Sibling similarity in education and employment trajectories in the UK: Same same, but different?

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Abstract

Young people's early education and employment careers hold profound implications for perpetuating or alleviating social inequalities across the life course. Considerable evidence indicates that family background, including dimensions like socioeconomic status and ethnicity, plays an instrumental role in shaping these trajectories. However, we have little understanding of how similar or different these trajectories are between siblings and which early adolescent experiences affect individual trajectories, after accounting for parental background. By using unique data from the UK Household Longitudinal Study which allows to follow siblings from adolescent years into their transition to adulthood, this paper explored which early adolescent experiences (10-15) influence differences in education and employment of siblings in late adolescence (16-19). Specifically, this study looks at the role of shared experiences, including parental background and family type, as well as individual experiences, such as personal educational aspirations, mental health, and wellbeing. On average, siblings were more likely to follow a similar trajectory regardless of the type of the trajectory compared to young people from similar parental background. Thus, siblings were more likely to stay in education or transition into labour market. However, they were also more likely to follow the more precarious pathway, highlighting the role of shared family background in perpetuating disadvantage. Family characteristics as well as siblings' compositional factors play an important role in shaping education and employment trajectories at ages 16-19 among siblings. After controlling for the shared parental characteristics, perceived family environment (e.g., parental support), adolescent educational aspirations and mental health are crucial predictors of education and employment trajectories.

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1. Introduction

What young people do after finishing compulsory education can affect their lifetime earnings and employment careers. Early experiences of precarious employment, unemployment, and inactivity, in particular, could have a harmful effect on young people's careers and lead to starkening of social inequalities throughout the life course (Dorsett & Lucchino 2014; Schoon & Lyons-Amos, 2016; Anders & Dorsett 2017; Pelikh & Rowe, 2022). There is considerable evidence that early education and employment trajectories are influenced by family background (e.g., social class and family type). To disaggregate family background effects, previous studies have examined differences in life course transitions between siblings. Evidence suggests that that, on average, siblings tend to exhibit greater similarity in their educational pursuits and employment trajectories compared to individuals coming from similar socio-economic backgrounds (Karhula et al., 2019). However, even after accounting for family background, disparities in outcomes between siblings persist, including differences in educational achievements (e.g., Grätz et al., 2021). Yet, our understanding remains limited regarding the factors responsible for driving these disparities, particularly in the context of early adolescent experiences. Additionally, the outcomes in these studies are usually measured as one-event-at-a-time (i.e., educational attainment or income at a specific age; with exception of Karhula et al., 2019) which can mask substantial differences in the processes leading to the outcomes.

The family of origin may affect early education and employment trajectories among siblings in various ways. Firstly, it is argued that young people's life choices, educational and career success are influenced by their parental background through the mechanisms of social stratification and structural constraints as well as through parenting strategies. This influence encompasses both the material aspects, such as parental wealth and resources, and the intangible aspects, such as values, attitudes, and expectations instilled by parents (Blau & Duncan, 1967; Lareau, 2003; Henderson, 2013; Mooyaart & Liefbroer, 2016, Keijer et al., 2018, Billari et al., 2019). Secondly, siblings themselves can mutually affect each other's life trajectories. Previous research has demonstrated that factors like family size, birth order, gender composition, and age differences between siblings contribute to shaping their early life course paths (Conger & Little, 2010; Lyngstad & Prskawetz, 2010; Raab et al., 2014; Bu, 2016; Karhula et al., 2019; Buyukkececi & Leopold, 2021; Her et al., 2022). Furthermore, the quality of relationships between siblings could also explain similarity in their behaviours (McHale et al., 2012; Yucel & Yuan, 2015,2016; Her et al., 2021). Thirdly, families undoubtfully have an effect on shaping children's own aspirations and expectations in life (Berrington et al., 2016; Brons et al., 2017; Berrington, 2020). Nevertheless, what remains less explored is the impact of individual agency, personality traits, and other unique factors that may apply to one sibling but not necessarily to another sibling in the context of their educational and career journeys (Her et al., 2021; 2023). For example, one sibling might opt not to pursue a university education, while another chooses to continue education. Similarly, one of the siblings might experience lower mental health and wellbeing compared to the other. These examples demonstrate that by focusing exclusively on the family-level characteristics, we might be overlooking the importance of individual factors that shape early life course trajectories among siblings.

This paper contributes to the literature by exploring the influence of a range of early adolescent experiences (10-15) on education and employment trajectories of siblings in late adolescence (16-19). Specifically, this study looks at the role of shared experiences, including parental background and family type, as well as individual experiences, such as personal educational aspirations, mental health, and wellbeing. By looking at trajectories over a 3-year period, this study aims to provide a more comprehensive understanding of the transitions that occur from the age of 16 onwards and to

pinpoint groups that may be marginalized or face particular challenges. Strengthening knowledge in this field is crucial for designing policies to support young people to manage the impacts of adverse early adolescent experiences, such as parental separation or poor mental health.

By using unique data from Understanding Society (UK Household Longitudinal Study) which allows us to follow siblings from adolescent years into their transition to adulthood, this paper explores which factors influence differences in education and employment trajectories between siblings. Using a longitudinal life course perspective, it will address three research questions: How similar are education and employment trajectories at ages 16-19 between siblings? (RQ1) What is the contribution of compositional factors and parental background characteristics in shaping the education and employment trajectories at ages 16-19 among siblings? (RQ2) How are the education and employment trajectories at ages 16-19 among siblings shaped by individual early adolescent experiences? (RQ3) We applied a combination of sequence and cluster analyses to describe education and employment trajectories between the ages of 16 and 19. We then compared the outcomes between siblings and conditionally assigned unrelated dyads from similar parental backgrounds to examine the contribution of compositional factors and parental characteristics in explaining the observed differences. Finally, we performed regression analyses on an individual level using the sample of siblings to explore the extent to which trajectories among siblings are shaped by individual early adolescent experiences.

2. Theoretical background

2.1 Shared family experiences

Parental education and resources are traditionally seen as the strongest predictors of children's educational and occupational outcomes. High-SES parents possess essential financial, social (i.e., networks) and cultural (i.e., parenting styles and involvement in children's education) capital which enable them to provide comprehensive support for their children's educational and developmental needs (Blau & Duncan, 1967; Lareau, 2003; Henderson, 2012; Sironi et al., 2015; Mooyaart & Liefbroer, 2016, Keijer et al., 2018, Billari et al., 2019). Additionally, high-SES parents are more likely to pass on elevated educational aspirations, often as a means of preserving family wealth, in contrast to low-SES families (Goldthorpe, 1996, Wiik, 2009). Consequently, children from high-SES and low-SES backgrounds tend to cultivate different intentions about their future life course decisions. For example, children of high-SES parents are likely to prioritise continuing education over early labour market entry (Berrington et al., 2016; Mooyaart & Liefbroer, 2016, Brons et al., 2017, Keijer et al., 2018). Existing evidence indeed suggests that young people from advantaged backgrounds are more inclined to follow in their parents' footsteps follow leaving the parental home to pursue higher education (De Jong Gierveld et al., 1991; Holdsworth, 2004; Patiniotis & Holdsworth, 2005). This path is associated with subsequent benefits, including higher returns on their educational investments and a smoother transition into the labour market, ultimately contributing to greater financial stability in the future. Conversely, the lack of comparable support for young individuals from less privileged backgrounds may result in lower educational and career ambitions, potentially leading to an earlier and more turbulent entry into the labour market.

Another factor that might affect how siblings fare in their transitions to adulthood is family type. With the increasing prevalence of divorce in developed nations, there is a growing argument that parental separation not only leads to a reduction in financial resources but is, in itself, a distressing event that can adversely impact children's well-being and future life chances (Amato, 2000; Waldfogel et al., 2010; Kiernan & Mensah, 2010; McLanahan, 2004, Härkönen et al., 2017). According to the "diverging

destinies" argument (McLanahan, 2004), children of highly-educated mothers are more likely to grow up in two-parent households with greater available resources, including both parental time and financial support. In contrast, children of mothers with lower levels of education, who often face challenges in accessing the job market, are more inclined to be raised in single-parent households characterized by financial constraints, thereby exacerbating the potentially detrimental effects on children's outcomes.

2.2 Sibling similarity

Research on sibling similarity in various behaviours has extensively discussed the roles of the birth order and family size, especially in relation to the educational outcomes. It has been shown empirically that first-borns are more likely to achieve higher educational achievements compared to later-born siblings (Black et al., 2005; Behrman & Taubman, 1986; Kalmijn & can de Werfhorst, 2016; Lehmann et al., 2018; Isungset et al., 2022). One of the most common explanations for this phenomenon is related to the "resource dilution" model (Blake, 1981; Downey, 2001), according to which a higher number of siblings limits the amount of parental resources to be distributed among siblings, resulting in less favourable outcomes for later-born children. Age gap and sex composition could also define siblings' similarities when they are growing up, with siblings born closer to each other and being of the same sex more likely to follow each other's behaviour during the transition to adulthood (Bu 2016; Raab et al., 2014; Her et al., 2022,2023). Apart from these quantifiable sibling characteristics, the quality of the relationship between siblings could also shed light on the observed similarities or differences between them. Intuitively, we can expect that siblings with higher quality/warmer relationships might be more prone to affect each other's life decisions and be more similar, whereas those with lower quality and higher prevalence of conflict and aggression towards each other, on the contrary, might have divergent experiences, especially during the transition to adulthood (McHale et al., 2012; Her et al., 2021).

2.3 Individual early adolescent experiences

Besides shared family experiences and sibling factors, individual early adolescent experiences may also play a role in explaining young people's education and employment trajectories. Thus, siblings may have different expectations and aspirations in life despite coming from the same family background. For example, siblings characterized by a conscientious personality style, denoting a high degree of careful planning and competence, may navigate life transitions in a more structured and organized manner (Conger & Little, 2010; Her et al., 2023). They might prefer to continue education or get a professional qualification straight after compulsory school. In contrast, individuals with a less planful disposition might embark on less linear trajectories. Siblings may also have varying degrees of closeness with their parents and could experience differing levels of familial support, potentially influencing their life choices and career paths. Furthermore, individual mental health and well-being may vary among siblings and can have significant impacts on their future educational and occupational trajectories. Therefore, while there is some evidence linking adolescent mental health and well-being to educational attainment and adverse early labour market outcomes (as seen in von Simson et al., 2022; Rodwell et al., 2018), there exists a gap in understanding the longitudinal educational and employment routes leading to these outcomes and how they interact within diverse family environments.

2.4 Transition to adulthood in the UK

Traditionally, in Britain, the transition to adulthood was seen to be heavily influenced by one's socio-economic background (Cavalli & Galland, 1995; Bynner, 2001, 2005). Young individuals from less privileged backgrounds often experienced rapid school-to-work transitions, coupled with early family formation patterns (referred to as the "fast-track" pathway). Conversely, those from more advantaged backgrounds typically followed their parents' footsteps into higher education, embarking on prolonged pathways to adulthood (termed the "slow-track" pathway). The existence of "fast-track" pathways can be traced back to the historical demand for unskilled youth in labour-intensive industries in Britain. This demand allowed young individuals to enter the labour market directly after completing compulsory schooling, without the need for additional qualifications (Ashton et al., 1990; Maguire & Maguire, 1997). However, economic shifts toward highly technological service industries have made it increasingly challenging for young individuals to transition directly from school to work without acquiring additional qualifications.

In response to these shifts, the rate of participation in education in Britain has gradually increased since the early 1980s. Despite the introduction of university tuition fees in 2006–07 and 2012–13, a new government funding system implemented in 2004 (effective from 2006–07) abolished the upfront payment system designed to support individuals from less advantaged backgrounds. Consequently, the national participation rate among young individuals from lower socio-economic backgrounds has substantially increased, although it still lags behind that of their more advantaged counterparts (Lymperopoulou & Parameshwaran, 2015; Murphy et al., 2019). Additionally, young people undergoing the transition to adulthood over the past two decades have faced economic and housing crises, as well as the introduction of austerity measures. These factors have led to increased economic precarity, especially among less privileged young people, with higher rates of unemployment, limited housing affordability, and reductions in welfare benefits (MacDonald, 1997; Furlong & Cartmel, 2006; Stone et al., 2011, 2014; Furlong et al., 2017).

The growing complexity and turbulence in early educational and employment pathways among recent cohorts in the UK have been previously discussed in the literature (Dorsett & Lucchino 2014; Schoon & Lyons-Amos, 2016; Anders & Dorsett 2017; Pelikh & Rowe, 2022). However, there is a limited understanding of how family factors influence these trajectories in an era of heightened uncertainty and whether siblings are similarly affected and share each other's pathways. We address the following research questions in this paper:

RQ1: How similar are education and employment trajectories (EET) at ages 16-19 between siblings?

RQ2: What is the contribution of compositional factors and parental background characteristics in shaping the EET at ages 16-19 among siblings?

RQ3: How are the EET at ages 16-19 among siblings shaped by individual early adolescent experiences?

3. Data and analytical strategy

3.1 Data

We used data from the UK Household Longitudinal Study (UKHLS, also known as Understanding Society; University of Essex, Institute for Social and Economic Research, 2022). UKHLS is a nationally representative household survey which started in 2009 and sampled approximately 40,000 households in the United Kingdom at Wave 1, including a boosted ethnic minority sample. The study contains detailed information on a wide range of socio-demographic and health characteristics, including partnership histories, changes in education and employment, and attitudinal data. 12 waves of data were available at the time the analyses were conducted. In the subsequent waves, the sample includes all adults who were part of the households recruited in Wave 1. This includes individuals who may have moved out of their original households but who were followed to a new household. Therefore, the study allows us to follow siblings from the same household longitudinally, even after they leave the parental home. Members of households between the ages of 10 and 15 are invited to fill out a youth questionnaire ('Youth Panel'), covering topics like personal values and attitudes, wellbeing, family relationships, and future expectations. When individuals reach the age of 16, they become eligible for their first adult interview ('rising 16s'). On average, a significant proportion of 15-year-olds in the sample, ranging from 75% to 89%, transition into the adult sample after reaching 16. Notably, the vast majority (98%) of these individuals have participated in the Youth Panel at least once, as documented by Pelikh (2019). By linking the Youth Panel and the adult main dataset, the study will use a range of unique variables available in UKHLS (e.g., own educational aspirations and household characteristics), as well as the ethnic-minority boost, to understand multiple predictors driving differences in school-to-work trajectories between siblings. In addition, the unique method of data collection enables the use of information reported by both parents and children in the same household, which is beneficial for building a picture of the experiences of those within the household, compared to studies in which only parents report children's mental health and wellbeing.

3.2 Analytical strategy

To assess the similarity in EET at ages 16-19 between siblings (RQ1) and examine the contribution of compositional factors and parental background characteristics in shaping the trajectories (RQ2), we constructed two analytical samples. The first sample consists of sibling dyads. To assess whether siblings are more similar to each other in terms of their education and employment trajectories than unrelated young people sharing similar parental backgrounds, we constructed the second sample by matching each of the siblings in the sibling dyad to an unrelated young person conditional on sharing three socio-demographic characteristics (maternal education, family type, and ethnicity). This sample includes individuals who did not have a sibling for comparison but met the criteria to be considered for matching sample. We refer to this sample as the sample of 'unrelated dyads'. A more detailed description of the sample selection follows in section 3.2.2.

We then employed a combination of sequence and cluster analysis to create a typology of education and employment trajectories at ages 16-19. We used the similarity of sequences in a dyad, i.e., whether both individuals in a dyad followed similar post-16 education and employment trajectories measured by belonging to the same cluster, as a binary outcome in the regression analysis, focusing on comparing sibling dyads to unrelated dyads. To explore the extent to which the trajectories are similar or different and in which ways, we looked at the combination of clusters in a dyad (i.e., going beyond the binary outcome and distinguishing between the potential combinations: for example,

"both people in the dyad stay in education", "one person stays in education, another one enters the labour market", "both enters the labour market"; full description will follow in section 5.1) and used it as an outcome in the multinomial regression analysis. We also examined the contribution of compositional factors (age difference and gender composition) and parental characteristics, to differences in trajectories between and within sibling dyads in comparison to unrelated dyads.

Finally, to explore the extent to which trajectories among siblings are shaped by individual early adolescent experiences (RQ3), we employed a series of regression models on an individual level using a sample containing only siblings. In the following sections, we explain in detail how we created the analytical samples and describe the methods used.

3.2.1 Sibling sample selection

Firstly, we identified all sibling dyads enumerated in Understanding Society using the Family Matrix (N=44,461). We then excluded dyads in which one or both siblings did not fill out the Youth Panel questionnaire completed at ages 10-15 (N=38,136)[2]. Next, we excluded dyads in which we did not have the complete information on both siblings' economic activity status between ages 16 and 19 (N=5,087), leaving 1,238 sibling dyad pairs in which both siblings were interviewed as adolescents and for whom we had available information on their economic activity status between ages 16 and 19. To be able to link early family circumstances shared between siblings we additionally excluded step, adopted and foster siblings (N=24) as well as those with missing parents' IDs (N=5). Finally, we also excluded three pairs in which one of the siblings was born in 2003 as this birth cohort mostly has not reached the age 19 by the end of the observation period in wave 12. The final analytical sample comprised of 1,983 individuals born 1993-2002 from 926 families. Two to four siblings in these families met the sample selection criteria, corresponding to 1,206 sibling dyads.

To illustrate the sample selection in more detail, Table 1 below shows an example of a sibling composition in a family which contains both siblings who were included in the analysis and who did not meet the selection criteria. Four siblings in this family form six sibling dyads which would be considered for inclusion in the analytical sample. Panel a) on Table 1 presents information on whether each sibling in the family meets the selection criteria of being interviewed aged 10-15 in the Youth Panel having information available on their economic activity status between age 16 and 19 (after they transitioned to the adult/main stage survey). Sibling 1 and Sibling 2 are the only siblings that meet the eligibility criteria for this study at the time 12 waves of Understanding Society were available. Panel b) presents all possible combination of sibling dyads in this family specifying whether they meet the selection criteria of this study. Only one pair of siblings from this family (Sibling 1 – Sibling 2) would be included in the analysis, with two more pairs (Sibling 1 – Sibling 3; Sibling 2 – Sibling 3) having a potential to join the study when Sibling 3 turns 19 in the future waves (conditional on availability of information on their economic activity status for ages 16-19).

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[2] One of both siblings in the excluded pairs were mostly already not eligible for the interview in the Youth Panel when first joined the study (i.e., aged 16 and above) as Pelikh (2019) has shown that around 98% of adolescents who transitioned to the main adults' sample ('Rising 16s') have completed the Youth questionnaire at least once at ages 10-15.

Table 1. Example of a family with siblings who met the sample selection criteria and their sibling counterparts who did not meet the selection criteria and were not included in the analysis

a) Family composition

Family X	Year of birth	Interviewed aged 10-15 in Youth Panel (Yes/No)	Information on economic activity status available for ages 16-19 (Yes/No)
Sibling 1	1995	Yes	Yes
Sibling 2	1998	Yes	Yes
Sibling 3	2004	Yes	No
Sibling 4	1991	No	Yes

b) Sibling dyads

Sibling dyads	Included in the sample (Yes/No)
1. Sibling 1 – Sibling 2	Yes; included in the sample
2. Sibling 1 – Sibling 3	No; but could join the sample in the future when Sibling 3 turns 19*
3. Sibling 1 – Sibling 4	No; Sibling 4 was not eligible for YP** interview
4. Sibling 2 – Sibling 3	No; but could join the sample in the future when Sibling 3 turns 19
5. Sibling 2 – Sibling 4	No; Sibling 4 was not eligible for YP interview
6. Sibling 3 – Sibling 4	No; Sibling 4 was not eligible for YP interview

Source: own design.
Note: * conditional on availability of information on their economic activity status for ages 16-19.
** 'YP' stands for Youth Panel.

Following the logic in the example in Table 1, in the 926 families included in the analytical sample, there is a total of 3,789 sibling dyads, including 1,206 comprised in the analytical sample. Table 2 below presents detailed information on the numbers of sibling dyads not in the included in the sample (N=2,583) and the reasons for exclusion. The listed reasons might not be mutually exclusive as step, adopted or foster sibling dyads (N=123; 3.2%) could also have been excluded for other reasons (i.e., data availability or panel attrition). The largest group of sibling dyads not included in the sample (N=1,295; 34.2%) involves younger cohorts born after 2002 who have not reached age 19 by the end of the observation period suggesting that the analytical sample could be enhanced when more waves of data become available. The second-largest excluded group is comprised of sibling dyads in which one of the siblings was not interviewed in the Youth Panel as they joined the study as adults aged 16 and over (N=777; 20.5%). The last two groups contain dyads in which either one of the siblings did not make the transition to the adult/main stage of UKHLS despite being interviewed at ages 10-15 (N=296; 7.8%) or one of both siblings did not make the transition to the adult/main stage of UKHLS and were not interviewed in the Youth Panel (N=116; 3.1%).

Table 2. Sibling dyads in 926 families in the analytical sample, which were not included in the analysis, by reason for exclusion

Type of reason	N	%	Reason for exclusion
1) Study design	123	3.2	Step, adopted, or foster siblings
2) Data availability	1,295	34.2	One or both siblings were born after 2002 and have not reached age 19 by Wave 12; could join the sample in the future
3) Data availability	777	20.5	One of the siblings was not interviewed in Youth Panel, but information on economic activity status is available for ages 16-19 for both siblings (includes older cohorts who were not eligible for Youth Panel interview when enumerated, i.e. aged 16 and over and a small number of those who did not fill out the questionnaire at ages 10-15 despite being eligible)
4) Panel attrition	296	7.8	One of the siblings did not transition to the adult/main stage of UKHLS ('Rising 16s'), but both were interviewed in Youth Panel
5) Data availability/panel attrition	116	3.1	One or both siblings were not interviewed in Youth Panel, and one or both were not followed into the main stage of UKHLS ('Rising 16s')
Total (n) of sibling dyads not included in the analytical sample	2,583	68.2	
Total (n) of sibling dyads included in the analytical sample	1,206	31.8	
Total (n) of sibling dyads in 926 families in the study	3,789	100	

Source: UKHLS, Waves 1-12; own calculations.

To contextualise the socio-demographic characteristics of sibling dyads included in the analysis, Table 3 presents information on maternal education, family type, ethnicity, and mean age gap for sibling dyads included in the analysis vis-à-vis the sibling dyads which did not meet the sample selection criteria. Step, adopted, and foster sibling dyads were excluded from the frequencies (N=123; 3.2%). As expected, due to the data availability, siblings included in the sample were more closely spaced (mean age gap of 2.6 years) compared to those who were not eligible for the analysis (mean age gap 7.0 years). Parents of siblings included in the analysis were more likely to be living together, with a higher proportion of mothers who achieved a high educational level. The sample included in the analysis was less ethnically diverse, with over 70% of sibling dyads from White British origin.

Table 3. Socio-demographic characteristics of sibling dyads included and excluded from the analytical sample

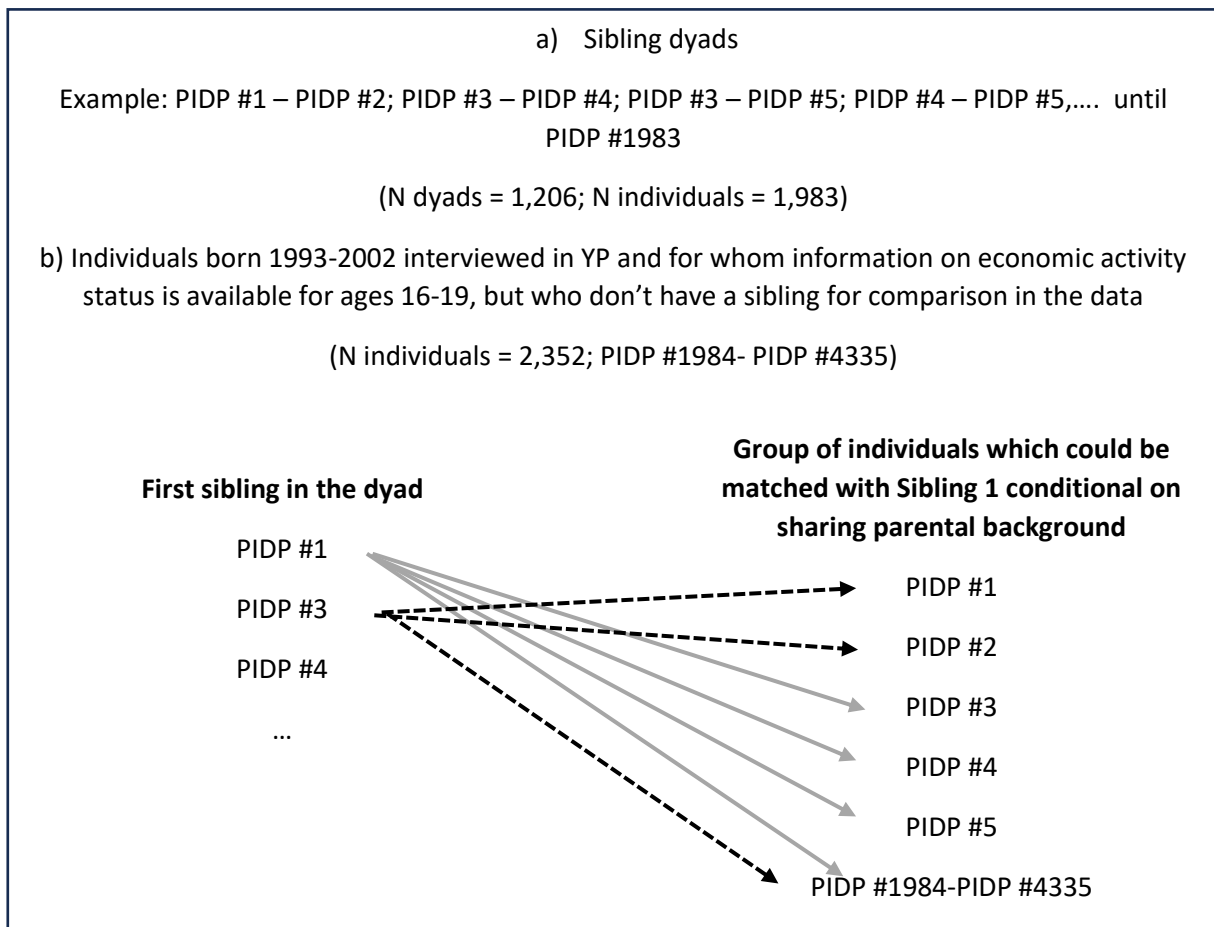| Socio-demographic characteristics	Sibling dyads not included in the analytical sample	Sibling dyads included in the analytical sample	All
Maternal education			
Degree/other higher	725	518	1,243
%	29.4	43.0	33.9
Medium/A-level etc	506	265	771
%	20.6	22.0	21.0
Low (GCSE/School)	1,229	423	1,652
%	50.0	35.1	45.1
Family type			
Parents together	1,262	812	2,074
%	51.3	67.4	56.6
Parents separated before any of the siblings in a dyad reached age 15	1,198	394	1,592
%	48.7	32.6	43.4
Ethnicity			
White British	1,234	855	2,089
%	50.2	70.9	57.0
Mixed or Other*	274	92	366
%	11.1	7.6	10.0
Indian/Pakistani/Bangladeshi	766	207	973
%	31.1	17.2	26.5
Black	186	52	238
%	7.6	4.3	6.5
Mean age gap between siblings, years (sd**)	7.0 (4.4)	2.6 (1.5)	5.6 (4.2)
Total	2,460	1,206	3,666
	100	100	100

Source: UKHLS, Waves 1-12; own calculations*.*

Note: *'Mixed' refers to dyads where both siblings identify themselves as Mixed or where siblings reported discordant ethnicity (i.e. White British and Mixed). ** 'sd' stands for standard deviation.

3.2.2 Matched sample

In order to balance out the differences in parental background traits among sibling dyads and unrelated dyads, we implement a conditional assignment method. This approach involves pairing two individuals together based on their shared parental background characteristics, as illustrated in the lower panel of Figure 1, to create unrelated dyads.

Figure 1. Illustration of matching using the conditional assignment method

a) Sibling dyads

Example: PIDP #1 – PIDP #2; PIDP #3 – PIDP #4; PIDP #3 – PIDP #5; PIDP #4 – PIDP #5,…. until PIDP #1983

(N dyads = 1,206; N individuals = 1,983)

b) Individuals born 1993-2002 interviewed in YP and for whom information on economic activity status is available for ages 16-19, but who don't have a sibling for comparison in the data

(N individuals = 2,352; PIDP #1984- PIDP #4335)

First sibling in the dyad

PIDP #1
PIDP #3
PIDP #4
…

Group of individuals which could be matched with Sibling 1 conditional on sharing parental background

PIDP #1
PIDP #2
PIDP #3
PIDP #4
PIDP #5
PIDP #1984-PIDP #4335

Source: own design.

To create the sample of unrelated dyads through conditional assignment, each sibling is matched with an unrelated individual conditional on sharing the same combination of three socio-demographic background characteristics: maternal education: low, medium, and high; family type: parents separated or together; and ethnicity: White British; Mixed; Indian/Pakistani/Bangladeshi; Black. This produces 24 (3×2×4) possible combinations for matching. The matching is performed in two stages. Firstly, we treat Sibling 1 as the first dyad member (for example, PIDP #1, see Figure 1) and match it with a group of individuals born 1993-2002 interviewed in YP and for whom information on economic activity status is available for ages 16-19. This group consists both of individuals who are part of the sibling sample, but are unrelated to Sibling 1 (in case of PIPD #1 these would be PIDP #3, PIPD #4, PIDP #5) and those who are not part of the sibling sample (i.e., only children or those whose siblings did not meet the sample selection criteria; N=2,352, PIDP #1984-#4335 on Figure 1, panel b). Table A1 in the Appendix contains socio-demographic characteristics of young people born in 1993-2002, who were interviewed in YP and for whom information on economic activity status is available for ages 16-19, including those part of the sibling sample and those who did not have a sibling for comparison (PIDP #1984- PIDP #4335 in Figure 1, panel b).

The matching generated a total number of 763,333 unrelated dyads, duplicates excluded. Each sibling in the sibling dyads is matched at least six times to an unrelated young person sharing the same socio-demographic background characteristics. Hence, six iterations of a sample (N=3,189 dyads) containing sibling dyads (N=1,206) and conditionally assigned unrelated dyads can be possible (N=1,983). This

conditional assignment effectively balances out the potential variability in observed parental background traits between sibling dyads and unrelated dyads. We will also investigate how similarity in education and employment trajectories at ages 16-19 is related to these characteristics using the regression analysis.

4. Methods

4.1 Sequence analysis

We employed sequence analysis to describe the education and employment trajectories at ages 16-19 among young people who were born in 1993-2002, who were interviewed in YP and for whom information on economic activity status is available for ages 16-19. In UKHLS, all economic activity states could be reported retrospectively since the last interview (up to 9 spells in some waves), providing the opportunity to create employment and education histories for individuals who might have missed some waves. Only spells reported as primary economic activity were taken into consideration.

Sequence analysis was performed on the sample described in section 3.2.2 which contains individuals who are part of the sibling sample and those who did not have a sibling for comparison but met the criteria to be considered for matching. In essence, sequence analysis considers individual life course as a chronologically ordered string of states. In our case, these are economic activity states experienced by young people between ages 16 and 19. The method aims to find comparable sequences of transitions between different states (such as, for example, transitioning from being a student to being employed full-time or transitioning from part-time employment to full-time employment) by measuring their dissimilarity and identifying a minimal cost through which the two sequences can be made more similar, based on optimal matching techniques. These techniques utilize insertion/deletion (indel) or substitution operations to determine the level of dissimilarity between sequences (Abbott 1995). Subsequently, the dissimilarity between each individual's trajectory is computed and utilized within a clustering algorithm to define representative trajectory categories.

Our study focused on individuals aged 16 who were in full-time education (completing secondary school) at the beginning of the observation period. Over time, we distinguished between seven economic activity states that young people could transition through: full-time employment (≥30 hours), part-time employment (<30 hours), full-time student (including a small portion involved in governmental training), unemployment, economic inactivity (comprising those engaged in family care, sick, or disabled), parental leave, and self-employment (including cases from the UKHLS where working hours were unspecified).

To calculate the dissimilarity between individual trajectories, we applied the Dynamic Hamming Distance (DHD) measure. DHD accounts for the timing of transitions and produces a pairwise dissimilarity matrix among individuals (Lesnard, 2010). It achieves this by using time-varying substitution operations, which are derived from the transition rates between states in each month obtained from the real data. These substitution costs are then employed to estimate a dissimilarity matrix encompassing all individuals in our sample.

In the next stage, the resulting dissimilarity matrix is employed in a clustering algorithm to generate representative trajectories. To determine an appropriate number of clusters, we adopted a two-stage approach. First, we scrutinized dendrograms generated through the application of Ward's hierarchical clustering algorithm to identify natural breakpoints in the data (see Figure 1A in the Appendix). Second, we computed the Studer et al. (2011) discrepancy measures for a range of sequences, namely

pseudo F and pseudo R^2, to compare the quality of different cluster solutions (see Table A2 in the Appendix). Based on the distance, size, and discrepancy parameters of these cluster solutions, we chose a four-cluster solution presented in the results section. A five-cluster solution suggested splitting the cluster which groups together individuals who spent a considerable amount of time out of the labour force from those who were unemployed. Although these groups are substantively different, they signal the least favourable outcome associated with turbulent economic activity after finishing compulsory education, and for the purposes of our analysis were grouped together.

4.2 Regression analysis

Having categorized individual education and employment trajectories at ages 16-19, we employed a combination of binary and multinomial logistic regression techniques for two primary objectives. First, we aimed to explore the extent of similarity or dissimilarity and the manner in which these trajectories differed between siblings when compared to conditionally assigned unrelated dyads. We represented our distinctive trajectories as a categorical variable and employed binary regression to examine whether they belonged to the same cluster as an outcome variable. To explore in which way the trajectories are similar or different and how they are affected by parental characteristics and siblings' composition, we utilized the combination of clusters within a dyad as an outcome variable in the multinomial regression analysis. We specified standard errors to be clustered on a family level. For unrelated dyads, a parental identifier[3] for the member of a sibling sample served as a family identifier. Second, we utilized multinomial logistic regression to explore how various individual adolescent experiences, such as educational aspirations, family dynamics, and mental health, were linked to the likelihood of following specific school-to-work pathways. Education and employment trajectories at ages 16-19 served as our outcome variables for this analysis and standard errors were clustered on a family level. For robustness checks, we also performed a regression analysis with family fixed effects, to isolate individual experiences from the influence of shared parental background. Each pathway served as an independent single outcome in these models.

4.3 Independent variables
4.3.1 Parental socio-demographic background

We used three characteristics to capture the parental socio-demographic background, which we employed to answer all three research questions. We chose to utilize maternal education as a measure of the family's socio-economic context for several reasons. Firstly, around 21% of our sample lacked paternal identification, and an additional 10% of parents had separated before their children reached the age of 15. In almost all cases (99%), children resided with their mothers. Therefore, incorporating information on the father's educational level would only be applicable to approximately two-thirds of our sample and may not significantly enhance the accuracy of capturing the parental background.[4] Furthermore, there are compelling reasons to believe that maternal education and her involvement in her children's education exert a more substantial influence on their educational outcomes than paternal education (for examples and mechanisms see Dollaghan et al., 1999; Magnuson et al., 2009; Harding et al., 2015). We categorized maternal education into three groups: low (comprising compulsory school education, GCSE, or equivalent), medium (A-levels or equivalent), and high (degree

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[3] Mother's ID was used as parental/family identifier in most cases as 21% of the sample had a missing father's ID. In single father's families (~1%), father's ID was used as parental/family identifier.
[4] We acknowledge that having a highly educated stepfather could influence children's outcomes, however, investigating the influence of stepparents' socio-demographic characteristics on children's educational outcomes is beyond the scope of this paper.

or other higher). During the modelling phase, we merged the medium and low categories into a single category – less than higher – since the results for children with mothers falling into these two educational groups were comparable.

To determine family type, we utilized the Marital and Cohabitation Histories dataset provided by Understanding Society (University of Essex, Institute for Social and Economic Research, 2023). When parents had separated before both siblings in a dyad reached the age of 15, we coded the family type as "separated."

To capture the experiences of children of mixed backgrounds more accurately, we employed ethnicity information collected directly from the children. We grouped these categories into four broader categories: White British, Mixed and Other, Black, Indian/Pakistani/Bangladeshi. While we acknowledge that such grouping might obscure significant differences within these categories, the study's design constraints prevented us from further disaggregating these groups. However, our additional sensitivity analysis, which explored subgroups within the "Indian/Pakistani/Bangladeshi" category, provided similar results for these subgroups (results available upon request). Due to limitations in sample sizes, we also had to merge the "Mixed and Other" and "Black" groups in our regression analysis. We did not attempt to interpret findings for this combined group as it represents a diverse array of ethnicities without a clear and coherent identity. Therefore, our primary focus was on the larger and more distinct ethnic groups.

4.3.2 Sibling composition

In order to examine how the composition of siblings contributes to explaining the similarities in education and employment trajectories at ages 16-19, we used information on sibling sex composition (whether they are of the same sex or mixed), age gap less than two years, two to three years, or more than four years), sibship size[5] (two, three, four or more sibling in a family) and birth order (first, second, third or higher). These characteristics were found to play a crucial role in explaining sibling similarities across various life course trajectories, including educational aspirations and outcomes (e.g., Bu 2016, Grätz et al., 2021). Moreover, we took into account the composition of the cohort (1993-1997 and 1998-2002) in which siblings belonged, in order to address potential variations caused by changes over time that might have affected some siblings but not others, such as fluctuations in the labour market. We also controlled for the twin status in the sibling dyad (71 pairs, 5.9% of the sample).

Additionally, we used information on the quality of sibling relationships collected in the Youth Panel. Children were asked a series of questions that began with: "How often do any of your brothers or sisters do any of the following to you at home?". These behaviours included "hit, kick, or push you", 'take your belongings", "call you nasty names" and "make fun of you". Respondents could select between four response categories: "never", "not much (1–3 times in the last 6 months)", "quite a lot (more than 4 times in the last 6 months)", "a lot (a few times every week)". Following these questions, children were also asked whether they themselves engaged in bullying behaviour towards their siblings. The same set of behaviours and response categories was used for these questions. We used a binary variable to identify siblings who responded "a lot" to any of these questions as potentially experiencing sibling conflict. Additional sensitivity analyses, including separate variables for sibling victimization and sibling bullying, as well as using a continuous scale variable instead of categorical

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[5] To create the sibship size and birth order variables, we used information from mothers' fertility histories (and fathers' in case of single father households) collected in Waves 1 and 6 of Understanding Society to capture information on older siblings who were not enumerated in the study.

ones, did not yield further insights into our research questions (detailed results are available upon request).

4.3.3 Family environment

Family environment was captured through a range of questions asked in both children and parents. Children were asked about the quality of their relationship with their parents and the level of parental interest and support in their education. For the family support question, we categorized responses into two groups: "feeling supported in most or all aspects" and "feeling supported in some areas or not feeling supported" (combining the latter two due to the low occurrence of the "not feeling supported" answer). We also utilised information on the frequency of conflicts with either the mother or father and how often they engaged in conversations with their parents about significant matters. These variables were coded as occurring at least once per week or less than once per week. Additionally, we used information on how often parents expressed interest in their children's school performance and how frequently they attended parent's evenings at school. We categorized these responses into two groups: "always or nearly always" and "less than always."

For parents, we explored their educational attitudes by assessing how important it was to them that their children completed A-levels (or Highers, in the case of Scotland). We classified responses into four categories following the Berrington et al. (2016) approach: at least one parent stating it was "very important," at least one parent considering it "important," at least one parent believing it was "not important," or "not known" (when neither parent responded). It's worth noting that due to our study's design and the data collection pattern for this question (which was asked in odd waves only for parents of children under 15), nearly 30% of parents were not asked this question. We are therefore cautious in interpreting the results for this category. Furthermore, we used parental answers on the frequency with which they helped their children with homework and coded it into two groups: helped on at least a weekly basis or less than weekly.

4.3.4 Educational aspirations, mental health and wellbeing

To measure adolescent educational aspirations, we data on whether adolescents expressed a desire to pursue further full-time education at a college or university after completing their current level of schooling. If their response was "yes," we categorized it as "intends to continue education," while all other responses were categorized as "no intention to continue education".

To capture adolescent mental health, we used the Strengths and Difficulties Questionnaire (SDQ) (Goodman et al., 1998). We used scores from four dimensions of SDQ: emotional symptoms, conduct problems, hyperactivity, and peer relationship problems. Each dimension was scored on a scale from 1 to 10. To identify individuals potentially experiencing issues in each of these domains, we used a cutoff at the 90th percentile of the scale scores, a method established by Goodman et al. (1998) and previously employed by various studies including He et al. (2012) and Smith et al. (2021). To capture adolescent wellbeing, we used data on life satisfaction, measured on a 7-point scale ranging from 1 (indicating very satisfied) to 7 (indicating very dissatisfied). To represent low wellbeing, we reverse-coded the scale and created a binary outcome, identifying individuals with scores below 4.

Since some of the individual variables were repeatedly measured for those aged 10-14 in Wave 1 of the Youth Panel, we selected data collected at age 15 (approximately for 80% of the sample) or the closest available age. In line with findings from Croll (2010) and Berrington et al. (2016), we observed that the percentage of individuals expressing an intention to continue their education increased with age, while the proportion reporting low wellbeing also rose with age, consistent with the findings

reported by Knies (2022). To account for these age-related effects, we introduced an additional variable capturing the age at the time of the last interview.

Additionally, in our individual-level analyses, we included the country of residence (England, Wales, Scotland, Northern Ireland) to account for potential structural factors that could influence the educational and employment trajectories of young people. Table A5 in the Appendix contains details on descriptive statistics for each variable used in the individual-level analyses (apart from the information on maternal education, family type, ethnicity, sex, and birth cohort, which are already presented in Table A1 in the Appendix).

5. Results

First, we describe the education and employment trajectories at ages 16-19 among siblings in the sample and individuals identified for matching (sample described in section 3.2.2). Next, we discuss whether trajectories are more similar or different, and in which way, between sibling dyads compared to conditionally assigned unrelated dyads sharing similar parental background. We also present the contribution of compositional factors (i.e., age difference and gender composition) and parental characteristics, to differences in trajectories between and within sibling dyads, in comparison to unrelated dyads. Finally, we analyse the influence of individual early adolescent experiences on 16-19 education and employment trajectories among siblings using a series of regression models on an individual level.

5.1 How similar are education and employment trajectories at ages 16-19 between siblings? (RQ1)

Table 5 provides a summary of the number of months spent in each state in four distinctive clusters describing educational and employment trajectories at ages 16-19 which were identified through sequence analysis, together with the cluster size. Table 5 refers for all individuals in the sibling sample (as discussed in section 3.2.1) and in the matching sample (as discussed in section 3.2.2). The largest cluster "in education" (44.7%) refer to young people continuously in education between ages 16 and 19. "Turbulent" cluster describes the trajectories among young people who struggled to establish themselves in the labour market after finishing education, experiencing short spells of employment (less than four months, on average; Table 5), but largely being unemployed (around 6 months in total; Table 5) or out of labour force (around 3 months in total Table 5). Despite the heterogeneity in the age at which young people have left education, this cluster signals a precarious pattern of not being able to make a stable transition to labour market which could have long-term negative effect on young people's careers. The two remaining clusters refer to young people who transitioned into the labour market either via a full-time employment (12.1%) or part-time employment (20.2%) route. These clusters could be different as transition to part-time employment might be masking a more turbulent transition into the labour market, as shown by Pelikh and Rowe (2022). However, as these trajectories cumulatively describe a pathway of getting labour market experience straight after school, which is very different from continuously staying in education or experiencing more turbulent entry into labour market, to avoid small sample sizes, we grouped these clusters together in the analysis.

Table 5. **Mean time spent in each economic activity state, by cluster (in months)**

| Cluster	Self-employed	FT	PT	Unemployed	Student	OLF	Total N (%)
1) In education	0	0	0	0	36	0	44.7
2) FT employment	0.34	11.06	0.58	0.89	22.79	0.35	12.1
3) PT employment	0.23	0.54	12.17	0.65	22.15	0.26	20.2
4) Turbulent	1.88	0.68	1.3	6.29	22.45	3.39	23.0
Total	0.52	1.6	2.83	1.69	28.48	0.88	4,335 (100%)

Source: UKHLS, Waves 1-12; own calculations.

Figure 2 presents indexplots for four-cluster solution describing distinctive educational and employment trajectories at ages 16-19. Indexplots represent individual sequences over time (i.e., each line represents one individual trajectory). All individuals start at age 16 being enrolled in full-time education (still at school; grey colour). Panel a) presents indexplots and distribution of trajectories among individuals in the sibling sample. Panel b) presents indexplots and distribution of trajectories among individuals who did not have a sibling for comparison but met the criteria to be considered for matching sample (described in section 3.2.2 and Figure 1, panel b). Percentages in brackets refer to the proportion of the overall sample following a particular trajectory. The results were very similar if sequence analysis was performed separately on subsamples (results not shown, available upon request). The distribution of trajectories by cluster was relatively similar among two samples, with a slightly higher proportion of individuals in the sibling sample staying in education between ages 16 and 19.

Figure 2. Indexplots for typology of school-to-work trajectories, a) in the sibling sample; b) in the matching sample, individual level
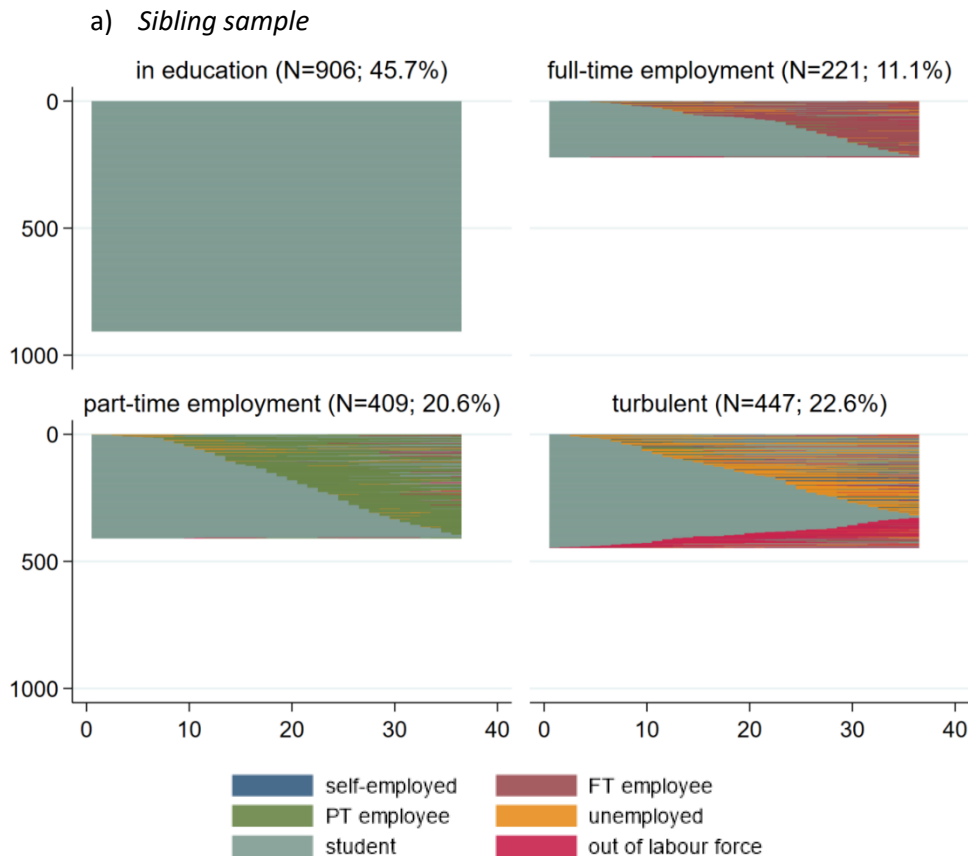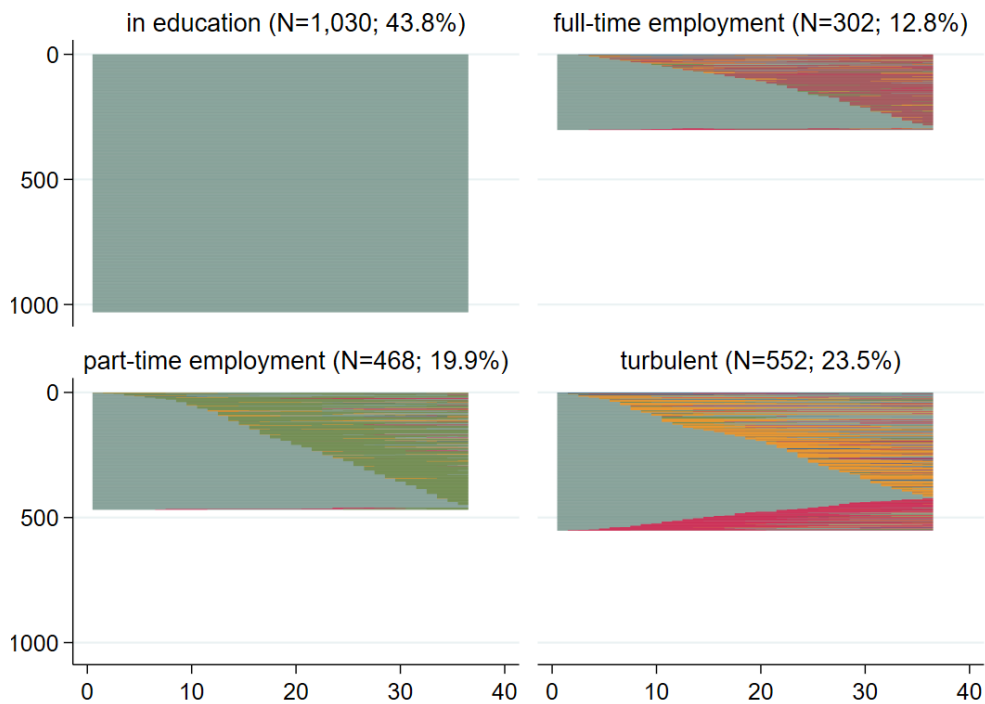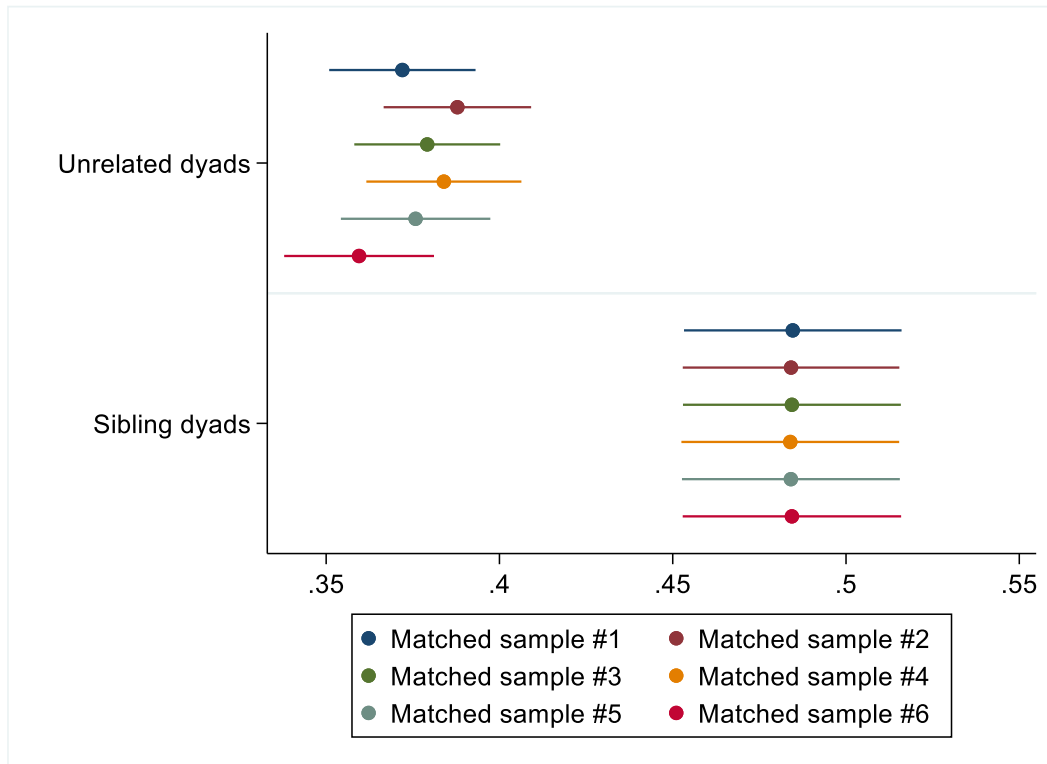

a) *Sibling sample*

Source: UKHLS, Waves 1-12; own calculations.

Note: The legend refers to both panels.

After establishing the six iterations of a matched sample containing sibling dyads and conditionally assigned unrelated dyads can be possible, we estimated the probability of both individuals to follow a similar education and employment trajectory at ages 16-19, i.e. belong to the same cluster identified by sequence analysis. Figure 3 presents the results from the regression analysis performed on six matched samples. In all the six iterations of the matched the sample, the probability of following the same trajectory was higher among the sibling pairs, suggesting that particular patterns of economic activity behaviour at ages 16-19 tend to cluster within families.

Figure 3. Predicted probability of following a similar education and employment trajectory at ages 16-19, among sibling dyads and conditionally matched unrelated dyads. Six iterations of the matched sample
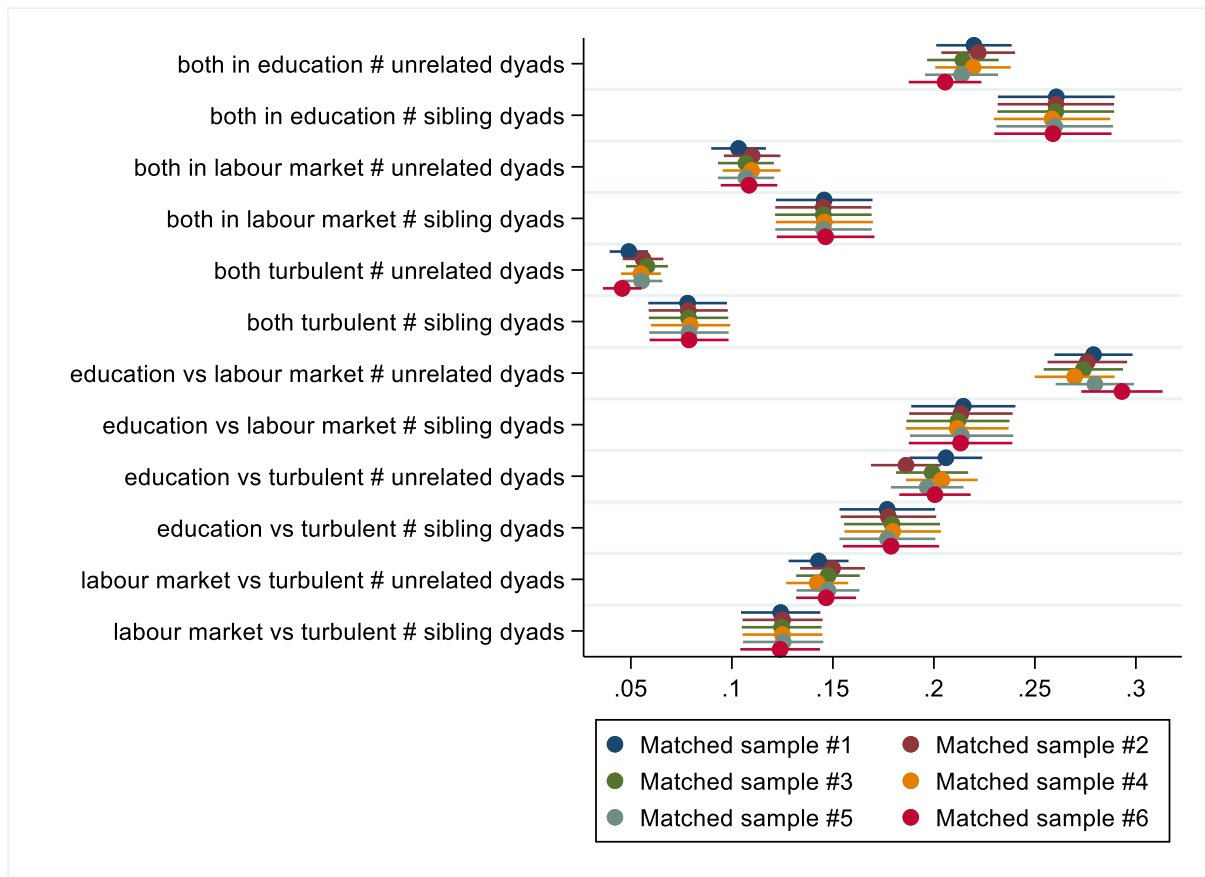

Source: UKHLS, Waves 1-12; own calculations.

Note: "Unrelated dyads" refer to dyads created through conditional assigning of each individual in the sibling sample to the unrelated young person from similar parental backgrounds as described in section 3.2.2. The figure presents estimates with 95% confidence intervals. The models are controlled for maternal education, family type, ethnicity, sex and cohort composition, and age gap. Standard errors are clustered on a family level.

Next, we investigate in which way the trajectories are similar or different (Figure 4). On average, siblings were more likely to follow a similar trajectory regardless of the type of the trajectory compared to young people from similar parental background. For example, two siblings were more likely to both stay in education or transition into labour market. However, they were also more likely to follow the turbulent pathway, highlighting the role of shared family background in perpetuating disadvantage. In subsequent analyses we use Matched sample #1.

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Figure 4. Predicted probability of following a similar education and employment trajectory at ages 16-19, by type, among siblings and conditionally matched unrelated dyads. Six iterations of the matched sample

Source: UKHLS, Waves 1-12; own calculations.

Note: "Unrelated dyads" refer to dyads created through conditional assigning of each individual in the sibling sample to the unrelated young person from similar parental backgrounds as described in section 3.2.2. The figure presents estimates with 95% confidence intervals. The models are controlled for maternal education, family type, ethnicity, sex and cohort composition, and age gap. Standard errors are clustered on a family level.
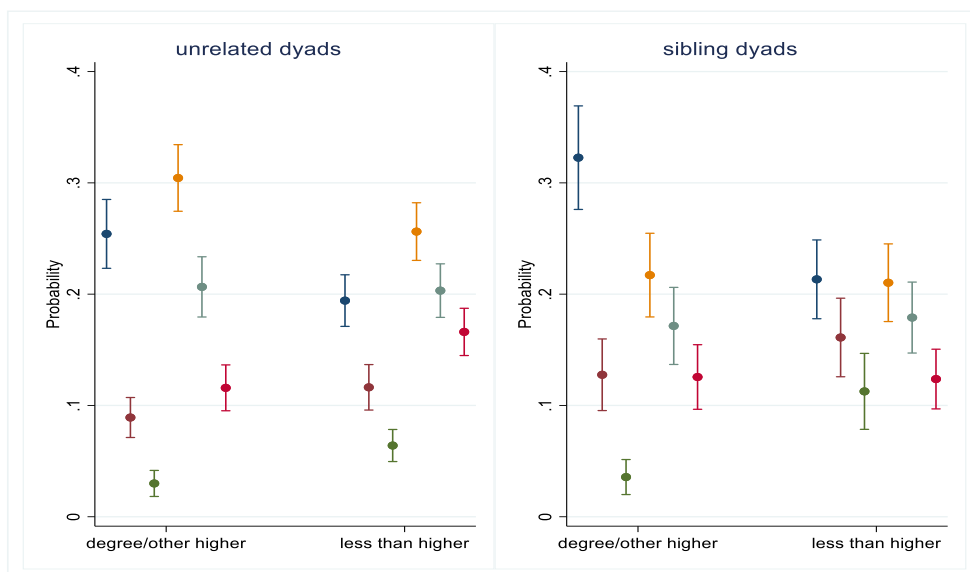
5.2 What is the contribution of compositional factors and parental background characteristics in shaping the education and employment trajectories at ages 16-19 among siblings? (RQ2)

Next, to estimate the contribution of compositional factors and parental background characteristics in shaping the trajectories, we randomly selected the Matched sample #1 and included an interaction effect in the multinomial logistic regression models between ethnicity, maternal education, family type, sex composition and age gap (one by one) and the variable indicating sibling or unrelated dyad. Table A3 in the Appendix demonstrates a good balancing of the socio-demographic characteristics between the sibling dyads and conditionally assigned unrelated dyads in the Matched sample #1. Table A4 in the Appendix summarises the distribution of the outcomes (post-16 education and employment trajectories) between the sibling dyads and conditionally assigned unrelated dyads in the Matched sample #1. A full table with estimates from multinomial logistic regression models is presented in the Appendix Table A5.
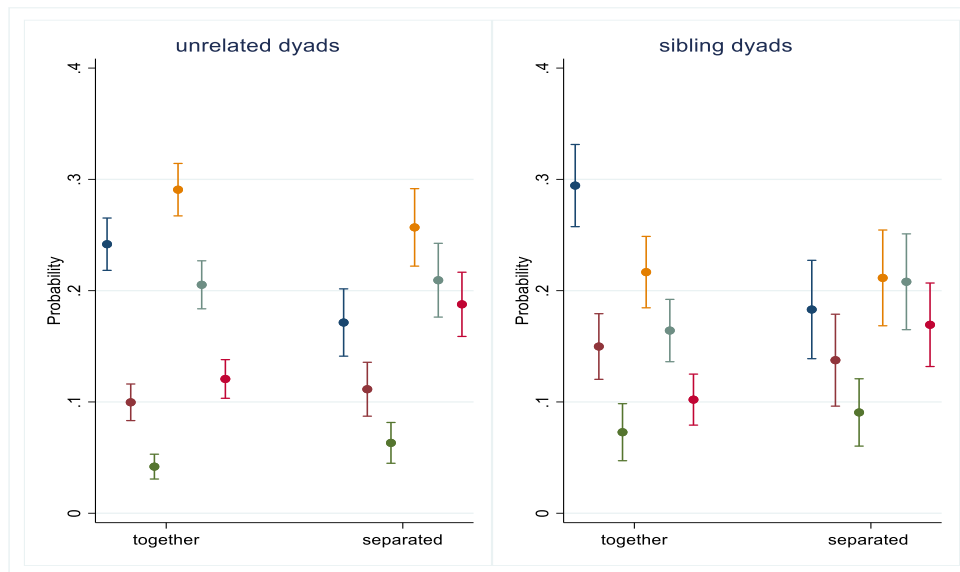
Figure 5 presents the results of the multinomial regression analyses on the role of parental background characteristics in shaping education and employment trajectories at ages 16-19. Overall, siblings from families where mothers were highly educated (panel a) and parents were living together (panel b) had higher probability of staying in education compared to the unrelated dyads from similar backgrounds. The differences in chances of staying in education by maternal education and family type were starker between the individuals in the sibling sample compared to unrelated dyads. Additionally, the differences in the probability of following a turbulent pathway were more pronounced by maternal education in the sibling dyads compared to unrelated dyads. With regards to ethnicity (panel c), there was more variation among outcomes for the White British group among unrelated dyads compared to the sibling sample, which can be largely explained by the size of this group and related to it unobserved heterogeneity between individuals. Young people from Indian, Pakistani, and Bangladeshi origins were more likely to stay in education, with the results being similar between sibling and unrelated dyads. This result in line with the recent trends of further and higher education participation among various ethnic groups reported by Lymperpolou & Parameshwaran (2015). Collectively, the results presented in Figure 4 suggest that it is not only the observed family characteristics that play an important role in shaping education and employment trajectories at ages 16-19, but also the unobserved family characteristics (i.e., values and practices) which affect all siblings' trajectories in a family.

Figure 5. Predicted probability of following a similar education and employment trajectory at ages 16-19, by type, among siblings and conditionally matched unrelated dyads in the Matched sample #1; a) by maternal education; b) family type; c) ethnicity
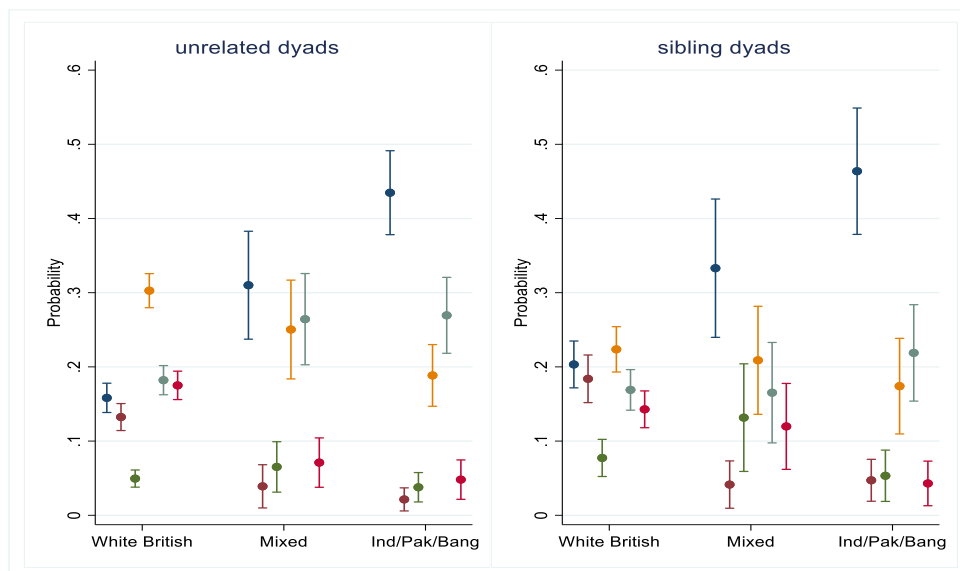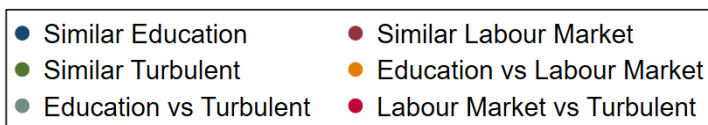
a) Maternal education

b) Family type

c) Ethnicity

Source: UKHLS, Waves 1-12; own calculations.

Similar Education	Similar Labour Market
Similar Turbulent	Education vs Labour Market
Education vs Turbulent	Labour Market vs Turbulent

Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The models are controlled for siblings' sex and cohort composition, and age gap. * "Mixed" category on the graph is comprised from three groups: Mixed; Other; or Black. Standard errors are clustered on a family level.

Figure 6 presents the results of the multinomial regression analyses on the role of sex composition and age gap in shaping education and employment trajectories at ages 16-19 between siblings and conditionally assigned unrelated dyads. Overall, siblings of the same sex had higher probability of staying in education compared to the unrelated dyads from similar backgrounds. The result was true

for both all-males and all-females dyads (not shown, available upon request). This suggests that siblings of the same sex might have a closer relationship or influence on each other (for example, younger siblings could be more likely to follow the example set up by an older sibling of the same sex) which could positively affect their chances of staying in education. With regards to the age gap, the results were less conclusive with large overlapping confidence intervals which could be related to the fact that siblings in the sample are quite closely spaced (mean age gap of 2.6 years; Table 3).

Figure 6. Predicted probability of following a similar education and employment trajectory at ages 16-19, by type, among siblings and conditionally matched unrelated dyads in the Matched sample #1; a) by sex composition; b) age gap

a) *Sex composition*
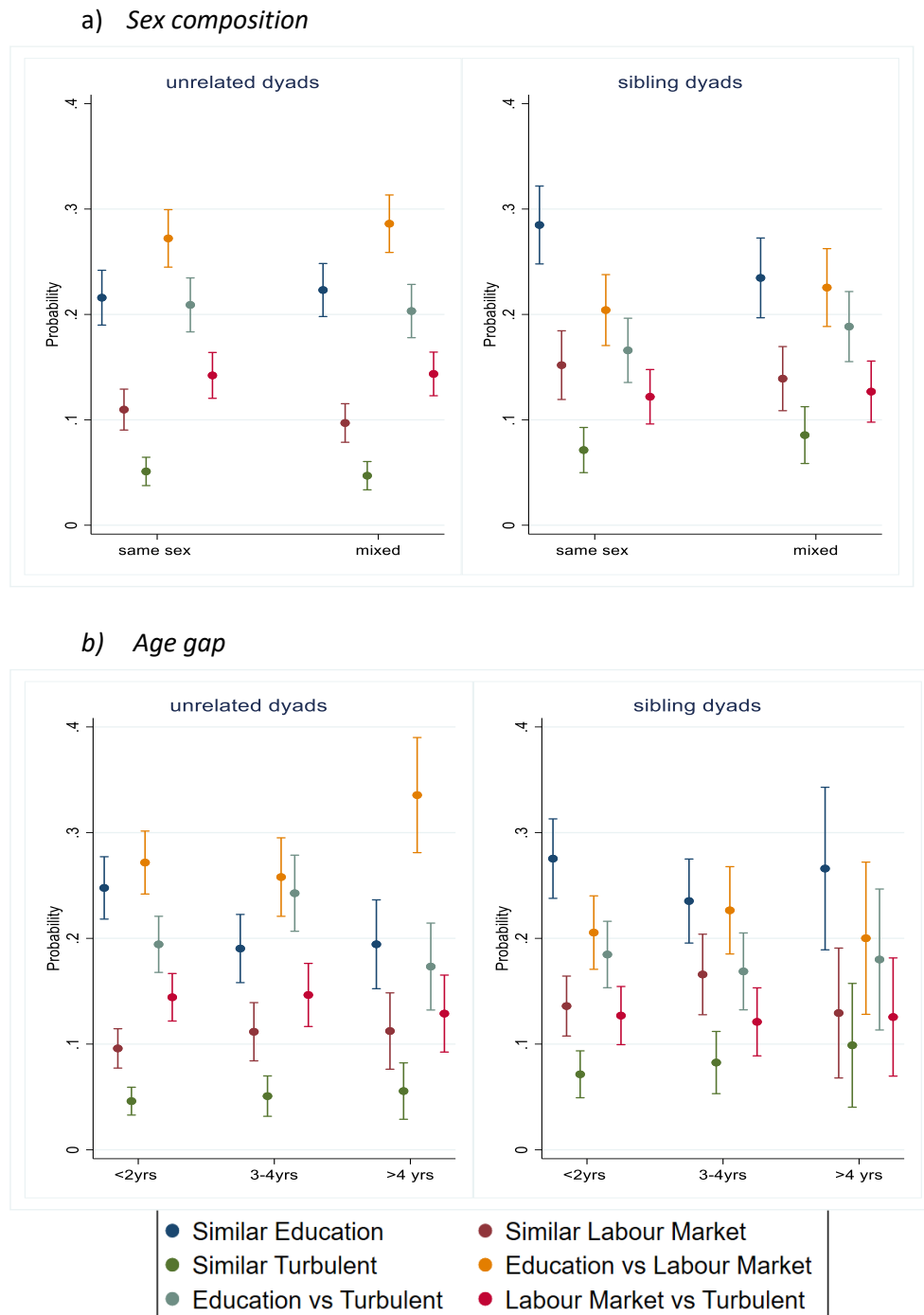

b) *Age gap*

Source: UKHLS, Waves 1-12; own calculations.

Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The
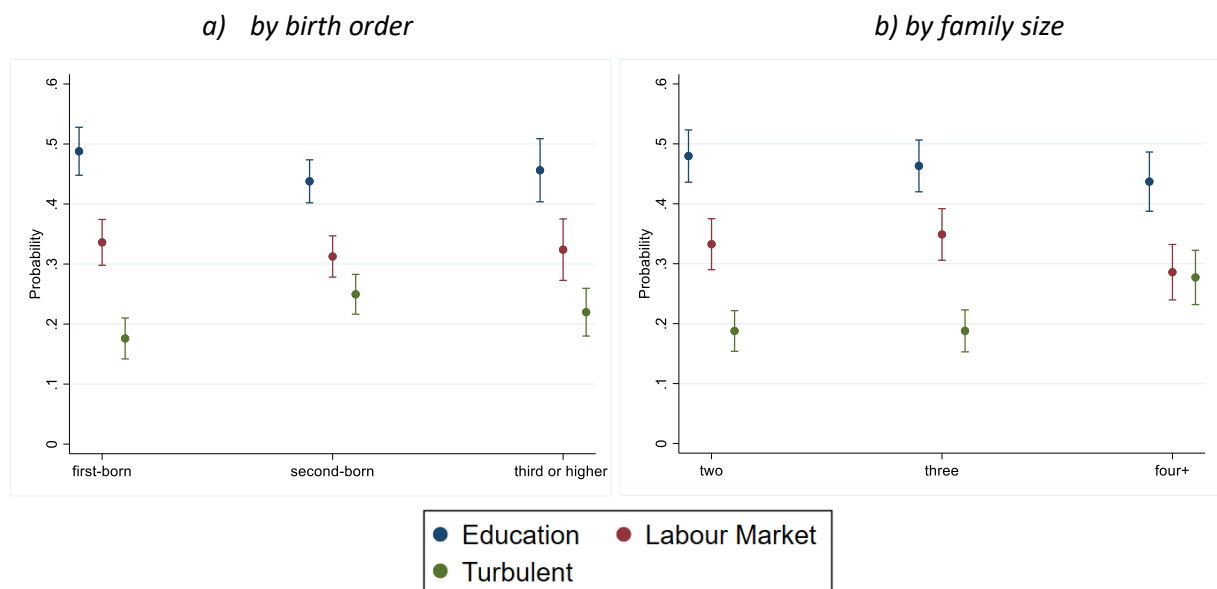
models are controlled for maternal education, family type, ethnicity and siblings' cohort composition. Standard errors are clustered on a family level.

5.3 How are the education and employment trajectories at ages 16-19 among siblings shaped by individual early adolescent experiences? (RQ3)

In this section, we present the results of the individual-level analyses which investigated the role of individual early adolescent experiences in shaping education and employment trajectories at ages 16-19 among siblings. A full table with estimates from multinomial logistic regression models is presented in the Appendix Table A7.

Figure 7 summarises the impact of birth order and family size on predicting education and employment trajectories at ages 16-19. Notably, first-born siblings within a family exhibited a greater likelihood of staying in education and were less likely to embark on the "Turbulent" trajectory (depicted in panel a)). Conversely, siblings hailing from larger families, characterized by four or more children, displayed a heightened propensity to follow the "Turbulent" path (as illustrated in panel b). These trends held true for both male and female siblings in our dataset. In our examination of the quality of sibling relationships, we explored variables related to sibling bullying and victimization. Surprisingly, these variables failed to explain any variations in educational and employment trajectories between the ages of 16 and 19. We discuss the implications of these findings and measurement issues in the discussion section.

Figure 7. Predicted probability of following a particular education and employment trajectory at ages 16-19, by type, among siblings; a) by birth order; b) family size

Source: UKHLS, Waves 1-12; own calculations.
Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The models are controlled for sex, maternal education, family type, twin status, country of residence, own educational aspirations, parental educational aspirations, frequency of conflicts and talking with parents, family support, parental help with homework, frequency of parental attendance of school evenings, sibling relationships, life satisfaction, mental health. Standard errors are clustered on a family level.

The family environment is among the factors that also played a significant role in explaining the 16-19 education and employment trajectories. Siblings who reported receiving substantial family support, as well as those whose parents consistently attended school evenings, exhibited the highest likelihood of remaining in education and the lowest likelihood of pursuing the "Turbulent" trajectory (as depicted in Figure 8, panels a and b). Notably, these effects were magnified when each of these variables was analysed independently (results available upon request), emphasizing the paramount importance of family relationships and parental engagement in influencing the educational outcomes of children. Surprisingly, we did not find any effects associated with variables related to the frequency of quarrels or communication with parents. Furthermore, parental interest in their children's schooling, as reported by the children themselves, and the frequency of parental assistance with homework, as reported by parents, also did not explain any differences in education and employment trajectories at ages 16-19 between siblings. We discuss the implications of these findings and measurement issues in the discussion section.

Figure 8. Predicted probability of following a particular education and employment trajectory at ages 16-19, by type, among siblings; a) by family support; b) by frequency of parental attendance of school evenings

a) by family support

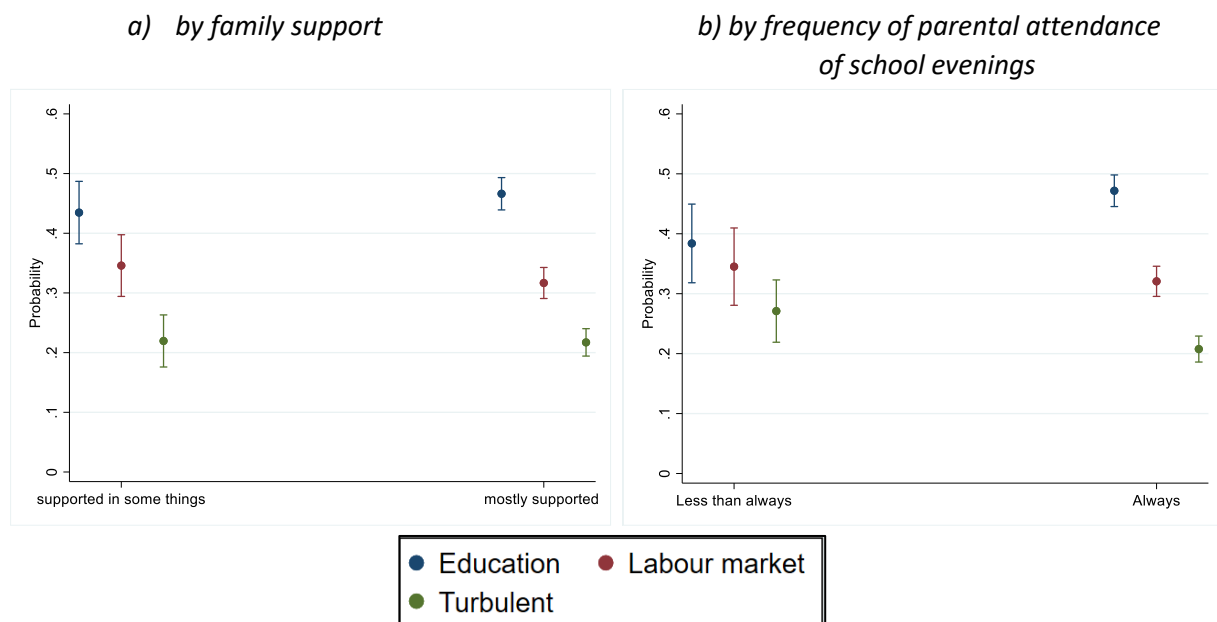*b) by frequency of parental attendance of school evenings*

Source: UKHLS, Waves 1-12; own calculations.
Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The models are controlled for sex, birth order, family size, maternal education, family type, twin status, country of residence, own educational aspirations, parental educational aspirations, frequency of conflicts and talking with parents, parental help with homework, sibling relationships, life satisfaction, mental health. Standard errors are clustered on a family level.

Positive educational aspirations (Figure 9, panel a) and positive parental educational aspirations (Figure 9, panel b) cumulatively predict a higher probability of staying in education and have a protective effect against following the "Turbulent" pathway. It's worth noting that the group of parents who expressed a lack of belief in the significance of continued education (at least one parent) comprised less than 4% of the total sample, which results in the large confidence intervals observed. Nonetheless, the direction of the coefficients aligns with expectations, indicating that children from this group were less inclined to pursue further education but showed a propensity for early entry into the labour market. We do not attempt to interpret the coefficients for the missing category in parental

answers as it potentially encompasses a diverse range of circumstances, as previously discussed in section 4.3.

Figure 9. Predicted probability of following a particular education and employment trajectory at ages 16-19, by type, among siblings; a) by own educational aspirations; b) by parental educational aspirations

a) by own educational aspirations   *b) by parental educational aspirations*
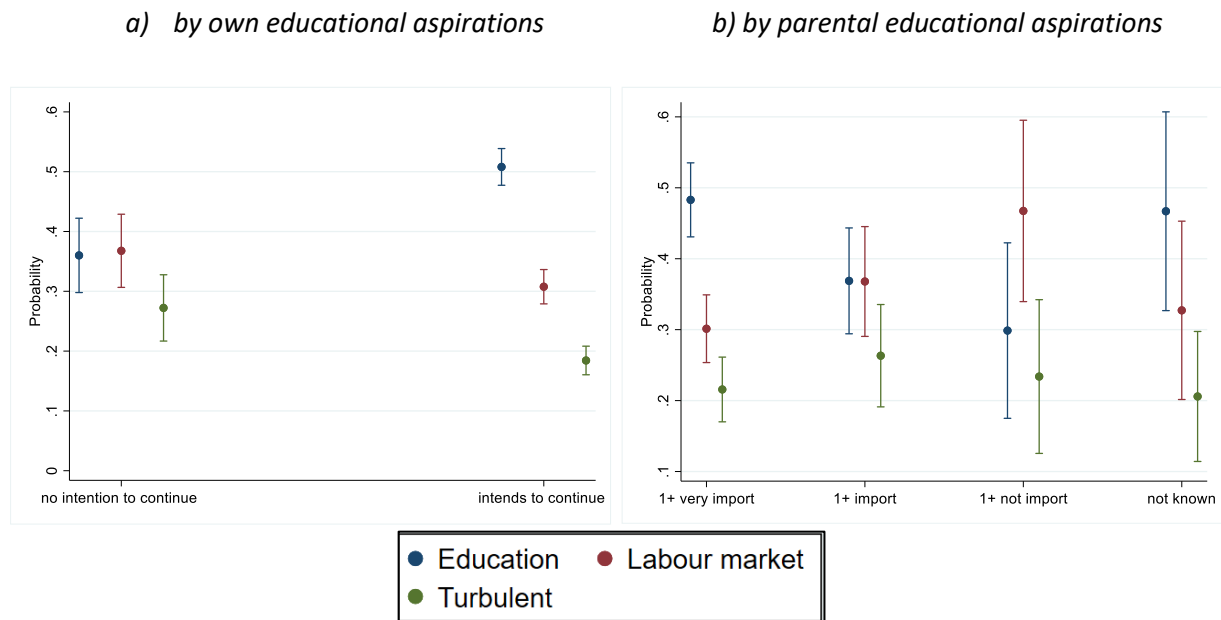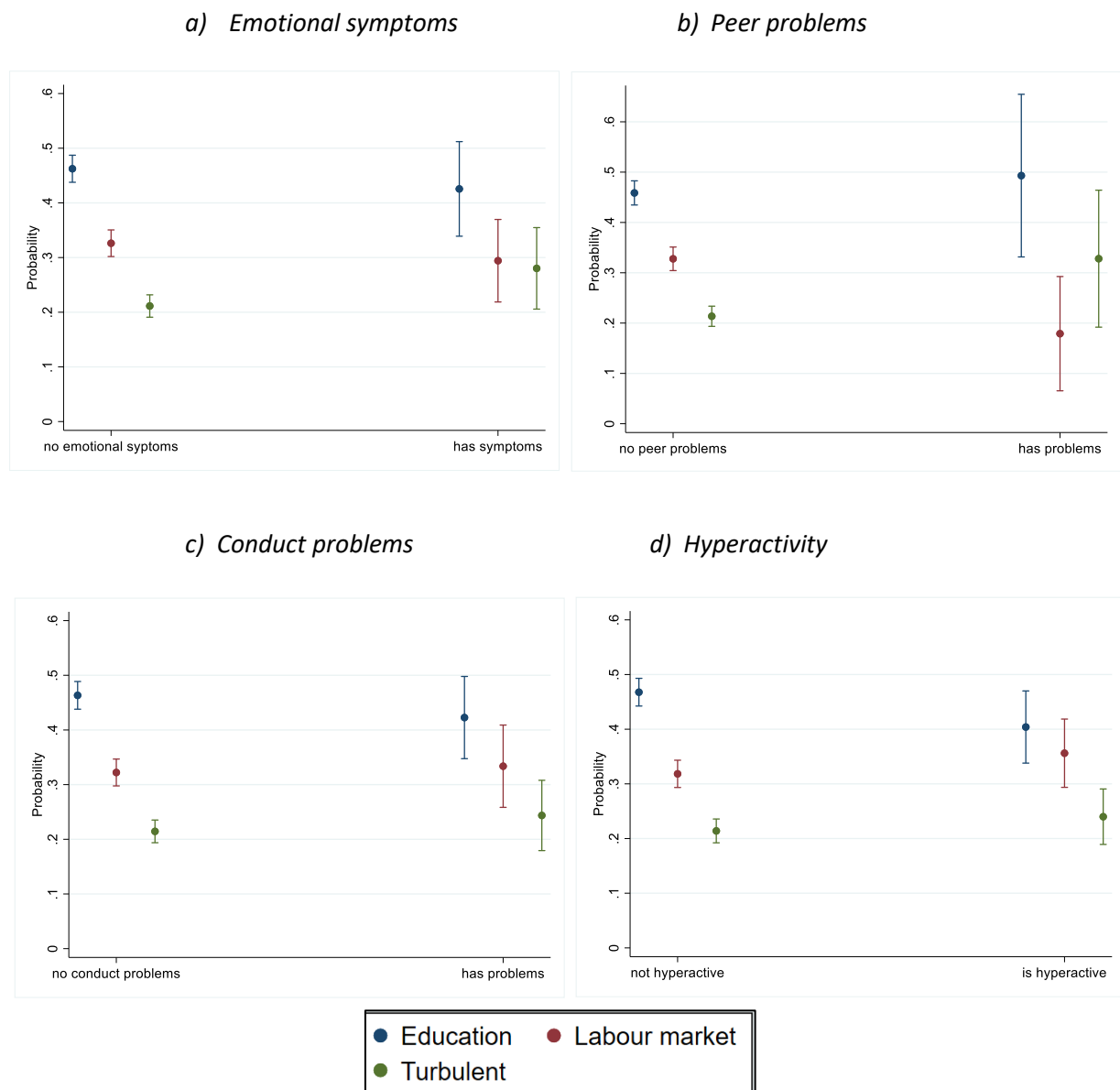
Source: UKHLS, Waves 1-12; own calculations.

Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The models are controlled for sex, birth order, family size, maternal education, family type, twin status, country of residence, frequency of conflicts and talking with parents, family support, parental help with homework, frequency of parental attendance of school evenings, sibling relationships, life satisfaction, mental health. Standard errors are clustered on a family level.

Next, we assessed the impact of mental health on education and employment trajectories of siblings between the ages of 16 and 19. Figure 10 presents the predicted probabilities of following a particular education and employment trajectory for four SDQ subscales. Our analysis reveals that internalizing problems, encompassing emotional symptoms and peer problems, tend to be associated with a higher probability of siblings pursuing the "Turbulent" trajectory. Conversely, externalizing problems, which include conduct issues and hyperactivity/inattention, appear to hinder the chances of staying in education. While these patterns align with existing literature (e.g., Smith et al., 2021), we are cautious in drawing firm conclusions due to the relatively small sample sizes. Additionally, we observed that low wellbeing, as indicated by lower life satisfaction, was also linked to reduced chances of siblings staying in education (see Table A6 in the Appendix).

To further validate our findings, we conducted supplementary analyses employing linear probability models with family fixed effects. The primary objective of these analyses was to disentangle individual experiences from the impact of shared parental backgrounds. Consistent with our primary findings, we observed that lower birth order and an intention to continue education remained instrumental in predicting a higher probability of staying in education among siblings. Conversely, higher birth order and the presence of peer relationship problems emerged as significant factors associated with an increased likelihood of siblings embarking on a "Turbulent" trajectory.

Figure 10. Predicted probability of following a particular education and employment trajectory at ages 16-19, by type, among siblings; a) by SDQ emotional symptoms subscale; b) by SDQ peer problems subscale; c) by SDQ conduct problems subscale; d) by SDQ hyperactivity/inattention subscales

Source: UKHLS, Waves 1-12; own calculations.

Note: The figure presents estimates with 95% confidence intervals. The legend refers to all panels. The models are controlled for sex, birth order, family size, maternal education, family type, twin status, own educational aspirations, parental educational aspirations, country of residence, frequency of conflicts and talking with parents, family support, parental help with homework, frequency of parental attendance of school evenings, sibling relationships, life satisfaction. Standard errors are clustered on a family level.

5.4 Robustness checks

Table 7. Within-family analysis of factors affecting education and employment trajectories at ages 16-19 among siblings

Variables	Staying in education				Labour market				Turbulent			
			[95% Conf.				[95% Conf.				[95% Conf.	
	Coef.	P>t	Interval]		Coef.	P>t	Interval]		Coef.	P>t	Interval]	
Sex: females (ref - males)	0.021	0.502	-0.040	0.082	0.025	0.403	-0.033	0.083	-0.046	0.094	-0.099	0.008
Birth order (ref - first)												
second	*-0.081*	0.003	-0.135	-0.028	-0.007	0.777	-0.058	0.043	*0.089*	0.000	0.042	0.135
third and higher	*-0.135*	0.004	-0.227	-0.043	0.057	0.196	-0.029	0.144	*0.078*	0.056	-0.002	0.158
Educational aspirations: intends to continue												
(ref - no intention to continue education)	*0.096*	0.018	0.016	0.176	-0.039	0.306	-0.115	0.036	-0.057	0.110	-0.127	0.013
Quarrelling with parents at least once per week												
(ref - less than once per week)	-0.027	0.447	-0.098	0.043	-0.004	0.916	-0.070	0.063	0.031	0.324	-0.030	0.092
Talking to parents at least once per week												
(ref - less than once per week)	-0.035	0.304	-0.101	0.032	-0.010	0.766	-0.072	0.053	0.044	0.133	-0.014	0.102
Family support: supported in most things												
(ref - supported in some things/not supported)	0.009	0.835	-0.073	0.091	-0.032	0.422	-0.109	0.046	0.023	0.528	-0.048	0.094
Parental help with homework: always												
(ref – less than always)	0.044	0.310	-0.041	0.130	-0.065	0.115	-0.146	0.016	0.021	0.587	-0.054	0.095
Frequency of parental attendance of school												
evenings: Always (ref – less than always)	0.036	0.485	-0.065	0.137	*-0.097*	0.047	-0.193	-0.001	0.061	0.174	-0.027	0.150
Sibling relationships (ref - frequent conflict)	0.014	0.702	-0.057	0.084	0.019	0.585	-0.048	0.085	-0.030	0.336	-0.092	0.031
Low wellbeing (ref - not low wellbeing)	-0.121	0.117	-0.273	0.030	0.107	0.145	-0.037	0.251	0.100	0.999	-0.133	0.132
SDQ emotional symptoms (ref - none)	-0.017	0.786	-0.138	0.104	-0.002	0.966	-0.117	0.112	0.028	0.599	-0.077	0.134
SDQ conduct problems (ref - none)	-0.062	0.250	-0.168	0.044	0.060	0.240	-0.040	0.160	0.001	0.990	-0.092	0.093
SDQ hyperactivity/inattention (ref - none)	-0.019	0.684	-0.112	0.073	0.011	0.799	-0.077	0.099	0.010	0.810	-0.071	0.091
SDQ peer relationships (ref - no problems)	-0.173	0.097	-0.376	0.031	-0.143	0.147	-0.335	0.050	*0.302*	0.001	0.124	0.480
Constant	0.468	0.000	0.294	0.641	0.477	0.000	0.332	0.623	0.113	0.098	-0.021	0.247

Source: UKHLS, Waves 1-12; own calculations.

Note: Three columns refer to three separate analyses using linear probability models on a single trajectory outcome with family fixed effects.

6. Discussion

In this paper we analysed education and employment trajectories (EET) at ages 16-19 among siblings born between 1993 and 2002 in the UK. A core aim of our research was to assess similarities and differences in EET between siblings and explore which factors shape the trajectories.

A key finding from this study was that siblings exhibited a greater tendency to follow similar post-16 EET, regardless of the type of pathway. Siblings had a higher probability of both remaining in education between ages 16 and 19 or transitioning together into the labour market, compared to unrelated individuals from comparable family backgrounds. Notably, siblings also demonstrated a higher likelihood of jointly embarking on the more precarious "Turbulent" trajectory characterized by difficulties establishing oneself in the labour market after finishing compulsory education. This pattern points to the crucial role of adverse childhood experiences and shared family disadvantage in perpetuating inequalities into young adulthood.

The results align with prior research emphasizing the lasting impacts of family background in shaping early life course transitions (Blau & Duncan, 1967; Goldthorpe, 1996; Lareau, 2003; Berrington et al., 2016; Karhula et al., 2019). Our study demonstrates that it is not only the observed parental characteristics like maternal education, family structure, and sibling composition that contribute to similarities in siblings' pathways. Unobserved qualities related to values, attitudes and practices inherited through families also likely play an integral part. Siblings from highly educated mothers and two-parent households face fewer barriers to accessing further education and securing smoother school-to-work transitions. In contrast, siblings from less privileged backgrounds may share exposures to scarcity of financial, social and cultural resources that constrain their options after finishing school.

The composition of the sibling pair, including sex and age gap, contributed to explaining similarities and differences in EET between siblings. Same-sex sibling pairs demonstrated a greater likelihood of staying in education between ages 16-19 compared to opposite-sex pairs. This pattern held for both brother-brother and sister-sister pairings, pointing to closer identification or influence among same-sex siblings that may motivate them to make similar choices after finishing compulsory schooling. For instance, a younger sister may be more inclined to follow the example set by an older sister in opting to pursue higher education, as opposed to an older brother. While prior research has emphasized the role of birth order and age spacing in sibling similarity (Bu, 2016; Raab et al., 2014), the results for age gap were less conclusive in this study. This pattern may relate to the narrow age distribution in the sibling sample. Wider age gaps may exert more influence on sibling similarity in trajectories when examined in samples with greater age dispersal. Overall, the results on sibling composition align with and build upon previous studies demonstrating that shared demographic traits are tied to more pronounced similarities in sibling behaviours and outcomes (Bu, 2016; Raab et al., 2014; Her et al., 2022, 2023). Our findings highlight that beyond just comparing siblings to unrelated individuals, certain constellations of siblings appear more likely to follow similar EET during the transition into adulthood.

However, this study also highlights that siblings often diverge onto different trajectories, pointing to the role of individual experiences. Although coming from identical family environments, siblings may form differing aspirations and expectations (Conger & Little, 2010; Her et al., 2023). Our results demonstrate that lower birth order and positive educational aspirations, in particular, were significant predictors of remaining in education and avoidance of turbulent pathways among siblings, even after accounting for shared family background. The findings also highlight that beyond parental

socioeconomic traits, siblings' perceptions of their family environment and individual mental health are key predictors of their EET. In particular, siblings reporting higher levels of family support during adolescence exhibited a higher likelihood of staying in education between ages 16-19 and avoided turbulent transitions. This result emphasizes the importance of emotional nurturing and encouragement within the home environment, above and beyond just financial resources, in enabling youth to pursue further education and training. Meanwhile, indicators of adolescent mental health also emerged as significant factors tied to pathways followed by siblings. Externalizing problems like conduct issues and hyperactivity were associated with reduced probabilities of staying in education. Internalizing problems encompassing emotional and peer-related difficulties showed links to heightened risks of turbulent trajectories marked by precarious labour market entry. These patterns align with prior research demonstrating academic challenges among youth with behavioural issues and risks of unstable school-to-work transitions for those facing internal distress (Smith et al., 2021; Rodwell et al.,2018). However, the role of mental health in shaping divergences between siblings represents a novel contribution.

By shedding light on factors tied to adversity in childhood, the findings from this paper point to the potential for early intervention to support at-risk youth in vulnerable family environments. Fostering nurturing home dynamics and addressing adolescent mental health concerns could help counteract adversity and open more positive socioeconomic pathways among siblings, independent of their family background. However, our study has some limitations. Measurements related to sibling bullying, parental engagement and interest in education surprisingly showed insignificant effects. Further research with more robust measurements is required to disentangle these relationships.

Overall, our study highlights that early life course trajectories are shaped by a complex interplay of family circumstances and individual experiences. The finding that siblings exhibit similarities in their post-16 education and employment trajectories, including following precarious pathways together, aligns with previous work by Karhula et al. (2019) using Finnish longitudinal data. Despite the notable differences between the Finnish and UK contexts, siblings in both settings appear more likely to accompany one another in their transitions regardless of trajectory type compared to unrelated peers. Several factors may contribute to this consistent pattern across the two countries. The enduring impact of family background and unobserved dimensions like values and norms are likely generalizable as shared influences shaping siblings' pathways. Finland's comprehensive welfare state and historically low levels of socioeconomic inequality could imply a weaker role for background compared to the UK's more stratified system. However, Karhula et al. (2019) similarly emphasize the continued importance of parental SES for sibling similarity. At the same time, it is important to consider how institutional variations across countries could modulate the relationships. Structural constraints and opportunity structures facing youth entering the labour market diverge significantly between Finland and the UK. The UK's liberal market economy provides weak protections against precarious employment which may exacerbate similarities in disadvantaged siblings' turbulent transitions in the UK. Overall, the parallels in siblings sticking together regardless of pathway speak to the fundamental role of family forces. More cross-national studies are warranted to investigate how institutional factors might dampen or amplify the risks tied to shared adversity in families. Understanding how family influences and institutional settings interact can help design policies and programs to create more equitable socioeconomic pathways across diverse settings.

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Appendix

Table A1. **Socio-demographic characteristics of young people born in 1993-2002, who were interviewed in YP and for who information on economic activity status available for ages 16-19**

Socio-demographic characteristics	Individuals born in 1993-2002, who were interviewed in YP and for who info on economic activity status available for ages 16-19, but have no siblings [eligible for the study]	Sibling sample	Total
Maternal education			
Degree/other higher	914	886	1,800
%	38.86	44.68	41.52
Medium/A-level etc	672	431	1,103
%	28.57	21.73	25.44
Low (GCSE/School)	766	666	1,432
%	32.57	33.59	33.03
Family type			
Parents together	1,401	1,363	2,764
%	59.57	68.73	63.76
Parents separated before any of the siblings in a dyad reached age 15	951	620	1,571
%	40.43	31.27	36.24
Ethnicity			
White British	1,823	1,454	3,277
%	77.51	73.32	75.59
Mixed*	147	117	264
%	6.25	5.9	6.09
Indian/Pakistani/Bangladeshi	766	323	590
%	11.35	16.29	13.61
Black	115	89	204
%	4.89	4.49	4.71
Cohort			
1993-1997	1,313	1,045	2,358
%	55.82	52.7	54.39
1998-2002	1,039	938	1,977
%	44.18	47.3	45.61
Sex			
Male	1,090	950	2,040
%	46.34	47.91	47.06
Female	1,262	1,033	2,295
%	53.66	52.09	52.94
Total	2,352	1,983	4,335
	100	100	100

Source: UKHLS waves 1–12; own calculations.

Figure A1. Dendrogram for four cluster solution
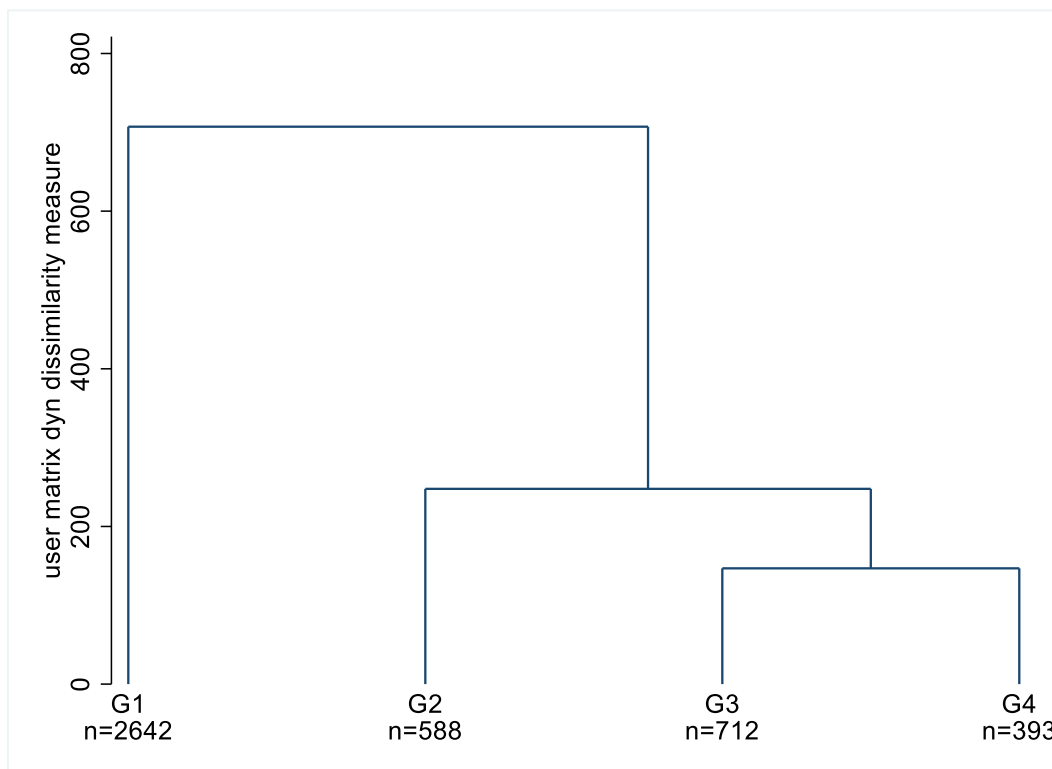
Source: UKHLS waves 1–12; own calculations.

Table A2. Cluster-specific pseudo F and R2 tests to determine the number of clusters

Number of clusters	Mean (pseudo_r)	Mean (pseudo_f)
2	0. 25	1409.36 , p<0.001
3	0. 33	1073.68 , p<0.001
4	0. 38	893.82 , p<0.001
5	0. 42	778.17 , p<0.001

Note: Pseudo F compares the sum of the squares explained by the cluster solution with the total sum by running 5,000 permutations of sequence reallocation based on the group membership vector (Studer et al., 2011). Pseudo R^2 shows the percent of total variability explained.
Source: UKHLS waves 1–12; own calculations.

Table A3. **Socio-demographic characteristics of the Matched sample #1, dyad level**

Socio-demographic characteristics	Unrelated dyads	Sibling dyads	Total
Family status			
Together	1,363	812	2,175
%	68.73	67.33	68.2
Separated before any of the siblings in pairs reached age			
15	620	394	1,014
%	31.27	32.67	31.8
Maternal education			
Degree/other higher	886	519	1,405

%	44.68	43.03	44.06
Medium/A-level etc	431	264	695
%	21.73	21.89	21.79
Low (GCSE/School)	666	423	1,089
%	33.59	35.07	34.15
Ethnicity			
White British	1,454	855	2,309
%	73.32	70.9	72.41
Mixed*	117	92	209
%	5.9	7.63	6.55
Indian/Pakistani/Bangladeshi	766	207	530
%	16.29	17.16	16.62
Black	89	52	141
%	4.49	4.31	4.42
Cohort composition			
both 1993-1997	551	325	876
%	27.79	26.95	27.47
Both 1998-2002	409	269	678
%	20.63	22.31	21.26
Mixed	1,023	612	1,635
%	51.59	50.75	51.27
Sex			
Same sex	985	631	1,616
%	49.67	52.32	50.67
Mixed	998	575	1,573
%	50.33	47.68	49.33
Total	1,983	1,206	3,189

Source: UKHLS waves 1–12; own calculations.

Table A4. **Dissimilarity in education and employment trajectories at ages 16-19 in the Matched sample #1, on a dyad level**

Education and employment trajectories	Unrelated dyad	Sibling dyads	All sample
Dissimilarity in trajectories			
Different	1,245	622	1,867
%	62.8	51.6	58.5
Similar	738	584	1,322
%	37.2	48.4	41.5
Dissimilarity in trajectories, by type			
Similar education	436	314	750
%	22.0	26.0	23.5
Similar labour market	206	174	380
%	10.4	14.4	11.9
Similar turbulent	96	96	192
%	4.8	8.0	6.0
Education & labour market	558	255	813
%	28.1	21.1	25.5
Education & turbulent	404	217	621

%	20.4	18.0	19.5
Labour market & turbulent	283	150	433
%	14.3	12.4	13.6
Total	1,983	1,206	3,189
	100	100	100

Source: UKHLS waves 1–12; own calculations.

Table A5. **Individual and family characteristics of individuals in the sibling sample**

Table A6. Multinomial logit models of education and employment pathways at ages 16-19 among siblings and conditionally assigned unrelated dyads, by type of pathway composition in a dyad

	Similar LM		Similar Turbulent		Education vs LM		Education vs Turbulent		LM vs Turbulent	
	RRR	p>Z	RRR	p>Z	RRR	p>Z	RRR	p>Z	RRR	p>Z
Sample type (ref - unrelated dyads)										
sibling dyads	1.18	0.105	1.36	0.046	0.65	<0.001	0.72	0.003	0.73	0.003
Maternal education (ref - high)										
medium	2.51	<0.001	3.77	<0.001	1.57	0.008	1.45	0.032	2.22	<0.001
low	1.58	0.036	3.80	<0.001	1.11	0.491	1.43	0.020	1.68	0.009
Family type (ref - together)										
separated	1.63	0.015	2.14	0.001	1.42	0.012	1.69	<0.001	2.52	<0.001
Ethnicity composition (ref - both White British)										
mixed	0.14	<0.001	0.80	0.508	0.47	<0.001	0.68	0.077	0.30	<0.001
Ind/Pak/Bang	0.08	<0.001	0.26	<0.001	0.25	<0.001	0.53	<0.001	0.10	<0.001
Sex composition (ref - same)										
mixed	0.95	0.720	1.11	0.524	1.13	0.228	1.09	0.440	1.08	0.531
Age gap (ref - <2 years)										
3-4yrs	1.53	0.011	1.44	0.073	1.27	0.079	1.39	0.019	1.27	0.145
>4 yrs	1.34	0.236	1.55	0.154	1.43	0.067	1.07	0.717	1.12	0.640
Cohort composition (ref - both 1993-98)										
both 1998-02	1.31	0.240	1.87	0.019	1.47	0.024	1.66	0.005	2.03	0.001
mixed	0.83	0.359	0.87	0.589	1.03	0.864	1.17	0.320	1.20	0.323
Constant	0.45	<0.001	0.08	<0.001	1.13	0.443	0.59	0.001	0.39	<0.001

Source: UKHLS waves 1–12; own calculations.