood and so on). However, siblings may also experience aspects of non-shared environment –both if parents treat different siblings differently (see section 5.2.3 following) *or* if siblings react differently to the same treatment (Dunn & Plomin, 1990).

5.2.3 Parental gender bias in investment

Third, sibship composition may influence preferences and behaviours due to the allocation of parental resources between siblings. Resource dilution theory argues that the more siblings in a household, the greater the dispersion of parental finances, time and investment in individual siblings—this means that the more siblings you have, the lower your educational attainment (Choi et al., 2017). However, gender composition also matters if parents are more likely to invest in boys rather than girls—Kalmijn and Van De Werfhorst (2016) provide evidence of a parental gender bias in educational investment towards sons, and show that, in inegalitarian countries, girls with brothers have worse educational outcomes. Conversely, Butcher and Case (1994) show that girls born in the US between 1920 and 1965, were more likely to

invest in higher education (a decision undertaken disproportionately by men at that time) if they had older brothers. This latter finding highlights that the influence of an older sibling may differ between girls and boys, again if it is more acceptable for girls to take on masculine behaviours than for boys to take on feminine behaviours (Paula England, 2010). Whilst it is less likely that parents would favour boys over girls in terms of educational investment in the UK, in the most recent cohort, it remains plausible that the strength of parental influence could be moderated by the number of other siblings in the family (whether same-sex or opposite sex).

Other sibling composition characteristics moderate sibling and parental influences on educational attainment and cognitive ability, for instance birth order and age spacing between siblings (Barclay, 2015a; Bu, 2014), whether siblings are biological, adopted or step-siblings (Barclay, 2015b), the closeness of siblings—geographical or emotional (Fowler & Christakis, 2008; McHale et al., 2012), or the capacity of parents to make compensatory investments for siblings who are academically weaker (Grätz, 2018). For now, it is not clear what the mechanisms would be for whether these influence the gender-typicality of preferences, so they are left for further study.

5.3 Research questions

I separate the proposed exploratory research questions into two components, first; sibling composition, considering only age, gender and number of siblings, and second; looking at the similarity of occupational preferences within a sibling cluster.

5.3.1 Sibling composition

Controlling for shared parental characteristics;

(1) Does the number of siblings influence your occupational preference (male-dominated, female-dominated or STEM aspirations)?

(2) Does the gender ratio of siblings influence your occupational preference? For instance, do more male sibships have more male-typical preferences, as compared to female-dominated or gender-neutral sibships?

(3) Does the influence of siblings vary for girls and boys?

5.3.2 Siblings as a social network

(1) Are siblings within the same family cluster more similar in the gender-typicality of their occupational preferences, as compared to respondents outside of the cluster, even after considering shared environment?

(2) Does sibship clustering vary between single-sex sibships and mixed sibships?

5.4 Data

To investigate sibling influence, I use a combined dataset using waves from two nationally representative UK household panel studies; Understanding Society (UKHLS) and its predecessor, the British Household Panel Survey (BHPS), covering the period 2006-2016, in what is effectively waves 16 to 23 of the combined survey.[25] I use both the youth panel, for respondents aged 11-15 (referred to as 'children' hereafter), and a module specifically for individuals aged 16-21[26] (referred to as 'young adults'). Hypotheses refer to both age groups together, as 'young people'.[27]

Sibling identification strategy

[25] BHPS comprises 18 waves, from 1991 to 2008. Only the 3 latest waves, 2006-2008, have occupational preferences coded consistently with UKHLS. The UKHLS follows on from BHPS, with the majority of BHPS participants added in 2010-2012. Thus wave 2 of UKHLS is effectively wave 19 of BHPS.
[26] In BHPS, some questions are asked to 16-22-year-olds. For consistency over 21s are excluded.
[27] I do not include job values in this Chapter, therefore the sample includes 11-21-year-olds.

The analysis in this chapter uses data from 2,636 observations of 1,158 individuals, nested within 822 families, identified by biological shared mother and biological shared father. Parental identifiers are longitudinal and unique—respondents are matched to only one mother and father throughout the survey, with siblings identified as clusters of individuals belonging to the same parents. This measure has several limitations—it does not tell us whether individuals currently live with their siblings, and it does not identify half- or step-siblings, adopted siblings or foster siblings. Alternative identification strategies include matching individuals who only share a biological mother, or father, or who share either a biological mother or a father. In the case of one shared parent, this identifies half-siblings, but also means that individuals can be part of multiple family clusters, which makes multilevel analysis more difficult. Lastly, we can use shared household identifiers. The household identifiers do cluster individuals uniquely within waves (individuals live only in one household for each wave), but they miss out siblings who do not live in the family home, and as soon as individuals move out of households as they get older, they are also missed. Most concerningly, UKHLS and BHPS identifiers for household change every wave, so the household measure does not have a longitudinal component, even when all the household members remain the same. Therefore, shared parent is the most parsimonious measure. Limitations of this measure for the generalisability of findings are discussed and additional analyses with alternative identification strategies are presented in the Appendix.

Occupational preferences

Children, aged 11-15, are asked, 'what job would you like to do once you leave school, finish your training or finish full-time education?' in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016[28] (waves 16, 17, 18, 20 and 22).

Young adults, aged 16-21, are asked the same question in 2006, 2007, 2008, 2011-2013, 2012-2014, 2013-2015, and 2014-2016 (waves 16, 17, 18, 20, 21, 22 and 23), if they are in full-time education or training (just over 60% of young people in these waves are eligible).

For all respondents, the question is open-ended with responses coded using the Standard Occupational Classification 2000 (SOC 2000). Responses are recoded to reflect the level of gender segregation in the aspired occupation, and its socio-economic group. As in other examples in the literature, I use an external source to create an index for the level of segregation in each occupation (Busch-Heizmann, 2015; Polavieja & Platt, 2014). Following the Office for National Statistics analysis of Employment by Occupation, I pool the April–June quarter of the UK Labour Force Survey (LFS), for each year of the combined dataset. This gives the proportion of men and women in each 3-digit SOC 2000 occupational category, from a combined sample of 498,423 working adults, over 81 SOC 2000 3-digit occupations. I calculate the average percentage of women in each 3-digit occupation over this time period and assign this as a score to each respondent's occupational preference.

Using the LFS survey data, occupations are coded as female-dominated if >=70% of adults in the occupation are female, and male-dominated if >=70% of adults in the occupation are male.[29] According to these criteria, in the adult labour market between 2006-2015, 27% of individuals worked in jobs that were male-dominated jobs, 28% were in female-dominated

[28] Data collection for each wave in UKHLS is over a period of two years, because the survey is so much larger than BHPS. However, within this, individuals are always interviewed at the same time every year. See survey timeline on https://www.understandingsociety.ac.uk/documentation/mainstage/survey-timeline

[29] The boundaries of 30%/70% are used to be consistent with other papers in the literature. For robustness, models were also estimated using a continuous variable for the proportion of individuals in an occupation who are the same gender. Results remain consistent.

jobs and 45% in gender-neutral jobs. I then create binary variables for ‘male-dominated’, or ‘female-dominated’ aspirations, to separate out between male-typed or female-typed preferences.

Secondly, I also create a binary variable for whether an aspiration is a Science, Technology, Engineering and Maths (STEM) occupational preference. This is one example of a male-dominated sector and is included to give a specific case study of within-family similarity in occupational aspirations. I code occupations as STEM if they require a significant proportion of scientific or mathematical knowledge, regardless of whether this is at degree-level, as defined by Anna Bagnoli’s (2014) ‘strict’ Science, Engineering and Technology definition. A full list of occupations included is in the Appendix for Chapter 3.

Gender liberalism

Two questions on gender attitudes are asked to children, young adults and their parents throughout the period. These follow a Likert scale response of how strongly a respondent agrees with the following statements;

1) (Do you personally agree or disagree...) All in all, family life suffers when the woman has a full-time job
2) (Do you personally agree or disagree...) A husband's job is to earn money, a wife's job is to look after the home and family

This is asked of children in 2008 (wave 18) and of young adults in 2007, 2010-2012 and 2012-2014 (waves 17, 19, 21).. These are recoded so that 1; the least liberal response, and 5; the most liberal response. I use principal component analysis to create a joint gender attitude score for the two questions. Cronbach’s Alpha for the two questions is 0.685, and the Spearman-Brown reliability coefficient is 0.686. I calculate a mean gender liberalism score (standardised) for each individual. Gender attitudes are stable within individuals between

waves, as shown in the Appendix. Unfortunately, this operationalisation of gender attitudes does not distinguish between different dimensions of gender egalitarianism, as suggested by Knight and Brinton (2017).

Socio-demographic characteristics

Gender and age are available in all waves. Parental education background is measured by mother's characteristics, from her own survey responses. This includes:

Dummy variables for:

(i) *mother's education*, degree-level education: 1, or below degree-level education: 0

(ii) *mother's job status,* 1: if mother is working, and 0: otherwise

(iii) *mother in a female-dominated occupation:* 1, 0: otherwise (including not working). The proportion of women in the occupation is measured using the same index as described for young people.

(iv) *mother in a male-dominated occupation:* analogous to female-dominated occupation calculation.

(v) *mother is working in a professional/managerial occupation*: 1, and 0 otherwise.

(vi) *mother is working in a STEM occupation*: 1, and 0 otherwise.

Continuous variable for:

(vii) *mother's gender attitudes*: standardised with mean 0 and variance 1. This is created using the first component from a principal component analysis of two gender attitude questions, with responses measured on a Likert scale: (1) A family suffers if the woman works full-time, and (2) The husband should earn, the wife should stay at home. Responses are coded such that they are increasing in liberalism.

Father characteristics are included using the same methods. Parental characteristics (other than gender attitudes which are measured as within-individual means) are measured concurrently with the observation of the occupational preference where possible. If missing, then the observation from the previous year is used. The sample of individuals who have observations complete on all these variables is 2,540 observations of 1,131 individuals.

5.5 Analytical strategy

For part 1, I consider the probability of aspiring to a certain type of occupation—male-dominated, female-dominated or STEM—and the association with number of siblings, sibship gender ratio, and interactions with gender.

I estimate associations between sibling composition variables and occupational preferences using linear probability models. Standard errors are robust and clustered at the individual level, to account for serial correlation between repeated observations of the same individual.

For part 2, I extend the siblings analysis to consider clustering within families, using a hierarchical, nested structure. I use a two-level structure for the data, with individuals as level 1 (*i*), nested within families at level 2—as measured by shared parents (*j)*. I use an alternative specification for the dependent variable, of an individual's occupational preference. This is measured at the individual level, as a continuous variable using the average proportion over time that an individual gives a positive response, e.g. the proportion of times they are observed answering 1: if a male-dominated occupational aspiration, 0 otherwise. Covariates are also recoded as proportions, if binary, or averages by individual, if continuous. This compresses the individual-level data to one level; instead of observing repeated waves/occasions as level 1, nested within individuals at level 2. These variables are bounded between 0 and 1. This generates a subsample, with only one observation per individual. On average, there are 2.3 observations per individual, with minimum 1 observation per

individual and maximum 7 observations per individual. This strategy also has limitations – for instance, if an individual is observed only once, then their proportion of times observed answering gender-typical will either be 0% or 100% of times, which is not directly comparable to an individual observed multiple times, who has more opportunity to change their mind.

Using a two-level model is more appropriate than a three-level model because in the three-level model, the dependent variable is a binary response. If instead I were to use repeated waves/occasions as level 1, individuals as level 2, and families as level 3, then this overestimates the proportion of variance attributable to the individual (within-individual, between-wave) at level 2, because the repeated observations over waves are not random, as they are of the same individuals, hence individuals' responses are highly correlated with their previous responses. This is a generic problem with binary response models like logit and probit, because the latent variable on which they are predicted is not observed, so normalisation at the 'bottom level' is imposed; e.g. in the probit model, variance is set to unity. It then becomes arbitrary to speak of the proportion of variance attributable to the higher levels. Because I am primarily interested in the between- and within-family level variance, and the proportion of total variance explained at family-level, the two-level model is more easily interpretable, as this provides simple between- and within-family variances, and the proportion at the family level.

With two levels, the overall variance can be defined by computing deviations from the overall mean across the whole dataset. Then, the proportion of variance accounted for at each level can be estimated. This is formalised as follows, where the overall mean, $\bar{x}$, is calculated across families and individuals, O=overall, B=between and W=within variance;

$$\bar{x} = \frac{1}{N}\sum_{j=1}^{J}\sum_{i=1}^{n_j} x_{ij}$$

$$s_{xO}^2 = \frac{1}{N-1}\sum_{j=1}^{J}\sum_{i=1}^{n_j}(x_{ij} - \bar{x}..)^2$$

The between-family variance is:

$$\bar{x}_{\cdot j} = \frac{1}{n_j}\sum_{i=1}^{n_j} x_{ij}$$

$$s_{xB}^2 = \frac{1}{J-1}\sum_{j=1}^{J}(x_{\cdot j} - \bar{x}..)^2 \quad \textbf{(1)}$$

The within-family variance is:

$$s_{xW}^2 = \frac{1}{N-1}\sum_{j=1}^{J}\sum_{i=1}^{n_j}(x_{ij} - \bar{x}_{\cdot j})^2 \textbf{ (2)}$$

$$s_{xO}^2 = s_{xB}^2 + s_{xW}^2$$

I first estimate the empty two-level variance components model, with no covariates;

$$y_{ij} = \beta + \zeta_j + \xi_{ij}$$

Where ζ_j is the family-specific component , and ξ_{ij} is the individual-specific component. I discuss the intraclass correlation coefficients from this model, which gives the ratio of variance of the family-specific component divided by the total variance;

$$\rho = s_{xB}^2/(s_{xB}^2 + s_{xW}^2)$$

Therefore, this shows how much of the total variance is shared by siblings. I then extend the random intercept model to include sibship composition variables and relevant covariates at the family and individual-level, to assess their relative importance.

5.6 Descriptive statistics

Table 1 provides the descriptive statistics for the sample with complete information, with the standard deviation decomposed into between- and within-family variance, for children aged 11 to 21. The average number of siblings is 1 or less—i.e. most families have one or two children. Individuals are equally likely to have a brother or a sister. The decompositions demonstrate that there is considerable variation both between- and within-families in terms of the type of occupational preference young people hold.

Table 2 shows that, as compared to statistics from the Office for National Statistics (ONS), the families in this sample are larger than the UK family average—of all families with at least one child, the ONS estimates 46% have no siblings, whereas in our sample, only 32% have no siblings. This is likely due to the age of the children picked up by ONS– the ONS measure only includes dependent children, as those living with their parent(s) and either (a) aged under 16, or (b) aged 16 to 18 in full-time education, excluding children aged 16 to 18 who have a spouse, partner or child living in the household. UKHLS or BHPS includes all children within the survey, regardless of their age. For this analysis, I am interested in all biological siblings identified. Alternatively, there could be oversampling of certain groups in UKHLS and BHPS, who may in turn be likely to have larger families, or due to the greater likelihood of larger families remaining in the survey over time. Weights are used in the analyses that follow to correct for unequal selection probability and non-response bias, as recommended by the UKHLS and BHPS User Guides.

Table 1: Descriptive statistics

Variable	Mean	SD	SD (Between)	SD (Within)	N
Individual-level attributes					
Age	15.36	2.67	2.19	1.91	2,636
Gender	0.53	0.50	0.46	0.26	2,636
Male-dominated occupational preference	0.25	0.43	0.36	0.29	2,636
Female-dominated occupational preference	0.16	0.37	0.31	0.26	2,636
STEM occupational preference	0.18	0.39	0.32	0.27	2,636
Gender-typical occupational preference	0.35	0.48	0.40	0.33	2,636
Individual gender attitudes	0.41	0.93	0.88	0.45	2,636
Sibling composition					
Number of siblings	0.96	0.88	-	-	2,636
Number of brothers	0.43	0.62	-	-	2,636
Number of sisters	0.42	0.65	-	-	2,636
Parental characteristics					
Mother has degree	0.48	0.50	-	-	2,636
Father has degree	0.50	0.50	-	-	2,636
Mother not working	0.23	0.42	-	-	2,636
Father not working	0.11	0.31	-	-	2,636
Mother in professional job	0.29	0.46	-	-	2,636
Father in professional job	0.39	0.49	-	-	2,636
Mother in STEM occupation	0.01	0.12	-	-	2,636
Father in STEM occupation	0.24	0.43	-	-	2,636
Mother's gender attitudes	0.14	0.91	-	-	2,636
Father's gender attitudes	0.13	0.89	-	-	2,636

Notes: Descriptive statistics from estimation sample, standard deviations show between and within family decomposition of variance. Parental characteristics are binary comparisons and show proportions. Source: Pooled UKHLS and BHPS, 2006 to 2014-2016

Table 2: Comparison to Office for National Statistics

Comparison	ONS average 2006-2015	Sample
No siblings	46%	32%
One sibling	39%	47%
Two or more siblings	15%	21%

Source: Pooled UKHLS and BHPS, 2006 to 2014-2016, observations with complete data. Office for National Statistics average 2006 to 2015, Families and Households (Office for National Statistics, 2017)

5.7 Results: Associations between sibship composition and occupational preferences

Table 3 shows the estimated coefficients for the associations between sibling composition variables and the probability of aspiring to either male-dominated, female-dominated or STEM occupations. Each of the occupational preferences categories is estimated separately, as a binary response variable, i.e. a male-dominated occupation versus all other occupations. All models control for mother and father's educational and occupational characteristics, as well as parental and individual gender attitudes. Model 1 includes number of siblings, Model 2 include number of siblings and their gender composition, and Model 3 includes interactions between sibling count and sibling gender composition with gender, where female = 1 and male = 0.

5.7.1 Number of siblings

As is known from previous estimations, girls are significantly less likely to aspire to male-dominated or STEM occupations than boys, and more likely to aspire to female-dominated occupations. In terms of number of siblings, considering boys and girls together in model 1, there is no substantive association between male-dominated aspirations and having more than zero siblings—the coefficients are close to zero. However, having two or more siblings is negatively associated with both female-dominated aspirations and STEM aspirations, and this is significant for the former. Individuals with two or more siblings are 6.1 percentage points less likely to aspire to female-dominated occupations as compared to those with no siblings. The coefficients remain similar in size once accounting for the gender ratio of the siblings in model 2, albeit no longer significant.

Including interactions in model 3 to distinguish between boys and girls, respondents who have at least one sibling are 17.72 percentage points more likely aspire to a male-dominated job than those who have no siblings. This is only significant for boys—there is a significant

difference between boys who are only children and girls who are only children—girls who have siblings are less likely to aspire to male-dominated occupations as compared to girls who are only children.

For female-dominated occupations, the coefficients on the gender interaction with number of siblings are far smaller. Girls are marginally more likely to aspire to female-dominated occupations if they have siblings, as compared to no siblings, as compared to boys with siblings. For STEM aspirations, there is again a significant gender difference between girls who are only children versus girls with siblings, as compared to boys who are only children versus boys with siblings—girls with one sibling are significantly less likely to aspire to STEM than girls who are only children, whereas boys with one sibling are more likely to aspire to STEM than boys who are only children. This could reflect how unusual it is for girls to aspire to STEM—potentially girls who are only children have greater parental investment and more resources to deviate from gender norms. On balance therefore, having more siblings is positively associated with gender-typical aspirations—boys are more likely to aspire to STEM or male-dominated jobs with more siblings, and girls are less likely to aspire to either of these with more siblings. This is after controlling for parental educational and occupational characteristics—so individuals with the same parental education background, but with fewer siblings, are less gender-typical.

5.7.2 Sibling gender ratio

For the sibling gender ratio, in model 2, there are no significant associations between siblings' gender ratio and their aspirations, nor does there appear to be any pattern in having more sisters or having more brothers, versus having no siblings or a gender-equal sibship. I also estimate this model using four categories to separate out no siblings from a gender-equal sibship, and the results are consistent, as shown in the Appendix. Including interactions by

gender in model 3 also does not support the hypothesis that the gender of your siblings affects your occupational preference. Instead, having a gender-dominated sibship of *either* only brothers or only sisters is positively associated with girls' aspirations for male-dominated occupations and negatively associated with female-dominated occupations, with the opposite finding for boys. This finding does not seem to fit with the theoretical explanations so far—the only consistent finding is that girls with no siblings are different to girls with siblings, and are more likely to choose either male-dominated or STEM occupations. Boys with more siblings are more likely to aspire to male-dominated occupations.

Table 3: Linear probability model estimated coefficients for the probability of aspiring to three occupational groups

	Male-dominated			Female-dominated		
	1	2	3	1	2	3
Female	-0.331***	-0.332***	-0.275***	0.206***	0.205***	0.208***
	(0.027)	(0.027)	(0.044)	(0.023)	(0.023)	(0.036)
Sibling composition variables:						
Sibling count, ref: no siblings						
One sibling	0.028	0.060	0.177*	-0.020	0.003	-0.032
	(0.027)	(0.042)	(0.074)	(0.022)	(0.036)	(0.037)
Two siblings or more	0.005	0.024	0.135	-0.061*	-0.048	-0.059
	(0.036)	(0.038)	(0.074)	(0.028)	(0.035)	(0.033)
Sibling gender ratio, ref: equal sibship/no siblings						
Only brothers		-0.045	-0.128		-0.028	0.003
		(0.040)	(0.074)		(0.033)	(0.034)
Only sisters		-0.022	-0.110		-0.022	0.022
		(0.041)	(0.074)		(0.034)	(0.034)
Gender/sibling composition interactions						
Sibling count, ref: male/no siblings						
Female x one sibling			-0.219**			0.071
			(0.081)			(0.066)
Female x two siblings or more			-0.197*			0.019
			(0.078)			(0.061)
Sibling gender ratio, ref: male x equal sibship/no siblings						
Female x only brothers			0.155*			-0.065
			(0.078)			(0.064)
Female x only sisters			0.162*			-0.087
			(0.083)			(0.063)
Constant	-8.927	-7.181	-6.597	12.277	13.496	13.463
	(11.228)	(11.111)	(11.021)	(10.392)	(10.526)	(10.559)
N (observations)	2540	2540	2540	2540	2540	2540
N (individuals)	1131	1131	1131	1131	1131	1131

Notes: All models control for gender, age, year of survey, mother and father occupational characteristics, education and gender attitudes of parents and individual. Coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < .05$, ** $p < 0.01$, *** $p < 0.001$. *Source: Pooled UKHLS and BHPS, 2006 to 2014-2016*

Table 3 continued: Linear probability model estimated coefficients for the probability of aspiring to three occupational groups

	STEM		
	1	2	3
Female	-0.219***	-0.219***	-0.166***
	(0.025)	(0.025)	(0.039)
Sibling composition variables:			
Sibling count, ref: no siblings			
One sibling	0.006	-0.005	0.094
	(0.025)	(0.037)	(0.068)
Two siblings or more	-0.046	-0.052	-0.014
	(0.028)	(0.030)	(0.061)
Sibling gender ratio, ref: equal sibship/no siblings			
Only brothers		0.003	-0.050
		(0.034)	(0.063)
Only sisters		0.020	-0.027
		(0.035)	(0.066)
Gender/sibling composition interactions			
Sibling count, ref: male/no siblings			
Female x one sibling			-0.200**
			(0.074)
Female x two siblings or more			-0.069
			(0.066)
Sibling gender ratio, ref: male x equal sibship/no siblings			
Female x only brothers			0.112
			(0.067)
Female x only sisters			0.100
			(0.072)
Constant	-20.501	-20.881*	-20.910*
	(10.548)	(10.600)	(10.524)
N (observations)	2540	2540	2540
N (individuals)	1131	1131	1131

Notes: All models control for gender, age, year of survey, mother and father occupational characteristics, education and gender attitudes of parents and individual. Coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: Pooled UKHLS and BHPS, 2006 to 2014-2016*

5.8 Results: Multi-level models

Next, I estimate the similarity between the actual occupational aspirations of siblings nested within families, using the multi-level model formulation. This tests whether aspirations are more similar between siblings with a shared mother and father, than they are between individuals who do not share parents—a different but related question to that tested by the association models.

5.8.1 Decomposition of variance at the family-level

The propensity to aspire to a male-dominated occupation, a female-dominated occupation or a STEM occupation does not significantly vary by family, when comparing all sibling cluster types. I estimated empty variance components models to test whether estimating a two-level model and partitioning variance between individual-level and family-level components makes a statistically significant improvement to model fit. The model is restricted to observations which are complete on gender, occupational aspirations, mother's education, mother's employment status, mother's occupational category and mother's gender attitudes, and the same variables for father. I then estimate the analysis separately for same-sex sibling clusters and mixed-sex sibling clusters (i.e. if an individual is a girl, who only has sisters, versus a girl with brothers or a girl with brothers and sisters, etc).

The results of the empty model are shown in **Table 4**. This gives an estimate of the intraclass correlation coefficient ρ; the proportion of the total overall variance that is accounted for by between-family variance. In the empty model for all siblings, 5% of the variance in aspirations for male-dominated occupations is explained by between-family variance, but none of the variance in aspirations for female-dominated or STEM aspirations is between families. However, the likelihood ratio test for the square root of the variance at family-level, which compares the two-level model to the single-level model, cannot reject the null

hypothesis for any of the occupational aspirations; adding in the family-level does not make a significant difference to the proportion of variance explained, and the single-level model performs just as well. However, separating the analysis between same-sex sibships and mixed-sex sibships shows that siblings' aspirations for male-dominated occupations are highly correlated within single-sex sibships, but not within mixed-sex sibships; 35.7% of the variance in male-dominated aspirations is explained by between-family variance.

Table 4: Sibling correlations in occupational aspirations, from empty variance component models; all sibships, same-sex sibships and mixed sibships

Empty models	All sibships	Same-sex sibling clusters	Mixed-sex sibling clusters
Male-dominated	0.047	0.357**	0.000
	(0.051)	(0.084)	0.000
Female-dominated	0.000	0.136	0.000
	(0.000)	(0.098)	0.000
STEM	0.008	0.158	0.000
	(0.051)	(0.110)	0.000

Notes: The table reports intraclass correlation coefficients for empty variance component models estimated using the maximum likelihood estimation. Standard errors are in parentheses.

N (individuals): 1,202, N (families) 849, of which 225 are single-sex clusters. Observations per family: minimum:1, average: 1.4, maximum: 5.

*Stars indicate whether the likelihood ratio test is significant for the comparison between the two-level model and the single-level model, * p<0.05, ** p<0.01 ***p<0.001. Source: Pooled UKHLS and BHPS, 2006 to 2014-2016*

5.8.2 Random-intercept models with covariates

Next, I test the relative importance of level-1 and level-2 covariates and how much, if any, of the family-level proportion of variance remains. I estimate three random intercept models, for the dependent variable male-dominated occupational aspirations, for single-sex sibships. This was the only model in Table 4 where the two-level structure explained a significant proportion of the variance.

Model 1 includes only individual-level variables, specifically gender and gender attitudes. Model 2 includes family-level variables; number of siblings, parental occupation, education and gender attitude variables.

Results are shown in **Table 5.** The total variance from the models is the below, calculated as the estimate of between variance plus the estimate of within variance:

Null model: $0.236^2 + 0.316^2 = 0.156$

Model 1: $0.131^2 + 0.317^2 = 0.118$

Model 2: $0.000^2 + 0.331^2 = 0.110$

It follows that the change in the proportion of variance explained from the null model to Model 1, is $R^2 = (0.156 – 0.118)/0.156 = 0.244$, and the change from the null to Model 2 is $R^2 = (0.156 – 0.110)/0.156 = 0.295$

This estimates therefore that 29.5% of the variance between families is explained by the individual-level and mother-level covariates included in Model 2—in fact, in the restricted sample used throughout, there is no variation between families in aspirations, after these controls are included. Almost all the change in variance explained is due to the inclusion of the individual-level covariates for gender and gender attitudes.

Table 5: Siblings correlations in aspirations for male-dominated occupations; single-sex sibships only

	Null	Model 1	Model 2
Between-variance	0.236	0.131	0.000
	(0.032)	(0.044)	(.)
Within- variance	0.317	0.317	0.331
	(0.021)	(0.020)	(0.013)
ICC	0.357**	0.146	0.000
	0.084	0.095	0.000

Notes: Models show estimates for between and within-variance components, and the intraclass correlation for models estimating the proportion of aspirations for male-dominated occupations, for single-sex sibships only.
N (individuals): 331, N (families of single-sex clusters): 225.

Models add variables cumulatively; null model is empty variance components model, Model 1 controls for individual-level variables; gender and gender attitudes, Model 2 adds controls for number of siblings, mother and father education, occupation and gender attitudes. Coefficients not shown. Standard errors are shown in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: Pooled UKHLS and BHPS, 2006 to 2014-2016*

5.9 Robustness checks

I tested the robustness of the findings by estimating models using different contrasts of sibling gender composition, for instance, comparing no siblings to mixed clusters, female-dominated clusters and male-dominated clusters, shown in the Appendix. Second, I restricted the analysis to individuals who only had one sibling, to check if siblings were more likely to have a direct influence on one another if there were fewer in the family. I estimated pairwise comparisons between sibling dyads, to test whether it was the case that only older siblings influenced younger siblings, results available on request. Results for both analyses were consistent with those presented here—the gender of the sibling has no significant association with an individual's occupational preference, and sibling preferences are not correlated. Third, I performed the same models using an alternative sibling identification strategy, including individuals who shared a mother but did not necessarily share a father, to include maternal half-siblings. No significant differences in findings were apparent.

5.10 Discussion and limitations

The aim of this chapter was to investigate two potential avenues of sibling influence on occupational preferences. First, whether the number of siblings or the ratio of brothers to sisters influenced an individual's occupational preferences, and second, whether individuals' preferences were correlated with their siblings' preference, apart from any similarity due to shared environment. Counter to some theoretical expectations, the empirical analysis showed that the gender composition of an individual's sibship is not significantly associated with the gender-typicality of occupational preferences. This is consistent with other papers which find a null association with sibship gender composition effects with other outcomes, for instance on educational attainment (Bu, 2014; Vroegh, 1971).

Instead, the primary contrast was between individuals who have any siblings at all and individuals who do not. Both boys and girls who have at least one sibling are more likely to aspire to gender-typical occupations, and, especially for girls, less likely to aspire to STEM careers, as compared to only children. This was despite controlling for an individual's gender attitudes, parental education, occupation and gender attitudes. Further research could explore the mechanisms behind this to ascertain exactly what occupations only children aspire to, and how their occupational preference formation process differs. It would also be useful to include educational attainment and educational aspirations, to assess whether this difference is due to higher ambition and higher parental investment for only children.

The main take-away from the multi-level analysis was that siblings are also not that similar in terms of their occupational preferences, either measured using aspirations for male-dominated, female-dominated or STEM categories. The exception to this is that individuals located in single-sex sibling clusters are more similar in terms of aspirations for male-dominated occupations than to others outside of their family. However, even this similarity

disappears once gender and shared parental characteristics are accounted for—it is likely therefore that individuals are similar to their same-sex siblings primarily because of their shared gender, rather than because of their sibship. This is counter to expectations based on influence through networks, and the clustering of traits found among friends, siblings and spouses (Fowler & Christakis, 2008). Studying siblings is a useful test of this network theory, because whilst siblings act like friends in many respects, individuals cannot choose who they are related to. Of course, not all siblings will be equally close, either geographically or emotionally, and therefore this analysis could be extended by looking at the quality of sibling relationships.

These findings have several limitations. First, the sample size of individuals and families is small, especially when restricted to single-sex sibling clusters. However, non-significant relationships are discussed throughout, and the pattern of the coefficients does not suggest that increasing the sample size would change the direction of the relationship. Of course, replication analysis with a larger sample would add credibility to these results. Second, whilst the advantage of the sibling identification strategy used here is that the sample is intuitive and easily interpretable, the disadvantage is that there are numerous ways that family could differ, by including step-siblings, half-siblings, adopted siblings and foster siblings, and these individuals may also influence occupational preferences. Nevertheless, these complex sibling relationships are likely to be a small proportion of all sibling relationships. Of more pertinence is that the methods here do not match siblings to those that they currently live with. It is plausible that siblings are more closely influenced by siblings they live with the longest, because they have more opportunity to observe their preferences and behaviour, and conversely, to be rewarded or punished for gender-appropriate behaviour. Relatedly, influence of siblings could be restricted to specific sibling relationships and this is left for further research, as this method can only look at the aggregate association within sibling

clusters. For instance, sibling birth order and age gap matter – older siblings may be more likely to younger siblings, within a wider family unit, or siblings who are closer in age may be more similar (or conversely, more dissimilar, if siblings with a greater age gap are more likely to play a parenting role, and therefore have more influence). Third, it is possible that some siblings influence one another to become more similar, through social learning, and that others influence one another through social differentiation—put simply, some siblings may want to mimic, others may want to be totally different to their siblings. Again, this type of analysis only picks up the average effect, so these two types of relationship could cancel each other out. Lastly, further research could look into the aspects of non-shared environment between siblings and how this could influence sibling differences or similarities. If there are mother-daughter or father-son dyads, it may be that siblings are both influenced by parents, and by how parents treat their siblings.

Even so, the results of this study have significance for research on gender differences in occupational preferences, as they emphasise that parental education and occupational characteristics, and individual-level attributes, are more important than any proposed sibling influence. In some ways, this is a positive conclusion because it is more obvious what factors need to change in order to encourage young people to consider gender-atypical or gender-neutral aspirations: as shown in Chapter 3, individual-level job values are associated with certain aspirations (e.g. highly valuing 'a job that helps others' is negatively associated with aspirations for STEM), gender-typical preferences intersect with preferences for jobs in certain occupational classes, and both boys and girls are influenced by parental gender-typical examples. Therefore, policy-makers can focus on understanding individual perceptions of gender-typical occupations, whether these match to an individual's own job values, as well as challenging whether these perceptions are accurate reflections of what an occupation is actually like (see, for instance, misperceptions of STEM as discussed in

Chapter 3). Secondly, any interventions to improve gender diversity in preferences should also consider differences in aspirations by parental education and the array of factors contributing to why young people from different backgrounds may rule out certain occupations, or groups of occupations, as not suitable or feasible for them. Lastly, given that parental example plays such a big role in influencing preferences, interventions should go beyond studying children and young people, and also focus on integrating the adult labour market, through changes to institutional arrangements such as parental leave, increasing adoption of family-friendly employment policies across the labour market, and challenging societal norms around the division of labour. I expand on potential implications and interventions in the concluding chapter.

Chapter 6: Conclusion

This thesis aimed to contribute to an understanding of gender differences in occupational preferences and job values among young people in the UK. Studying young people's preferences is important because these are one of the key determinants of educational and occupational choices and adult outcomes. In order to understand the persistent occupational gender segregation in the adult labour market, it is first necessary to understand gender segregation in the type of work that young people aspire to and value. Indeed, the attributes of a job that young people think are important are understudied in the UK, with most studies focusing on specific occupational preferences rather than job attributes in and of themselves.

The goal of the thesis was twofold, first to provide an up-to-date description of gender differences among young people's occupational preferences and job values, and second, to investigate how these are related to one another, to mother, father, sibling or an individual's own characteristics, or structural characteristics of the labour market. Research on young people's occupational preferences is extensive, but there are some common assumptions made throughout the literature without supporting empirical evidence. This thesis aimed to test some of these unresearched assumptions and contribute to an empirically grounded discussion about gender differences in young people's career-planning.

In this chapter, I first restate the main findings and limitations of each chapter. Next, I discuss their implications for relevant parties, for instance, academics, policy-makers and educational institutions. Finally, I discuss outstanding questions and subsequent recommendations for future research into occupational preferences and job values.

6.1 Summary of main findings and contributions

Overall, I confirm that gender-typical occupational preferences are common among 14-21-year-olds in the UK and are more frequent among boys than girls; 28% of all girls and 40% of all boys aspire to a gender-typical occupation (Chapter 4). Girls are also more likely to aspire to gender-atypical (male-dominated) occupations, as compared to boys' aspirations for gender-atypical (female-dominated) occupations (Chapters 4 and 5). In some sectors, segregation is higher than in others—for instance, only 4% of girls aspire to STEM as compared to 14% of boys (Chapter 2), and gender-segregated occupations make up a greater proportion of occupations in intermediate and low occupational classes, as compared to in the high occupational classes (Chapter 4).

Chapter 2 ('A description of job values among UK youth and a cross-national comparison') aimed to provide a description of differences in job values among 14-21-year-olds in the UK, by gender and parental education background. There was a significant gap in the literature on young people in the UK, with previous research focusing on (i) young people in other countries, (ii) older age groups in the UK, or (iii) change over time in highly aggregated groups of job values. Despite this, it was frequently assumed that gender differences *would* exist and could explain gender differences in other outcomes, such as preferences or adult occupational outcomes, as hypothesised by Hakim and others who uphold a basic gender differences explanation. Research on adult job values also implied that job values could differ within young people, by parental education background, due to anticipatory socialisation—literature on differences in aspirations often makes reference to 'cultural' differences between classes in the meaning of work (MacLeod, 2004; Reay, 1995; Willis, 1980).

This chapter demonstrated that there were significant gender differences on all job values for the older age group (16-21-year-olds) and on altruistic job values and job pay for the younger age group (14-15-year-olds). The most substantial gender differences were on the altruistic

job values ('a job that helps others', 'a job that contributes to society'), with girls' valuing these more highly than boys, with far smaller differences on other job values. This is interesting because it does provide support for preference theory insofar as there are consistent and observable trends. However, it counters the assumption that any differences in occupational preferences are due to boys' preferences for job pay, and girls' preferences for time for family (Hakim, 2000). This analysis shows that gender differences on these two job values are marginal.

The chapter also demonstrated significant differences in job values by parental education background. Individuals of both genders from low parental education backgrounds are more likely to highly value extrinsic aspects of a job ('job pay', 'job security') and are less likely to value intrinsic aspects of a job ('a job that is interesting'), than their high parental education background peers. In comparison to survey data from 23 EU member countries, which matches three of the job values asked in UKHLS and BHPS ('time for family', 'job security' and 'job pay') gender differences in the UK are greater than average, whereas differences by parental education background were smaller than average. If related to occupational preferences, this could explain why the UK also has higher than average gender segregation in some STEM fields (Perkins, 2014).

This descriptive analysis is limited by the data available—other attributes of a job are important and frequently referenced in the literature on gender differences. Most pertinently, the questions asked in BHPS, UKHLS and ESS do not adequately capture the oft-cited gender difference in valuing 'people' versus 'things'. Job attributes relating to 'people' include social aspects, such as the friendliness of colleagues or employers, or the extent to which employees socialise outside of work, as well as the altruistic aspects covered in the data used in the thesis. Attributes relating to 'things' include impersonal tasks, such as dealing with machines, materials and tools. This distinction is a potential cause for gender

differences in STEM aspirations (Geary & Stoet, 2018b), given perceptions of STEM occupations (Department for Business Innovation and Skills, 2014; Faulkner, 2007), and unfortunately this chapter cannot ascertain the size or significance of gender differences on the social aspect of the 'people' dimension, or any aspect of 'things'. Secondly, the data only provides a description of gender differences between the age of 14 and 21. It is plausible that an individual's job values change with age, and previous literature has demonstrated that this does occur (Jin & Rounds, 2012). Boys and girls may change differently, therefore it is not possible to extrapolate from this chapter to gender differences among adults.

Chapter 3 ('Gender differences in job values and aspirations for Science, Technology, Engineering and Maths occupations') was a logical extension of Chapter 2. It focused on the 'consequences' of gender differences in job values and asked four questions; (a) if specific job values were associated with STEM aspirations, (b) if gender differences in job value rating explained gender differences in STEM aspirations, (c) if some job values were more important than others, and (d) whether job values had a different importance for girls and boys. I also explored the conventional definition of STEM occupations and disaggregated this into six fields; Business and Finance; Science and Engineering; Healthcare; Information, Communication and Technology (ICT); Skilled Metal/Electrical work and Skilled Construction work. This was a novel contribution to the empirical literature because often STEM is assumed to be a homogenous group, when there is great variation in the attributes of occupations within this group and in their level of gender segregation. I demonstrated that the significance of the job values changed depending on which definition of STEM was used, further illustrating the limitations of using an aggregate STEM definition.

The chapter showed that for both genders, *some* job values were important for *some* STEM fields, supporting Eccles' expectancy-value framework of decision-making. In particular, job pay and altruistic job values were important for aspirations for Business and Finance

occupations and Healthcare occupations (higher values on job pay and lower values on altruistic job values were associated with a higher probability of the former, and a lower probability of the latter). The greatest reduction in the gender difference in aspirations for Healthcare was found by including 'a job that helps others' as a mediator variable. There was also evidence of gender differences in the relative importance of job values—girls who highly valued altruistic job values were especially unlikely to aspire to Science and Engineering occupations as compared to boys with the same values. Therefore, gender differences in job values do form part of the explanation for gender differences in aspirations, and this provides some support for preference theory. Job values were of differing importance to girls and boys, although this finding could be because more typically 'masculine' values (such as the 'things' dimension) are not included in the survey.

This chapter is primarily limited by its cross-sectional approach and the likely endogeneity between job values and occupational preferences—it is highly likely that job values are informed by preferred occupations, as well as vice versa. Additionally, as for Chapter 2, conclusions are limited by the job values available in the survey—it is plausible that there is a wider difference between girls and boys, not entirely captured by the altruistic job values.

Chapter 4 ('Parental education and gender-typical occupations. Evidence from the UK') extended the discussion of aspirations to all gender-typical occupations and the relationship between parental education and gender-typicality. This association with parental education is a relatively recent finding, also present in gender-typical educational choices (Van De Werfhorst, 2017). To date, few studies have explored the reasons behind this association. This chapter sought to address this, studying four potential explanations in turn.

The primary explanation for differences by parental education was the concentration of extremely gender segregated occupations in the intermediate and low occupational classes,

and the greater likelihood of low parental education individuals to aspire to occupations in these classes. There was also a difference in parental role modelling; the lower an individual's parental education, the more likely they were to have parents in gender-typical occupations (or mothers outside of the labour force), therefore inspiring gender-typicality in their own preferences. This confirmed previous findings about 'ambition' and the role of parents in occupational preference formation (Polavieja & Platt, 2014). Individual gender attitudes did vary by parental education but contributed less to differences in aspirations than has been assumed. Job values did contribute to gender-typicality ('a job that helps others' was positively associated with female-dominated aspirations for both genders) but did not explain differences by parental education. Even accounting for these explanations, there were persistent differences by parental education *within* high occupational class aspirations—individuals from a low parental education who do aspire to high occupations were more likely to aspire to gender-typical occupations.

These add up to several novel contributions; first, the role of gender attitudes and job values in explaining socio-economic differences in gender-typicality have not previously been tested empirically (Polavieja & Platt, 2014). Second, the chapter provided a more detailed description of the distribution of gender-typical occupations than previously identified—both male-dominated and female-dominated aspirations were concentrated outside of the highest occupational class, counter to previous explanations which argued this was only the case for female-dominated aspirations (P. England, 2010; Polavieja & Platt, 2014). Third, it demonstrated that within-class differences in gender-typical aspirations exist, therefore the difference is *not* solely due to differences in ambition (i.e. in the occupational class aspired to) (Polavieja & Platt, 2014).

Again, this chapter has notable limitations; first, the cross-sectional approach restricts findings to associations rather than any causal interpretation, second, the gender attitude and

job values questions are limited, leaving the door open for explanations based on other dimensions of gender attitudes, and third, the number of available cases limits the extent to which occupational preferences can be disaggregated into classes. Nonetheless, this chapter tackles several important assumptions in the existing literature and contributes to a more informed conversation around the relationship between parental education and gender-typicality.

Chapter 5 ('The role of siblings in gender-typical occupational preference formation') asked whether sibship composition, in terms of number or gender of siblings, or siblings' own occupational preferences, could influence the gender-typicality of an individual's occupational preference, measured using male-dominated, female-dominated or STEM aspirations. Many of the theories of gendered socialisation and role modelling focus on the influence of parents but also plausibly apply to sibling influence. Most sociological research on sibling influence to date focuses on educational outcomes, whilst analysis of gender composition has thus far been focused within the psychological literature.

This chapter extends the literature on behavioural role-modelling, beyond the discussion of parental role-models. However, it shows that the main contrast between families in terms of gender-typical occupational preferences is between individuals with no siblings and individuals with any siblings at all. Only children are more likely to have gender-atypical preferences (girls' aspirations for male-dominated or STEM occupations, boys' aspirations for female-dominated occupations) than those with siblings. The gender ratio of siblings did not influence aspirations, nor was there evidence of clustering within sibships. This is interesting because it is counter to expectations about learning from siblings via gendered role modelling within the home. It adds to previous findings that sibship size matters (Choi et al., 2017; Kalmijn & Van De Werfhorst, 2016), and not only for educational outcomes.

The sibling analysis in this paper can only pick up an 'average' sibling influence association—it could be that in some families, siblings imitate, whereas in other families, siblings differentiate. Furthermore, sibling influence could be restricted to certain types of relationship, for instance, older to younger same-sex sibling dyads, or siblings with a certain age gap, or a good quality relationship. Even so, this chapter shows that, on average, siblings do not influence our occupational preferences.

6.2 Implications

Gender differences in occupational preferences are of proven interest to academics, policy-makers, thinktanks and educational institutions. There are government research projects (Department for Business Innovation and Skills, 2014), research funds (Engineering and Physical Sciences Research Council, 2018; Royal Society of Chemistry, 2018), in-school workshops (WISE, 2018b) and TED talks (Sandberg, 2013) dedicated to 'diversity and inclusion'[30]. In general, it is argued that the underrepresentation of women in certain occupations is a problem that needs to be addressed, and many initiatives focus on changing preferences. These encourage individuals to aspire to gender-atypical occupations through various methods including; providing ambassadors and role models, practical demonstrations and workshops in scientific skills, career progression information, and increased funding for teaching in STEM subjects (Pyper, McGuiness, Roberts, & Danby, 2016) . Some initiatives (but far fewer) argue that the underrepresentation of men in other occupations is also a problem, for instance, arguing in favour of increasing male primary school teachers to provide role models for children.

What are the cumulative implications of this thesis for such initiatives? I argue that there are four main points. First, that gender-typicality in occupational preferences is as pertinent an

[30] Of course, this is a wider discussion than gender, involving the underrepresentation of individuals from low socio-economic backgrounds, ethnic minorities, LGBTQ+ groups, and those with disabilities in elite occupations, educational institutions and public life.

issue for boys as it is for girls. Second, that initiatives should consider how parental education affects the pool of gender-typical (and a-typical) occupations that young people deem available, as well as the role models present in their lives. Third, that gender differences in job values are relevant (and perhaps even more relevant than gender attitudes). Finally, perhaps counterintuitive to the title of the thesis, initiatives should avoid focusing solely on occupational preferences and consider structural and institutional constraints. I explain these points and potential applications further below.

First, and most simply, boys are more likely to aspire to gender-typical occupations than girls, therefore inclusion initiatives should focus on encouraging *both* boys and girls to consider gender-atypical or gender-neutral occupations. There are valid reasons for the current public emphasis on girls' representation in male-dominated occupations, due to historically worse conditions in female-dominated occupations, as compared to better salaries and promotion opportunities in male-dominated occupations (Busch, 2017). However, focusing primarily on girls' or women's actions forms part of a wider trend which risks devaluing traditionally 'female' activities and idolising traditionally 'male' activities. Change in the adult labour market has come predominantly from women moving into previously male-dominated activities, rather than from men moving into female-dominated activities (P. England, 2010). As of April 2018, in the UK, women made up 47 percent of medical practitioners and 52 percent of legal practitioners (Office for National Statistics, 2018) . Meanwhile, men constitute only 16 percent of primary and nursery school teachers and 12 percent of nurses (Office for National Statistics, 2018). Situating this within the wider context of gender inequality, this is also evident in (i) changes in the domestic division of labour—the gender division of domestic labour became more equal in the 1980s, primarily because women dramatically decreased their time spent on housework (Bianchi, Sayer, Milkie, & Robinson, 2012), (ii) in popular culture, traditionally 'female' tastes, preferences and choices

are regarded as regressive, and (iii) in the workplace, female professionals are encouraged to downplay nurturing, friendly or communitarian behaviours, and take on traditionally 'male' displays of professionalism (e.g. Sandberg, 2013). Overall, this thesis reiterates that boys have more gender-typical preferences than girls, therefore any commitment to improving diversity and inclusion should focus on both genders.

Second, there is a clear relationship between parental education and gender-typicality of preferences, explained mostly by the distribution of gender-typical occupations outside of the highest occupational class. This is relevant for policy-makers because it suggests that initiatives which increase diversity of aspiration among individuals from a high parental education may not do the same for individuals from a low parental education. Chapter 4 showed that individuals from a low parental education are more likely to aspire to intermediate or low occupations, where there are more gender-typical occupations *and* there is less choice in terms of the gender distribution of an occupation—occupations are less likely to be gender-neutral than they are in the high occupational class. Furthermore, lower parental education individuals are more likely to have gender-typical role models in their parents. Initiatives face a compound problem where low social mobility is associated with persistent gender segregation and individuals will require additional incentives to aspire to gender-a-typical or gender-neutral occupations if they are from a lower parental education, for instance, via bursaries for non-traditional study pathways, additional tuition or closer mentoring relationships.

Third, gender differences in job values are relevant for gender-typical aspirations, especially regarding STEM aspirations. Chapter 3 showed that, for girls in particular, valuing altruistic job values was negatively associated with STEM aspirations. Chapter 4 showed that for both boys and girls, valuing 'a job that helps others' was significantly associated with female-dominated aspirations, and this association was more substantial than the association with

their individual gender attitudes. Many initiatives focus on breaking down negative gender stereotypes about who can fill a certain occupation, for instance, Shell's 2018 social media campaign emphasises unconscious bias and microaggressions experienced by female engineers (Shell, 2018) . Yet, this thesis suggests that it is equally useful, if not more useful, to provide information about how STEM jobs practically help other people and society. Previous research shows that girls are more likely than boys to hold narrow or stereotypical views of what STEM involves (Cheryan et al., 2017; Department for Business Innovation and Skills, 2014), therefore initiatives which demystify the day-to-day of STEM careers may do more to encourage girls to aspire to STEM than initiatives which focus solely on negative stereotypes about women's competences. Indeed, Cech (2013) argues that, net of cultural beliefs about gender egalitarianism, young people are likely to evaluate their strengths in a gender-typical way and consequently aspire to gender-typical occupations. In the context of STEM, girls can believe simultaneously that men and women are equally capable of being scientists in the abstract sense, but also believe that science is not for them personally, as it does not match their values or competences. Thus, one better example is the WISE Campaign's People Like Me initiative (WISE, 2018a), which provides detailed descriptions of the skills and tasks involved in a variety of STEM careers. This could go even further by describing the long-term impact of STEM occupations on individuals and wider society, to demonstrate if STEM is a 'match' to an individual's altruistic job values.

Fourth, initiatives should not solely focus on occupational preferences as a driver for change. Chapter 4 emphasises the importance of the structural distribution of the labour market in shaping the pool of occupations that young people select from. Furthermore, the supplementary analysis in the Appendix demonstrates that, regardless of their preferences as a young person, both girls and those from a low parental education are more likely to be found in gender-typical occupations as an adult. This supports findings from McRae (2003)

that women with similar preferences, but different capacities for overcoming constraints, can end up on very different occupational pathways—gender segregation in the adult labour market is not solely due to preferences *and* occupational preferences are constrained by factors other than individual tastes (David S. Pedulla & Thébaud, 2015). Other important factors influencing the gender-typicality of occupational destinations include institutional arrangements, such as parental leave provision (Dex & Joshi, 1999; Gangl & Ziefle, 2015), childcare availability and cost, employer flexibility and the provision of quality part-time work (Connolly & Gregory, 2008; Dikkers, van Engen, & Vinkenbury, 2010; Goldin, 2014), and these interact with partner's occupation, attitudes and behaviour (Bünning, 2015; Gerstel & Clawson, 2014). Initiatives should therefore focus efforts equally on campaigning for change in institutions, policy and employer provisions, and, to reiterate point 1, on boys' behaviour as much as girls.

6.3 Outstanding research questions and recommendations for future research

In this final section I highlight four main research questions prompted by the contributions and limitations of this thesis and suggest recommendations for future research. These are the following; first, can occupational preferences change and if so, why? Second, how can interventions influence preferences? Third, what are the factors other than preferences which determine whether an individual ends up in their aspired occupation as an adult? Fourth, what are the factors differentiating only children from children with siblings? For all of these questions, I argue that a longitudinal perspective will be beneficial, as will experimental methods.

First, central to the majority of diversity and inclusion initiatives, and within my proposed recommendations from the thesis, is the assumption that occupational preferences can be influenced or changed, by outside interventions. However, Chapter 4 suggests that, for most people, occupational preferences are relatively stable over the age period observed.

Therefore, further research into the characteristics of individuals who did change their preferences is required. This thesis is limited in this respect by its cross-sectional approach—it can only claim associations between job values, parental characteristics, parental education, individual gender attitudes and occupational preferences, rather than any causal relationship. Future research would benefit from a longitudinal approach which follows the same individuals over time and looks in detail at those who changed their occupational preferences and if this coincided with changes in job values (or any other characteristic). Research on young women in an American high school suggests that girls who maintain male-dominated aspirations into adulthood are likely to have different job values than girls who drop these aspirations (Frome et al., 2006), therefore it would be useful to know whether changes in job values within an individual also change preferences, and if this relationship holds in the UK, for STEM aspirations, or for boys' aspirations for female-dominated occupations.

Second, further research is required into the influence of initiatives at occupational preference formation stage, or in changing preferences once established. Establishing the effectiveness of interventions is inherently difficult, due to self-selection of interested parties into workshops, limited follow-up time and reporting bias[31]. In this case, experimental research designs can help to untangle potential causal pathways. For instance, Claudia Finger has begun to do this for certain job values and educational aspirations; she randomly assigned a 25-minute informational intervention on the returns of different fields of study to groups of German high-school students (Finger, 2018). She measured individual's ratings of the importance of job pay and their likelihood of choosing certain fields of study, before and after the intervention. For boys only, those who highly valued job pay and who received information on returns, subsequently increased their applications for high-reward fields of

[31] Individuals are likely to positively evaluate the effectiveness of an intervention in order to justify the time they have invested. Self-evaluations taken immediately after a workshop may not indicate long-term changes in competence or interest.

study. For the UK, Chapter 3 of this thesis shows that gender differences on job pay were smaller than anticipated and the largest differences were on altruistic job values, therefore it would be interesting to extend this study to altruistic job values and include informational interventions on the altruistic consequences of STEM occupations. Other research projects studying the effectiveness of interventions on aspirations, for instance, under the "Inclusion Matters" call from the Engineering and Physical Sciences Research Council (2018) would also benefit from including measures of job values.

Third, further research is required on the pathway from gender-typical occupational aspirations to gender-typical adult occupational attainment, and especially on individuals who end up in a gender-typical occupations counter to their aspirations as a young person. This is important because it will help us to understand the other factors that influence gender-typicality, aside from initial preferences. Ideally, analysis would include multiple countries to disentangle the influence of institutional arrangements from individual choices and preferences. Leuze and Helbig (2015) demonstrate that substantial differences in the gender-typicality of young people's occupational preferences exist between countries, and are influenced by both cultural norms and institutional factors. Research with a longitudinal perspective could examine the extent to which these preferences are translated into adult occupational outcomes, and whether there is between-country variation in boys' or girls' ability to overcome constraints.

Fourth, research into the unique position of only children and their greater propensity to choose gender-atypical occupations could highlight the determinants of gender-typical preferences. Longitudinal analysis could examine occupational preferences of first-born children before and after their siblings were born. However, only children may also be different, due to the type of families who choose to only have one child. Further research into these family units as a whole is therefore necessary.

In conclusion, the outstanding research questions primarily concern the explanatory factors and mechanisms behind change in occupational preferences, and in adult occupational attainment. This thesis has provided an important description of the associations between gender differences in occupational preferences, job values, gender attitudes, family characteristics and the structure of the labour market. The next steps are to uncover the causal relationships, in order to inform policies that aim to create change.

Appendices

7.1 Appendix: Chapter 2

Table 1: Average job value ratings for boys and girls by wave, response scale ranging from 1 (not at all important) to 4 (very important).

	BHPS			
Education level	*Degree level or higher*		*Upper secondary*	
Job value	N	Mean	N	Mean
A job that is interesting	1,209	3.77	201	3.74
Job security	1,166	3.43	196	3.36
Job pay	1,201	3.37	198	3.40
A job that helps others	1,136	2.99	188	3.06
Time for leisure	1,186	2.96	189	2.90
A job that contributes to society	1,115	2.79	181	2.80
Education level	*Lower secondary*		*Other/no qualification*	
	N	Mean	N	Mean
A job that is interesting	340	3.74	289	3.58
Job security	324	3.39	284	3.26
Job pay	339	3.53	292	3.48
A job that helps others	321	3.09	282	3.12
Time for leisure	333	2.92	282	3.02
A job that contributes to society	316	2.81	270	2.79

Job value	Parental education coefficient	SE	*	N (clusters)
A job that is interesting	- 0.12	0.03	***	2,214
Job security	- 0.02	0.03		2,171
Job pay	0.13	0.03	***	2,206
A job that helps others	0.10	0.04	**	1,562
Time for leisure	- 0.11	0.03	**	2,819
A job that contributes to society	0.15	0.04	***	2,108

Notes: Ordered by girls' mean score. Data from UKHLS (age 16-21) and BHPS (14-15) shown separately. BHPS (three waves, from 2002-2007), UKHLS (three waves, 2010-2016). 'Time for family' is not asked in BHPS. Parental education coefficient presented for pairwise comparison of above and below degree-level education, with standard errors clustered by individual to correct for correlation within individual over waves, with N (clusters) presenting the total number of clusters. Stars indicate p-value; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 1 continued: Average job value ratings for boys and girls by wave, response scale ranging from 1 (not at all important) to 4 (very important).

	UKHLS			
Education level	*Degree level or higher*		*Upper secondary*	
Job value	N	Mean	N	Mean
A job that is interesting	4,479	3.73	2,060	3.66
Job security	4,475	3.54	2,056	3.60
Time for family	4,477	3.31	2,058	3.28
Job pay	4,479	3.11	2,059	3.19
A job that helps others	4,472	3.06	2,057	3.02
A job that contributes to society	4,468	2.94	2,055	2.86
Time for leisure	4,473	2.78	2,059	2.78
Education level	*Lower secondary*		*Other/no qualification*	
	N	Mean	N	Mean
A job that is interesting	2,109	3.64	1,817	3.58
Job security	2,108	3.61	1,812	3.61
Time for family	2,105	3.29	1,817	3.32
Job pay	2,104	3.21	1,814	3.27
A job that helps others	2,106	3.10	1,814	3.14
A job that contributes to society	2,100	2.88	1,808	2.93
Time for leisure	2,105	2.78	1,813	2.85

Job value	Parental education coefficient	SE	*	N (clusters)
A job that is interesting	- 0.10	0.01	***	6,516
Job security	0.06	0.01	***	6,507
Time for family	- 0.02	0.01		6,513
Job pay	0.11	0.01	***	6,511
A job that helps others	0.02	0.02		6,508
A job that contributes to society	- 0.05	0.02	**	6,500
Time for leisure	0.02	0.02		6,507

Notes: Ordered by girls' mean score. Data from UKHLS (age 16-21) and BHPS (14-15) shown separately. BHPS (three waves, from 2002-2007), UKHLS (three waves, 2010-2016). 'Time for family' is not asked in BHPS. Parental education coefficient presented for pairwise comparison of above and below degree-level education, with standard errors clustered by individual to correct for correlation within individual over waves, with N (clusters) presenting the total number of clusters. Stars indicate p-value; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

7.2 Appendix: Chapter 3

Breakdown of occupations within STEM definitions

All occupations coded using the Standard Occupational Classification (SOC) 2000 categories. This is the only version of SOC that is used consistently between BHPS and UKHLS for young people's occupational preferences. Not elsewhere classified is abbreviated to 'n.e.c.'

1. Traditional STEM definition

Science Professionals

2111 Chemists
2112 Biological scientists and biochemists
2113 Physicists, geologists and meteorologists

Engineering Professionals

2121 Civil engineers
2122 Mechanical engineers
2123 Electrical engineers
2124 Electronics engineers
2125 Chemical engineers
2126 Design and development engineers
2127 Production and process engineers
2128 Planning and quality control engineers
2129 Engineering professionals n.e.c.

Information and Communication Technology Professionals

2131 IT strategy and planning professionals
2132 Software professionals

Science and Engineering Technicians

3111 Laboratory technicians
3112 Electrical/electronics technicians
3113 Engineering technicians
3114 Building and civil engineering technicians
3115 Quality assurance technicians
3119 Science and engineering technicians n.e.c.

IT Service Delivery Occupations

3131 IT operations technicians
3132 IT user support technicians

2. STEM 'strict'

Includes all occupations from (1) and the following additional occupations:

Production Managers

1121 Production, works and maintenance managers
1122 Managers in construction
1123 Managers in mining and energy

Research Professionals

2321 Scientific researchers
2322 Social science researchers
2329 Researchers

Architects, Town Planners, Surveyors

2431 Architects
2432 Town planners
2433 Quantity surveyors
2434 Chartered surveyors (not quantity surveyors)

Draughtspersons and Building Inspectors

3121 Architectural technologists and town planning technicians
3122 Draughtspersons
3123 Building inspectors

Metal Forming, Welding and Related Trades

5211 Smiths and forge workers
5212 Moulders, core makers, die casters
5213 Sheet metal workers
5214 Metal plate workers, shipwrights, riveters
5215 Welding trades
5216 Pipe fitters

Metal Machining, Fitting and Instrument Making Trades

5221 Metal machining setters and setter-operators
5222 Tool makers, tool fitters and markers-out
5223 Metal working production and maintenance fitters
5224 Precision instrument makers and repairers

Vehicle Trades

5231 Motor mechanics, auto engineers
5232 Vehicle body builders and repairers
5233 Auto electricians
5234 Vehicle spray painters

Electrical Trades

5241 Electricians, electrical fitters
5242 Telecommunications engineers

5243 Lines repairers and cable jointers
5244 TV, video and audio engineers
5245 Computer engineers, installation and maintenance
5249 Electrical/electronics engineers n.e.c.

Construction Trades

5311 Steel erectors
5312 Bricklayers, masons
5313 Roofers, roof tilers and slaters
5314 Plumbers, heating and ventilating engineers
5315 Carpenters and joiners
5316 Glaziers, window fabricators and fitters
5319 Construction trades n.e.c.

Building Trades

5321 Plasterers
5322 Floorers and wall tilers
5323 Painters and decorators

3. STEM 'wide'

Includes all occupations from (2) and the following additional occupations:

Health Professionals

2211 Medical practitioners
2212 Psychologists
2213 Pharmacists/pharmacologists
2214 Ophthalmic opticians
2215 Dental practitioners
2216 Veterinarians

Health Associate Professionals

3211 Nurses
3212 Midwives
3213 Paramedics
3214 Medical radiographers
3215 Chiropodists
3216 Dispensing opticians
3217 Pharmaceutical dispensers
3218 Medical and dental technicians

Therapists

3221 Physiotherapists
3222 Occupational therapists
3223 Speech and language therapists
3229 Therapists n.e.c.

4. Minor groups: Science and engineering

Science Professionals

2111 Chemists
2112 Biological scientists and biochemists
2113 Physicists, geologists and meteorologists

Engineering Professionals

2121 Civil engineers
2122 Mechanical engineers
2123 Electrical engineers
2124 Electronics engineers
2125 Chemical engineers
2126 Design and development engineers
2127 Production and process engineers
2128 Planning and quality control engineers
2129 Engineering professionals n.e.c.

Science and Engineering Technicians

3111 Laboratory technicians
3112 Electrical/electronics technicians
3113 Engineering technicians
3114 Building and civil engineering technicians
3115 Quality assurance technicians
3119 Science and engineering technicians n.e.c.

5. Minor groups: Information, communication and technology

Information and Communication Technology Professionals

2131 IT strategy and planning professionals
2132 Software professionals

IT Service Delivery Occupations

3131 IT operations technicians
3132 IT user support technicians

6. Minor groups: Healthcare

Health Professionals

2211 Medical practitioners
2212 Psychologists
2213 Pharmacists/pharmacologists
2214 Ophthalmic opticians
2215 Dental practitioners
2216 Veterinarians

Health Associate Professionals

3211 Nurses
3212 Midwives
3213 Paramedics
3214 Medical radiographers
3215 Chiropodists
3216 Dispensing opticians
3217 Pharmaceutical dispensers
3218 Medical and dental technicians

Therapists

3221 Physiotherapists
3222 Occupational therapists
3223 Speech and language therapists
3229 Therapists n.e.c.

7. Minor groups: Business and finance

Business and Statistical Professionals

2421 Chartered and certified accountants
2422 Management accountants
2423 Management consultants, actuaries, economists and statisticians

Business and Finance Associate Professionals

3531 Estimators, valuers and assessors
3532 Brokers
3533 Insurance underwriters
3534 Finance and investment analysts/advisers
3535 Taxation experts
3536 Importers, exporters
3537 Financial and accounting technicians
3539 Business and related associate professionals n.e.c.

8. Minor groups: Skilled metal and electrical trades

Metal Forming, Welding and Related Trades

5211 Smiths and forge workers
5212 Moulders, core makers, die casters
5213 Sheet metal workers
5214 Metal plate workers, shipwrights, riveters
5215 Welding trades
5216 Pipe fitters

Metal Machining, Fitting and Instrument Making Trades

5221 Metal machining setters and setter-operators
5222 Tool makers, tool fitters and markers-out
5223 Metal working production and maintenance fitters
5224 Precision instrument makers and repairers

Vehicle Trades

5231 Motor mechanics, auto engineers
5232 Vehicle body builders and repairers
5233 Auto electricians
5234 Vehicle spray painters

Electrical Trades

5241 Electricians, electrical fitters
5242 Telecommunications engineers
5243 Lines repairers and cable jointers
5244 TV, video and audio engineers
5245 Computer engineers, installation and maintenance
5249 Electrical/electronics engineers n.e.c.

9. Minor groups: Skilled construction and building trades

Architects, Town Planners, Surveyors

2431 Architects
2432 Town planners
2433 Quantity surveyors
2434 Chartered surveyors (not quantity surveyors)

Draughtspersons and Building Inspectors

3121 Architectural technologists and town planning technicians
3122 Draughtspersons
3123 Building inspectors

Construction Trades

5311 Steel erectors
5312 Bricklayers, masons
5313 Roofers, roof tilers and slaters
5314 Plumbers, heating and ventilating engineers
5315 Carpenters and joiners
5316 Glaziers, window fabricators and fitters
5319 Construction trades n.e.c.

Building Trades

5321 Plasterers
5322 Floorers and wall tilers

5323 Painters and decorators

Table 1: Linear probability model estimated coefficients for probability of aspiring to STEM: base Model and all job values – without including gender attitudes or parental education

	STEM traditional			Strict STEM skills			Wide STEM skills		
Model coefficients/specifications	1	2	2a	1	2	2a	1	2	2a
Female	-0.116***	-0.110***	-0.120***	-0.265***	-0.256***	-0.258***	-0.146***	-0.168***	-0.171***
	-0.015	-0.015	-0.016	-0.019	-0.02	-0.02	-0.023	-0.024	-0.025
Job pay		-0.006	-0.007		0.008	0.004		0.008	0.003
		-0.012	-0.012		-0.016	-0.016		-0.019	-0.02
Time for leisure		0.008	0.018		0.011	0.021		-0.005	0.014
		-0.011	-0.013		-0.014	-0.016		-0.018	-0.019
A job that contributes to society		0.027*	0.032*		0.033	0.045*		0.032	0.062**
		-0.013	-0.015		-0.017	-0.018		-0.02	-0.02
A job that helps others		-0.050**	-0.044**		-0.063***	-0.066***		0.045*	0.033
		-0.015	-0.015		-0.018	-0.019		-0.022	-0.022
A job that is interesting		0.023	0.025		0.014	0.015		0.045	0.056*
		-0.016	-0.016		-0.021	-0.022		-0.025	-0.025
A job that is secure		0.025	0.025		0.021	0.021		0.015	0.027
		-0.013	-0.014		-0.017	-0.019		-0.021	-0.022
Time for family			-0.022			-0.009			-0.024
			-0.015			-0.018			-0.021
R^2	0.037	0.047	0.051	0.106	0.113	0.115	0.024	0.038	0.046

Notes for Table 1:

(i) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

(ii) Standard errors in parentheses, robust and clustered by individual.

(iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(iv) Control variables not shown: Age, year of survey. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Table 2: Linear probability model estimated coefficients for probability of aspiring to STEM: base model and separate job values : without gender liberalism and parental education

	STEM traditional			Strict STEM skills			Wide STEM skills		
Model specifications/Coefficients	Gender	Job value	Job value x female	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.116***			-0.265***			-0.146***		
	-0.015			-0.019			-0.023		
3. Job pay	-0.116***	-0.002		-0.265***	0.012		-0.146***	0.008	
	-0.015	(0.012)		(0.019)	(0.015)		(0.023)	(0.018)	
3a. Job pay x female	-0.164*	-0.009	0.015	-0.230*	0.017	-0.011	-0.129	0.011	-0.006
	-0.073	(0.020)	(0.022)	(0.092)	(0.026)	(0.029)	(0.113)	(0.027)	(0.035)
4. Time for leisure	-0.115***	0.005		-0.264***	0.010		-0.145***	0.008	
	-0.015	(0.011)		(0.019)	(0.014)		(0.023)	(0.017)	
4a. Time for leisure x female	-0.04	0.019	-0.027	-0.133	0.033	-0.047	-0.059	0.023	-0.032
	-0.062	(0.019)	(0.022)	(0.079)	(0.024)	(0.027)	(0.096)	(0.025)	(0.034)
5. A job that helps others	-0.109***	-0.026*		-0.256***	-0.037*		-0.165***	0.072***	
	-0.016	(0.012)		(0.020)	(0.014)		(0.024)	(0.017)	
5a. A job that helps others x female	0.018	-0.008	-0.041	-0.190*	-0.027	-0.021	-0.293**	0.053*	0.042
	-0.078	(0.018)	(0.024)	(0.091)	(0.022)	(0.028)	(0.113)	(0.023)	(0.036)

Table 2 ctd:

Model specifications/Coefficients	STEM traditional			Strict STEM skills			Wide STEM skills		
	Gender	Job value	Job value x female	Gender	Job value	Job value x female	Gender	Job value	Job value x female
6. A job that contributes to society	-0.116***	0.005		-0.266***	0.002		-0.158***	0.064***	
	-0.015	(0.011)		(0.020)	(0.013)		(0.024)	(0.016)	
6a. A job that contributes to society x female	0.005	0.023	-0.041*	-0.259***	0.003	-0.002	-0.314**	0.041	0.053
	-0.061	(0.017)	(0.020)	(0.076)	(0.022)	(0.025)	(0.100)	(0.023)	(0.033)
7. A job that is interesting	-0.117***	0.019		-0.266***	0.008		-0.150***	0.067**	
	-0.015	(0.015)		(0.019)	(0.020)		(0.023)	(0.024)	
7a. A job that is interesting x female	-0.121	0.018	0.001	-0.421**	-0.010	0.041	-0.338	0.046	0.050
	-0.102	(0.024)	(0.028)	(0.140)	(0.033)	(0.037)	(0.176)	(0.035)	(0.047)
8. A job that is secure	-0.117***	0.020		-0.267***	0.018		-0.149***	0.032	
	-0.015	(0.013)		(0.019)	(0.016)		(0.023)	(0.020)	
8a. A job that is secure x female	-0.112	0.020	-0.002	-0.333**	0.009	0.019	-0.136	0.034	-0.004
	-0.087	(0.022)	(0.024)	(0.111)	(0.028)	(0.031)	(0.141)	(0.030)	(0.039)
9. Time for family	-0.124***	-0.017		-0.267***	-0.008		-0.148***	0.013	
	-0.016	(0.013)		(0.020)	(0.016)		(0.024)	(0.019)	
9a. Time for family x female	-0.124	-0.017	0.000	-0.244*	-0.005	-0.007	-0.208	0.005	0.018
	-0.086	(0.022)	(0.025)	(0.104)	(0.027)	(0.031)	(0.127)	(0.028)	(0.038)

Notes for Table 2:

(i) Standard errors in parentheses, robust and clustered by individual.

(ii) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

*(iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

(iv) Control variables not shown: Age, year of survey. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Table 3: Linear probability model estimated coefficients for probability of aspiring to STEM fields: base model and all job values

STEM subfield		**Maths**			**Science and Engineering**			**Healthcare**	
Model coefficients/specification	1	2	2a	1	2	2a	1	2	2a
Female	-0.018*	-0.012	-0.014	-0.053***	-0.054***	-0.062***	0.119***	0.088***	0.087***
	-0.007	-0.006	-0.007	-0.012	-0.013	-0.014	-0.017	-0.017	-0.018
Job pay		0.001	0.001		-0.009	-0.009		0.001	-0.001
		-0.004	-0.005		-0.01	-0.01		-0.014	-0.014
Time for leisure		0.003	-0.001		-0.002	0.001		-0.016	-0.007
		-0.007	-0.009		-0.009	-0.01		-0.013	-0.013
A job that contributes to society		-0.008	-0.01		0.02	0.026*		-0.001	0.018
		-0.006	-0.007		-0.011	-0.011		-0.015	-0.014
A job that helps others		-0.008	-0.012*		-0.029*	-0.023		0.108***	0.099***
		-0.005	-0.006		-0.013	-0.013		-0.015	-0.015
A job that is interesting		-0.028*	-0.031*		0.026*	0.022		0.031	0.041**
		-0.012	-0.013		-0.012	-0.012		-0.016	-0.016
A job that is secure		0.006	0.005		0.021	0.015		-0.005	0.007
		-0.005	-0.006		-0.011	-0.012		-0.014	-0.015
Time for family			0.013*			-0.001			-0.016
			-0.006			-0.011			-0.016
R^2	0.009	0.026	0.030	0.012	0.020	0.022	0.027	0.071	0.074

Table 3: Linear probability model estimated coefficients for probability of aspiring to STEM fields: base model and all job values, continued

STEM subfield	ICT			Skilled Metal/Electrical			Construction		
Model coefficients/specification	1	2	2a	1	2	2a	1	2	2a
Female	-0.062***	-0.057***	-0.058***	-0.077***	-0.072***	-0.073***	-0.074***	-0.073***	-0.064***
	-0.01	-0.009	-0.01	-0.01	-0.009	-0.01	-0.011	-0.011	-0.011
Job pay		0.003	0.003		-0.002	-0.003		0.017*	0.014
		-0.008	-0.008		-0.008	-0.009		-0.008	-0.008
Time for leisure		0.01	0.016		0.011	0.008		-0.005	-0.003
		-0.008	-0.009		-0.008	-0.009		-0.008	-0.008
A job that contributes to society		0.006	0.006		-0.008	-0.006		0.001	0.003
		-0.009	-0.011		-0.008	-0.009		-0.01	-0.009
A job that helps others		-0.021*	-0.021*		-0.009	-0.015		0.001	-0.002
		-0.009	-0.01		-0.007	-0.008		-0.009	-0.009
A job that is interesting		-0.003	0.003		0.001	0.005		-0.006	-0.012
		-0.01	-0.012		-0.011	-0.012		-0.012	-0.013
A job that is secure		0.004	0.01		0.002	0.001		-0.01	-0.01
		-0.008	-0.009		-0.009	-0.011		-0.008	-0.009
Time for family			-0.021			0.004			0.012
			-0.011			-0.009			-0.008
R^2	0.031	0.036	0.041	0.040	0.044	0.049	0.035	0.038	0.035

Notes for Table 3:

(i) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

(ii) Standard errors in parentheses, robust and clustered by individual.

(iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(iv) Control variables not shown: Age, year of survey, parental education. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

Table 4: Linear probability model estimated coefficients for probability of aspiring to Business and Finance and Science and Engineering: base model and separate job values

	Business and finance			Science and Engineering		
	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.018*			-0.053***		
	(0.007)			(0.012)		
3. Job pay	-0.017*	0.005		-0.054***	-0.008	
	(0.007)	(0.004)		(0.012)	(0.009)	
3a. Job pay x female	-0.046*	0.000	0.009	-0.084	-0.013	0.010
	(0.023)	(0.006)	(0.007)	(0.058)	(0.015)	(0.018)
4. Time for leisure	-0.017*	0.001		-0.054***	-0.004	
	(0.007)	(0.007)		(0.012)	(0.009)	
4a. Time for leisure x female	-0.013	0.002	-0.001	-0.020	0.002	-0.012
	(0.038)	(0.013)	(0.013)	(0.052)	(0.015)	(0.018)
5. A job that helps others	-0.013*	-0.016**		-0.051***	-0.011	
	(0.006)	(0.005)		(0.013)	(0.011)	
5a. A job that helps others x female	-0.048	-0.021*	0.011	0.144*	0.018	-0.062**
	(0.036)	(0.009)	(0.010)	(0.070)	(0.015)	(0.021)
6. A job that contributes to society	-0.015*	-0.016**		-0.055***	0.010	
	(0.006)	(0.005)		(0.013)	(0.009)	
6a. A job that contributes to society x female	-0.035	-0.019*	0.007	0.080	0.031*	-0.046**
	(0.034)	(0.009)	(0.010)	(0.050)	(0.013)	(0.017)
7. A job that is interesting	-0.016*	-0.032**		-0.055***	0.025*	
	(0.007)	(0.011)		(0.012)	(0.011)	
7a. A job that is interesting x female	-0.165*	-0.049**	0.040*	-0.012	0.030	-0.011
	(0.078)	(0.019)	(0.020)	(0.077)	(0.017)	(0.021)
8. A job that is secure	-0.018**	0.003		-0.055***	0.017	
	(0.007)	(0.005)		(0.012)	(0.010)	
8a. A job that is secure x female	-0.061	-0.003	0.012	-0.061	0.016	0.002
	(0.037)	(0.009)	(0.010)	(0.070)	(0.017)	(0.020)
9. Time for family	-0.021**	0.005		-0.060***	0.002	
	(0.008)	(0.006)		(0.013)	(0.011)	
9a. Time for family x female	0.014	0.009	-0.010	0.041	0.016	-0.030
	(0.036)	(0.009)	(0.011)	(0.068)	(0.017)	(0.021)

Table 5: Linear probability model estimated coefficients for probability of aspiring to Healthcare and ICT: base model and separate job values

	Healthcare			ICT		
	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	0.119***			-0.062***		
	(0.017)			(0.010)		
3. Job pay	0.119***	-0.003		-0.062***	0.006	
	(0.017)	(0.013)		(0.010)	(0.008)	
3a. Job pay x female	0.102	-0.006	0.006	-0.080	0.003	0.006
	(0.081)	(0.015)	(0.025)	(0.049)	(0.015)	(0.015)
4. Time for leisure	0.119***	-0.003		-0.061***	0.009	
	(0.017)	(0.012)		(0.009)	(0.007)	
4a. Time for leisure x female	0.075	-0.010	0.016	-0.019	0.017	-0.015
	(0.070)	(0.014)	(0.025)	(0.037)	(0.013)	(0.013)
5. A job that helps others	0.091***	0.109***		-0.058***	-0.016*	
	(0.017)	(0.013)		(0.009)	(0.006)	
5a. A job that helps others x female	-0.103	0.080***	0.062*	-0.126**	-0.026*	0.022
	(0.078)	(0.015)	(0.026)	(0.040)	(0.011)	(0.012)
6. A job that contributes to society	0.108***	0.063***		-0.061***	-0.005	
	(0.017)	(0.013)		(0.010)	(0.007)	
6a. A job that contributes to society x female	-0.055	0.038*	0.055*	-0.075*	-0.007	0.005
	(0.079)	(0.015)	(0.026)	(0.036)	(0.012)	(0.012)
7. A job that is interesting	0.115***	0.059***		-0.062***	-0.006	
	(0.017)	(0.016)		(0.010)	(0.010)	
7a. A job that is interesting x female	0.082	0.056**	0.009	-0.110	-0.012	0.013
	(0.123)	(0.017)	(0.033)	(0.068)	(0.017)	(0.018)
8. A job that is secure	0.118***	0.014		-0.063***	0.003	
	(0.017)	(0.014)		(0.010)	(0.008)	
8a. A job that is secure x female	0.196	0.025	-0.022	-0.051	0.004	-0.003
	(0.104)	(0.016)	(0.029)	(0.054)	(0.015)	(0.015)
9. Time for family	0.119***	0.021		-0.064***	-0.019*	
	(0.017)	(0.013)		(0.010)	(0.010)	
9a. Time for family x female	0.037	0.010	0.025	-0.165**	-0.032	0.030
	(0.091)	(0.015)	(0.027)	(0.061)	(0.017)	(0.017)

Table 6: Linear probability model estimated coefficients for probability of aspiring to Skilled Metal/Electrical and Skilled Construction: base model and separate job values

	Metal/Electrical			Construction		
	Gender	Job value	Job value x female	Gender	Job value	Job value x female
1. Base	-0.077***			-0.074***		
	(0.010)			(0.011)		
3. Job pay	-0.077***	0.001		-0.073***	0.014	
	(0.010)	(0.007)		(0.011)	(0.007)	
3a. Job pay x female	-0.060	0.004	-0.005	0.026	0.030*	-0.032*
	(0.046)	(0.014)	(0.014)	(0.044)	(0.014)	(0.015)
4. Time for leisure	-0.075***	0.009		-0.074***	-0.002	
	(0.010)	(0.007)		(0.011)	(0.008)	
4a. Time for leisure x female	-0.024	0.018	-0.019	-0.044	0.003	-0.011
	(0.040)	(0.014)	(0.014)	(0.044)	(0.014)	(0.015)
5. A job that helps others	-0.074***	-0.012		-0.073***	-0.001	
	(0.010)	(0.007)		(0.011)	(0.006)	
5a. A job that helps others x female	-0.131**	-0.021	0.019	-0.077*	-0.001	0.001
	(0.044)	(0.013)	(0.013)	(0.037)	(0.011)	(0.012)
6. A job that contributes to society	-0.074***	-0.012		-0.073***	-0.001	
	(0.010)	(0.007)		(0.011)	(0.007)	
6a. A job that contributes to society x female	-0.136**	-0.022	0.021	-0.126***	-0.009	0.018
	(0.043)	(0.013)	(0.013)	(0.038)	(0.012)	(0.012)
7. A job that is interesting	-0.077***	-0.002		-0.073***	-0.008	
	(0.010)	(0.010)		(0.011)	(0.012)	
7a. A job that is interesting x female	-0.071	-0.002	-0.001	-0.122	-0.013	0.013
	(0.065)	(0.017)	(0.017)	(0.083)	(0.019)	(0.022)
8. A job that is secure	-0.077***	0.000		-0.073***	-0.005	
	(0.010)	(0.008)		(0.011)	(0.008)	
8a. A job that is secure x female	-0.095	-0.003	0.005	-0.114	-0.011	0.011
	(0.057)	(0.016)	(0.016)	(0.060)	(0.015)	(0.016)
9. Time for family	-0.079***	0.001		-0.065***	0.009	
	(0.011)	(0.008)		(0.011)	(0.008)	
9a. Time for family x female	-0.054	0.004	-0.007	-0.075	0.008	0.003
	(0.051)	(0.015)	(0.015)	(0.046)	(0.013)	(0.014)

Notes for Tables 4 to 6:

(v) N = 2,063 individuals, 2,516 observations, with the exception of models with 'time for family', with N=1,855 individuals and 2,190 observations. 'Time for family' is compared to base model 1a, not shown, with the same nested sample. Results for this model are substantially unchanged from the base model shown here and available on request.

(vi) Standard errors in parentheses, robust and clustered by individual.

(vii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(viii) Control variables not shown: Age, year of survey, parental education. Weights to account for non-response bias and unequal sample selection probability included.

Source: BHPS (age 14-15, 2006-2008) and UKHLS (age 16-21, 2010-2016).

7.3 Appendix Chapter 4

Outline

(A) Additional models and statistical significance

(i) P-values from tests of statistical significance between model coefficients and base model 0

(ii) Linear probability model estimated coefficients for the probability of aspiring to gender-typical occupation: all explanations included

(iii) Models 0, 1, 2, 3, 4 disaggregated by male-dominated and female-dominated occupations, girls and boys estimated separately

(B) Additional descriptive statistics

(i) Transition tables of change between waves; gender-typical occupational preferences, gender attitudes, job values

(ii) Regression for probability of attaining a gender-typical adult occupation

(iii) Principal component analysis for gender attitudes and job values

(A) Additional models and significance tests

(i) Table 1: P-values from tests of statistical significance between model coefficients and base model 0

Model	Means	SES	SES contrasts
1	n/s	n/s	n/s
1a	n/s	n/s	2: 0.0338 3: n/s 4: n/s
2	n/s	n/s	2: n/s 3: 0.0361 4: 0.0234
2a	n/s	n/s	2: n/s 3: n/s 4: 0.0338
2b	n/s	0.0393	2: n/s 3: n/s 4:0.0149
3	n/s	n/s	n/s
3a	n/s	n/s	n/s
4	0	0	2:0.0205 3:0.000 4:0.000
4a	0	0	2: 0.030 3: 0.000 4:0.001

Notes: n/s denotes that the contrast is not-significant, i.e. p-value>0.05, 2: coefficient on contrast between upper secondary and degree-level, 3: coefficient on contrast between lower secondary and degree-level, 4: coefficient on contrast between other/no qualification and degree-level.
Source: Pooled UKHLS and BHPS, 2006 to 2014-2016

(ii) Table 2: Linear probability model estimated coefficients for the probability of aspiring to gender-typical occupation: all explanations included

Models	**0**	**5**
Parental education (Ref: Degree)		
Upper secondary	0.050	0.016
	(0.039)	(0.037)
Lower secondary	0.091	-0.015
	(0.049)	(0.048)
Other or no qualification	0.240***	0.121
	(0.068)	(0.068)
Mother's occupation (Ref: female-dominated)		
Other occupation		0.001
		(0.032)
Outside of the labour force		0.048
		(0.043)
Father's occupation (Ref: male-dominated)		
Other occupation		-0.060
		(0.032)
Outside of the labour force		0.003
		(0.045)
Parental gender attitudes		
Mother: traditional gender role attitudes		-0.002
		(0.012)
Mother: support for non-traditional gender roles		-0.016
		(0.017)
Father: traditional gender role attitudes		0.016
		(0.011)
Father: support for non-traditional gender roles		0.009
		(0.016)
Gender attitudes		
Traditional gender roles		-0.008
		(0.012)
Support for non-traditional gender roles		-0.005

		(0.018)
Job values		
Job security		-0.006
		(0.014)
A job that is interesting		0.011
		(0.017)
A job that helps others		0.029*
		(0.014)
Table 2 continued		
Job pay		0.011
		(0.015)
NS-SEC of preference (ref: High)		
Intermediate		0.126***
		(0.037)
Low		0.426***
		(0.043)
Constant	-61.929**	-45.115*
	(21.592)	(21.356)
N (observations)	1434	1434
N (individuals)	1152	1152

Notes: Model controls for gender, age and year of survey, coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: BHPS (2006-2008) and UKHLS (2010-2016).

(iii) Table 3: Models 0, 1, disaggregated by male-dominated and female-dominated occupations, girls and boys estimated separately

	Female-dominated				Male-dominated			
Gender	Girls		Boys		Girls		Boys	
Model	0	1	0	1	0	1	0	1
Parental education (Ref: Degree)								
Upper secondary	0.161**	0.161**	0.005	0.003	-0.006	-0.007	-0.053	-0.081
	(0.055)	(0.056)	(0.034)	(0.034)	(0.028)	(0.030)	(0.055)	(0.056)
Lower secondary	0.200**	0.198**	-0.029	-0.025	-0.006	0.005	-0.012	-0.048
	(0.062)	(0.065)	(0.030)	(0.031)	(0.037)	(0.044)	(0.072)	(0.069)
Other or no qualification	0.365***	0.346***	0.047	0.053	-0.047	-0.036	0.123	0.050
	(0.087)	(0.087)	(0.055)	(0.059)	(0.031)	(0.034)	(0.098)	(0.106)
Mother's occupation (Ref: female-dominated)								
Other occupation		-0.030		-0.042		-0.034		0.013
		(0.042)		(0.031)		(0.031)		(0.051)
Outside of the labour force		-0.011		-0.081*		-0.059		0.082
		(0.056)		(0.033)		(0.037)		(0.068)
Father's occupation (Ref: male-dominated)								
Other occupation		0.020		0.008		-0.008		-0.143**
		(0.042)		(0.029)		(0.029)		(0.051)
Outside of the labour force		0.097		0.005		0.037		-0.022
		(0.061)		(0.039)		(0.036)		(0.073)
Parental gender attitudes								
Mother: traditional gender role attitudes		-0.001		0.010		(0.003)		(0.014)
		(0.016)		-0.012		-0.009		-0.018
Mother: support for non-traditional gender roles		0.010		0.010		0.010		(0.039)
		(0.022)		-0.014		-0.015		-0.026
Father: traditional gender role attitudes		0.014		-0.025*		0.010		0.020
		(0.014)		-0.011		-0.007		-0.018
Father: support for non-traditional gender roles		0.014		0.020		0.010		0.000
		(0.020)		-0.013		-0.014		-0.027
Constant	-51.642	-51.235	-0.708	-5.016	9.384	9.170	-63.217	-66.925*
	(27.342)	(27.257)	(18.517)	(18.536)	(14.198)	(14.165)	(33.451)	(33.494)
N (observations)	781	781	653	653	781	781	653	653
N (individuals)	622	622	530	530	622	622	530	530

Table 4: Models 2 and 2a disaggregated by male-dominated and female-dominated occupations, girls and boys estimated separately

	Female-dominated				Male-dominated			
Gender	Girls		Boys		Girls		Boys	
Model	2	2b	2	2b	2	2b	2	2b
Parental education (Ref: Degree)								
Upper secondary	0.158**	0.182*	0.004	0.016	-0.009	-0.017	-0.053	-0.083
	(0.055)	(0.077)	(0.034)	(0.036)	(0.028)	(0.031)	(0.055)	(0.058)
Lower secondary	0.196**	0.145*	-0.032	-0.033	-0.004	-0.010	-0.019	-0.031
	(0.063)	(0.071)	(0.030)	(0.027)	(0.038)	(0.043)	(0.072)	(0.075)
Other or no qualification	0.357***	0.324***	0.037	0.010	-0.041	-0.053*	0.111	0.026
	(0.089)	(0.097)	(0.054)	(0.051)	(0.033)	(0.026)	(0.100)	(0.096)
Gender attitudes								
Traditional gender roles	-0.009	-0.007	-0.005	0.002	0.002	-0.005	-0.024	-0.043
	(0.016)	(0.020)	(0.010)	(0.013)	(0.009)	(0.013)	(0.018)	(0.023)
Support for non-traditional gender roles	0.027	0.019	0.025	0.025	0.027*	0.030*	-0.025	-0.045
	(0.023)	(0.027)	(0.017)	(0.023)	(0.013)	(0.014)	(0.027)	(0.035)
Gender attitudes/parental education interaction								
Traditional gender roles/Upper secondary		0.017		-0.013		0.010		0.070
		(0.048)		(0.022)		(0.020)		(0.043)
Traditional gender roles/lower secondary		0.003		-0.010		0.038		0.028
		(0.052)		(0.019)		(0.028)		(0.057)
Traditional gender roles/other or no qualification		-0.061		-0.028		0.020		0.060
		(0.057)		(0.054)		(0.020)		(0.077)
Non-traditional gender roles/upper secondary		-0.068		-0.033		-0.003		0.022
		(0.071)		(0.045)		(0.034)		(0.066)
Non-traditional gender roles/lower secondary		0.116		0.017		-0.033		0.021
		(0.076)		(0.036)		(0.058)		(0.080)
Non-traditional gender roles/other or no qualification		0.054		0.048		0.022		0.219*
		(0.102)		(0.080)		(0.048)		(0.102)
Constant	-53.845	-53.340	1.597	3.309	7.371	7.129	-66.056*	-64.179
	(27.567)	(27.537)	(18.805)	(18.808)	(14.021)	(14.153)	(33.430)	(33.646)
N (observations)	781	781	653	653	781	781	653	653
N (individuals)	0.074	0.083	0.014	0.02	0.01	0.014	0.026	0.04

Table 5: Model 3, disaggregated by male-dominated and female-dominated occupations, girls and boys estimated separately

	Female-dominated		Male-dominated	
Gender	Girls	Boys	Girls	Boys
Model	3	3	3	3
Parental education (Ref: Degree)				
Upper secondary	0.157**	0.000	-0.007	-0.058
	(0.052)	(0.034)	(0.028)	(0.055)
Lower secondary	0.210***	-0.038	-0.007	-0.015
	(0.063)	(0.030)	(0.038)	(0.072)
Other or no qualification	0.356***	0.044	-0.048	0.114
	(0.085)	(0.055)	(0.031)	(0.098)
Job values				
Job security	0.028	0.009	0.010	-0.019
	(0.020)	-0.012	(0.012)	(0.022)
A job that is interesting	0.013	-0.031	-0.025	-0.009
	(0.024)	-0.017	(0.022)	(0.027)
A job that helps others	0.061**	0.020	-0.012	-0.020
	(0.019)	-0.014	(0.012)	(0.023)
Job pay	-0.019	-0.006	0.003	0.031
	(0.020)	-0.013	(0.015)	(0.024)
Constant	-47.505	3.588	9.293	-68.205*
	(26.934)	(19.102)	(14.103)	(33.119)
N (observations)	781	653	781	653
N (individuals)	0.097	0.021	0.012	0.026

Table 6: Model 4, disaggregated by male-dominated and female-dominated occupations, girls and boys estimated separately

	Female-dominated		Male-dominated	
Gender	Girls	Boys	Girls	Boys
Model	4	4	4	4
Parental education (Ref: Degree)				
Upper secondary	0.128*	0.005	-0.013	-0.065
	(0.052)	(0.034)	(0.027)	(0.049)
Lower secondary	0.110	-0.045	-0.017	-0.081
	(0.058)	(0.030)	(0.040)	(0.073)
Other or no qualification	0.276**	0.029	-0.065*	0.072
NS-SEC of preference (ref: High)				
Intermediate	0.089	0.117**	0.160***	0.148**
	(0.050)	(0.037)	(0.041)	(0.055)
Low	0.376***	0.069	0.050	0.450***
	(0.061)	(0.040)	(0.034)	(0.061)
Constant	-29.987	0.023	15.899	-50.015
	(27.163)	(18.820)	(14.161)	(32.937)
N (observations)	781	653	781	653
N (individuals)	0.134	0.04	0.059	0.122

Notes for Tables 3 to 6: All models control for age and year of survey, coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: BHPS (2006-2008) and UKHLS (2010-2016).*

(B) Additional descriptive statistics

(i) Transition tables of changes between waves

Table 7: Stability of gender-typical occupational preferences between waves

	Overall		*Between*		*Within*
Occupational preference	Freq.	Percent	Freq.	Percent	Percent
Not gender-typical	10,349	75.5	6,646	81.81	93.87
Gender-typical	3,358	24.5	2,324	28.61	81.13
Total	13,707	100	8,970 (n=8,124)	110.41	90.57

Note: Calculated using binary variable for occupational preferences; 0=not gender-typical, 1=gender-typical. 'Stability' refers to whether an individual's occupational preference changes between the waves they are observed.

Source: Author's calculation based on pooled UKHLS/BHPS data 2006-2016. Descriptive statistics for all individuals who gave a valid occupational preference.

Table 7 shows that occupational preferences are generally stable between waves, although gender-typical preferences are less stable than gender-atypical/gender-neutral preferences; there is an 81% chance of aspiring to a gender-typical preference if you gave this response in the previous wave.

Table 8: Stability of gender attitudes and job values between waves

Variable		Mean	Std.Dev	Min	Max	Observations
GA1	Overall	3.21	1.01	1.00	5.00	N = 9149
	Between		0.96	1.00	5.00	n = 7002
			0.39	1.21	5.21	T-bar =
	Within					1.30663
GA2	Overall	3.56	1.07	1.00	5.00	N = 10356
	Between		1.02	1.00	5.00	n = 7634
			0.42	0.89	5.89	T-bar =
	Within					1.35656
GA3	Overall	3.99	0.87	1.00	5.00	N = 9142
	Between		0.83	1.00	5.00	n = 6998
			0.35	1.32	5.99	T-bar =
	Within					1.30637
GA4	Overall	3.81	1.10	1.00	5.00	N = 10359
	Between		1.07	1.00	5.00	n = 7636
			0.41	1.15	6.48	T-bar =
	Within					1.3566
Job security	Overall	1.43	0.57	1.00	4.00	N = 13294
	Between		0.51	1.00	4.00	n = 7975
			0.30	-	3.43	T-bar =
	Within			0.24		1.66696
A job that is interesting	Overall	1.34	0.54	1.00	4.00	N = 13334
	Between		0.49	1.00	4.00	n = 7985
			0.28	-	3.59	T-bar =
	Within			0.16		1.66988
Job pay	Overall	1.82	0.63	1.00	4.00	N = 13321
	Between		0.59	1.00	4.00	n = 7981
			0.31	-	3.82	T-bar =
	Within			0.18		1.66909
A job that helps others	Overall	1.92	0.69	1.00	4.00	N = 13275
	Between		0.63	1.00	4.00	n = 7972
			0.33	0.17	3.92	T-bar =
	Within					1.6652

Note: Job value components ranked on a scale from 1 to 4, where 1 is very important and 4 is not at all important. Gender attitudes coded on a scale from 1 to 5, where 1=most traditional response, 5=most liberal response. Two gender attitude measures are used in the main paper, the first created from a principal component analysis of GA1, GA2 and GA4, the second using a standardised version of GA3, averaged across an individual's available responses. Values for age<=21. Source: BHPS (2006-2008) and UKHLS (2010-2016).

Table 8 shows that for all gender attitudes and job values, there is greater between-individual variance than within-individual variation. There is some within-individual variation, especially for gender attitudes, but the sample size is insufficient to examine this in this survey.

Table 9: Linear probability model estimates of attaining a gender-typical adult occupation

Probability of gender-typical adult occupation	
Gender-typical occupational preference	0.100***
	(0.029)
Parental education (Ref: Degree)	
Upper secondary	-0.025
	(0.036)
Lower secondary	0.014
	(0.037)
Other/no qualification	0.122*
	(0.058)
Female	0.335***
	(0.028)
Constant	13.535
	(11.605)
N (observations)	1927
N (individuals)	1499

Notes: Model controls for year of survey, coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: BHPS (2006-2008) and UKHLS (2010-2016).*

Table 9 shows that having gender-typical occupational preferences between 14 and 21 is significantly associated with having a gender-typical current job as an adult. Controlling for occupational preferences, women, and those from a lower parental education are also more likely to end up in a gender-typical occupation, regardless of preference.

(ii) Principal component analysis

(a) Gender attitudes

Table 10 shows the squared multiple correlations for each gender attitude variable with all other gender attitude variables.

Table 10: Gender attitude variables, squared multiple correlations

Variable	Squared multiple correlations
GA1: A pre-school child suffers if their mother works	0.528
GA2: The family suffers if the woman works full-time	0.567
GA3: The husband and wife should both contribute to household income	0.048
GA4: The husband should earn, the wife should stay at home	0.293
GA5: Employers should help mothers combine jobs and childcare	0.033

Notes: Variables measured on a Likert scale, 1-5, then standardised with mean 0 and variance 1.

Source: BHPS (2006-2008) and UKHLS (2010-2016).

GA3 and GA5 have the lowest squared multiple correlations and are therefore not well-explained by the other gender attitude variables.

Table 11: Rotated component loadings using principal component analysis; GA1, GA2 and GA4 only

Variables*	Component 1	Component 2
GA1: A pre-school child suffers if their mother works	**0.595**	-0.457
GA2: The family suffers if the woman works full-time	**0.613**	-0.274
GA4: The husband should earn, the wife should stay at home	**0.520**	0.846
Eigenvalue	2.142	0.584
Proportion of total variance explained	0.714	0.195
Cronbach's Alpha	0.796	

**Variables measured on a Likert scale, 1 to 5, then standardised with mean 0 and variance 1. Emboldened numbers show highest component loadings. Source: BHPS (2006-2008) and UKHLS (2010-2016).*

Table 12: Job value variables, squared multiple correlations

Variable	Squared multiple correlations
Job security	0.096
A job that is interesting	0.099
A job that contributes to society	0.368
A job that helps others	0.367
Job pay	0.141
Time for leisure	0.111

Notes: Variables measured on a scale from 1 to 4, where 1 is not at all important and 4 is very important, then standardised with mean 0 and variance 1. Source: BHPS (2006-2008) and UKHLS (2010-2016).

7.4 Appendix Chapter 5

7.4.1 Siblings statistics: alternative household identification strategy

Table 1: Number of siblings in household by age

Respondent age/Household	11	12	13	14	15	16	17	18	19	20	21
No siblings	15%	15%	17%	17%	18%	22%	21%	23%	31%	42%	39%
One sibling	46%	43%	45%	46%	44%	42%	43%	40%	34%	32%	30%
Two or more siblings	39%	42%	37%	37%	37%	36%	36%	36%	35%	26%	31%

Notes: Pooled UKHLS/BHPS data, 2006-2016. Identifies siblings currently living in the same household only, including step-siblings and adopted siblings.

Table 1 shows the number of siblings that respondents currently live with, by age. For 11-15-year-olds, the most common household composition is to live with one sibling (~45%), then to live with two or more siblings (~37%), and the least common scenario is to live with no siblings. As respondents get older, they, or their siblings, are likely to move out of the family home, therefore the proportion living with no siblings increases, until the age of 21 where this is the most common household composition (39%).

Office for National Statistics (ONS) data suggests that this is higher than the number of siblings in the UK on average. Using ONS statistics on families with dependent children, between 2006 and 2015, the most common number of children (given at least one child) was 1 child (46% of families), followed by two children (39% of families) (Office for National Statistics, 2017).

Table 2: Presence of older siblings, in one or two-child households

	No. of siblings in household		
Older siblings	**0**	**1**	**Total**
No older siblings	11,905	4,620	16,525
Older same-sex siblings	0	4,172	4,172
Older opposite-sex sibling	0	4,810	4,810
Total	11,905	13,602	25,507

Source: BHPS (2006-2008) and UKHLS (2010-2016).

Table 2 shows the observations of individuals in one or two-child households. This shows that if there is at least one sibling living in the household with you, they are more likely to be older than younger. If they are older, they are equally likely to be the same-sex or the opposite-sex.

7.4.2 Alternative regression analyses

(i) Influence of same-sex siblings: one-child or two-child families only

Table 3: Linear probability model estimated coefficients for the probability of gender-typical aspirations

Model specification	1	2	3	4
Female	-0.145***	-0.118**	-0.145***	-0.128*
	-0.023	-0.042	-0.023	-0.053
Sibling type				
Ref: Same-sex sibling				
No siblings	-0.016	-0.032	-0.014	-0.015
	-0.029	-0.042	-0.031	-0.044
Opposite-sex sibling	-0.016	0.030	-0.020	0.019
	-0.027	-0.042	-0.034	-0.053
Sibling/gender interaction				
Female x no siblings		0.026		0.000
		-0.058		-0.059
Female x opposite-sex siblings		-0.084		-0.070
		-0.055		-0.069
Constant	8.169	8.198	8.302	8.330
	-10.728	-10.712	-10.759	-10.747
N (observations)	2987	2987	2987	2987
N (individuals)	1469	1469	1469	1469

Notes: Data sourced from UKHLS/BHPS 2006-2016. All models control for age, parental education and year of survey, coefficients not shown. Standard errors are robust, clustered by individuals, and shown in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0$

Table 3 shows the estimated coefficients for four linear probability models, where the dependent variable is a binary variable indicating whether a respondent aspires to a gender-typical occupation (1) or not (0).

The samples are restricted to individuals who either live with no siblings or live with one sibling only. In Models 1 or 2, the sibling they live with can be any age, whereas in Models 3 or 4 this sample is further restricted to whether they live with an older sibling or not.

The sibling type variable indicates three possible scenarios; either they have no siblings in the house, they have one same-sex sibling, or, they have one opposite-sex sibling. In Models 3 or 4, this refers specifically to either no older siblings, one older same-sex sibling, or one older opposite-sex sibling. The reference category is living with a same-sex sibling.

The coefficients show that there is no significant association between these sibling configurations with the gender-typicality of an individual's occupational preference. The direction of the coefficients suggests that living with same-sex siblings is positively associated with gender-typicality, as compared to either having no siblings or having an opposite-sex sibling, but this association is not significant.

Models 2 and 4 include an interaction between sibling composition and gender—does the gender of the respondent affect the association between sibling configuration and gender-typicality? The results indicate that it does not. The direction of the coefficient suggests that for girls, having an opposite-sex sibling has an additional negative association with being gender-typical, as compared to having a same-sex sibling and being a boy, but these associations are not significant.

Overall, there is no evidence in this sample for either a social differentiation effect or a gendered social learning effect, there are no significant differences in the gender-typicality of

occupational preferences for respondents with no siblings, or opposite-sex siblings as compared to individuals living with a same-sex sibling.

(ii) Influence of number of siblings and gender composition: any size family

However, this analysis is restrictive because it does not pick up on individuals who live with more than one sibling. If an individual lives with an older same-sex sibling, this may be less important than the overall gender composition of their household, for instance, if they are one of three sisters, as opposed to belonging to a mixed gender sibship. Furthermore, if there are more siblings in total, this may reduce parental influence on each sibling, and reduce occupational imitation, which may in turn reduce gender-typicality, as generations become more liberal over time.

Therefore, I also estimate associations with the number of siblings and the gender ratio of brothers to sisters (comparing equal gender ratio, to more brothers than sisters, to more sisters than brothers). None of these associations are significantly associated with gender-typicality of preference, therefore coefficients are not shown.

(iii) Within- and between-sibling variation in occupational preferences: alternative sibling identification strategy; shared mother

As an alternative sibling identification strategy, I use shared mother. The propensity to aspire to a male-dominated occupation, a female-dominated occupation or a STEM occupation does vary by family, as measured by shared mother. This can be shown by estimating an empty variance components model to test whether estimating a two-level model and partitioning variance between individual-level and family-level components makes a statistically significant improvement to model fit. I restrict the model to observations which are complete on gender, occupational aspirations, mother's education, mother's employment status, mother's occupational category and mother's gender attitudes.

The results of the empty model are shown in Table 4. This gives an estimate of the intraclass correlation coefficient rho; the proportion of the total overall variance that is accounted for by between-family variance. Rho in the empty model says that 11% of the variance in aspirations for male-dominated occupations is explained by between-family variance, as is 5% of the variance in aspirations for female-dominated occupations and 4% of the variance for STEM occupations. The 95% confidence interval for rho does not include zero in either of the three models. However, the likelihood ratio test for sigma-u (the square root of the variance at family-level), which compares the two-level model to the single-level model, can only reject the null hypothesis for male-dominated occupational aspirations.

Therefore, for female-dominated occupational aspirations or STEM occupations, adding in the family-level does not make a significant difference to the proportion of variance explained, and the single-level model performs just as well. For male-dominated occupational aspirations, more variance is attributable to individuals than is attributable to the family-level. Once including the individual-level covariate for gender, the majority of this between-family variation is explained. This is consistent with the main paper results—the majority of variance is between individual rather than between family.

Table 4: Empty model of proportion of occupational aspirations by category, with between- and within-family variance decomposed

Male-dominated	Coef.	Std. Err.	z	P>z	95% C.I.	
Constant	0.282	0.010	29.050	-	0.263	0.301
Between-family	0.137	0.025			0.096	0.195
Between-individual	0.387	0.010			0.367	0.407
Rho	0.111	0.039			0.052	0.209
LR test of between-family variance=0, Prob >= chibar2 = 0.002						
Female-dominated	Coef.	Std. Err.	z	P>z	95% C.I.	
Constant	0.177	0.008	22.410	-	0.162	0.193
Between-family	0.077	0.030			0.036	0.166
Between-individual	0.332	0.009			0.315	0.349
Rho	0.051	0.040			0.009	0.188
LR test of between-family variance=0, Prob >= chibar2 = 0.098					0.098	
STEM	Coef.	Std. Err.	z	P>z	95% C.I.	
Constant	0.217	0.009	25.300	-	0.200	0.234
Between-family	0.075	0.035			0.030	0.189
Between-individual	0.363	0.009			0.345	0.381
Rho	0.041	0.039			0.005	0.190
LR test of between-family variance=0, Prob >= chibar2 = 0.140						

Notes: N (individuals): 1,915, N (mothers): 1364. Observations per mother: minimum:1, average: 1.4, maximum: 5. Empty models. Source: BHPS (2006-2008) and UKHLS (2010-2016).

(iv) Sibling gender ratio comparison: 4 categories instead of 3

I estimate the models in the main paper using an alternative coding of the sibling gender ratio. Results are consistent, shown in Table 5.

Table 5: Linear probability model estimated coefficients for the probability of aspiring to three occupational groups

	Male-dominated			Female-dominated		
	1	2	3	1	2	3
Female	-0.331***	-0.331***	-0.275***	0.206***	0.205***	0.208***
	(0.027)	(0.027)	(0.044)	(0.023)	(0.023)	(0.036)
Sibling composition variables:						
Sibling count, ref: no siblings						
One sibling	0.028	0.082	0.192*	-0.020	-0.005	-0.015
	(0.027)	(0.048)	(0.081)	(0.022)	(0.045)	(0.056)
Two siblings or more	0.005	0.055	0.157	-0.061*	-0.059	-0.033
	(0.036)	(0.058)	(0.101)	(0.028)	(0.050)	(0.067)
Sibling gender ratio, ref: no siblings						
Only brothers		-0.069	-0.145		-0.020	-0.015
		(0.048)	(0.085)		(0.046)	(0.057)
Only sisters		-0.046	-0.127		-0.013	0.004
		(0.048)	(0.082)		(0.047)	(0.057)
Mixed gender siblings		-0.044	-0.034		0.016	-0.042
		(0.064)	(0.120)		(0.059)	(0.068)
Gender/sibling composition interactions						
Sibling count, ref: male/no siblings						
Female x one sibling			-0.224*			0.022
			(0.090)			(0.083)
Female x two siblings or more			-0.204			-0.054
			(0.108)			(0.094)
Sibling gender ratio, ref: male/no siblings						
Female x only brothers			0.160			-0.011
			(0.090)			(0.086)
Female x only sisters			0.168			-0.033
			(0.092)			(0.086)
Female x mixed gender siblings			0.016			0.106
			(0.126)			(0.111)
Constant	-8.927	-5.517	-5.636	12.277	12.891	12.905
	(11.228)	(11.339)	(11.303)	(10.392)	(10.870)	(10.900)
N (observations)	2540	2540	2540	2540	2540	2540
N (individuals)	1131	1131	1131	1131	1131	1131

Notes: All models control for gender, age, year of survey, mother and father occupational characteristics, education and gender attitudes of parents and individual. Coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: BHPS (2006-2008) and UKHLS (2010-2016).*

Table 5 continued

	STEM		
	1	2	3
Female	-0.219***	-0.219***	-0.166***
	(0.025)	(0.025)	(0.039)
Sibling composition variables:			
Sibling count, ref: no siblings			
One sibling	0.006	-0.014	0.079
	(0.025)	(0.046)	(0.080)
Two siblings or more	-0.046	-0.064	-0.036
	(0.028)	(0.048)	(0.087)
Sibling gender ratio, ref: no siblings			
Only brothers		0.012	-0.034
		(0.046)	(0.081)
Only sisters		0.029	-0.010
		(0.045)	(0.081)
Mixed gender siblings		0.018	0.034
		(0.053)	(0.100)
Gender/sibling composition interactions			
Sibling count, ref: male/no siblings			
Female x one sibling			-0.192*
			(0.085)
Female x two siblings or more			-0.057
			(0.093)
Sibling gender ratio, ref: male/no siblings			
Female x only brothers			0.104
			(0.083)
Female x only sisters			0.092
			(0.085)
Female x mixed gender siblings			-0.021
			(0.103)
Constant	-20.501	-21.547*	-21.743*
	(10.548)	(10.801)	(10.787)
N (observations)	2540	2540	2540
N (individuals)	1131	1131	1131

Notes: All models control for gender, age, year of survey, mother and father occupational characteristics, education and gender attitudes of parents and individual. Coefficients not shown. Cross-sectional weights to correct for unequal selection probability and non-response bias included in all analyses. Standard errors are robust and clustered by individual, shown in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Source: BHPS (2006-2008) and UKHLS (2010-2016).*

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