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Research Article

Union formation and fertility amongst immigrants from Pakistan and their descendants in the United Kingdom: A multichannel sequence analysis

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Abstract

BACKGROUND
Previous work identifies conservative family behaviour amongst Pakistanis in the United Kingdom relative to natives, including earlier marriages, fewer dissolutions, and higher fertility. However, few studies have investigated how fertility and partnership are intertwined and interdependent.

OBJECTIVE
Our aims are, first, to identify differences between the family trajectories of Pakistanis and natives and, second, to determine if patterns are consistent across immigrant generations. Finally, we aim to identify how family trajectories vary across birth cohorts and education levels.

METHODS
We apply multichannel sequence analysis (MCSA) to data from the UK Household Longitudinal Study. We first use clustering methods to group similar individuals and then apply multinomial logistic regression to calculate the probability of belonging to a cluster based on individual characteristics.

RESULTS
The Pakistani population exhibits a higher likelihood of entering a direct marriage and having large families compared to natives. Cohabitation is rare amongst Pakistani population. These patterns have changed little between immigrant generations. Degree-

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level education is associated with a higher likelihood of adopting behaviours typical to ancestral natives; however, the effects are not large enough to indicate convergence.

CONTRIBUTION

We demonstrate the need to investigate partnership and fertility trajectories simultaneously and show the value of MCSA for identifying differences between migrant groups. The results improve our understanding of family formation patterns of Pakistani immigrants and their descendants in the United Kingdom.

1. Introduction

Family processes and fertility are key metrics for measuring the acculturation and assimilation of immigrant minority groups (Glick 2010; Van Hook and Glick 2020; Kulu and González-Ferrer 2014; Lichter et al. 2012). The study of the Pakistani minority in the United Kingdom is increasingly important since they are one of the fastest growing ethnic groups in the United Kingdom (Rees et al. 2012). Today the United Kingdom's Pakistani population, of approximately 1 million individuals, is the second largest non-White ethnic group; around half are born in Pakistan and half are British born with at least one Pakistan-born parent (Office for National Statistics 2020). The study of large immigrant groups and the identification of changes in their family behaviours between generations is pivotal to understanding and developing projections of the future population. Moreover, it can be an indicator for policymakers on the success of integration. For example, if we were to observe persistent differences in family processes between native and Pakistani groups, this would suggest segmented assimilation which might be occurring in other domains as well (Portes and Zhou 1993).

Researchers continue to establish differences within South Asian immigrant populations in the United Kingdom and explore the heterogeneity of their life outcomes (Dale and Ahmed 2011; Modood et al. 1997), preferences (Berrington 2020), and identity (Robinson 2009). Pakistanis are found to be consistently disadvantaged socio-economically with worse outcomes in labour market entry and income compared to both the White British majority and Indians, the other major South Asian population (Khoudja and Platt 2018; Li and Heath 2008, 2020).

Research on Pakistani immigrants has focussed on aspects of the life course in isolation, including fertility patterns (Coleman and Dubuc 2010; Kulu and Hannemann 2016; Wilson 2019; Wilson and Kuha 2018), union formation and dissolution (Berrington 1994, 2020; Hannemann and Kulu 2015), health (Harding 2003; Wild et al. 2006, 2007), and labour market outcomes (Heath and Di Stasio 2019; Li and Heath 2008). However, we know that these domains are intertwined (Balbo, Billari, and Mills 2013; Kulu and

Milewski 2007). As such, whilst the literature involving Pakistani family formation and fertility in the UK context is growing, we still lack a holistic investigation of how they are intertwined and interdependent. The purpose of this study is to identify differences in the ordering and tempo of family processes between natives and Pakistanis and to increase our knowledge of assimilation processes in Pakistani families in the United Kingdom.

While previous research has investigated the union formation and fertility of the Pakistani population separately, few have studied the trajectories simultaneously. Those that have, have applied sequence analysis techniques to the period of time around migration and not the entire life course (Mikolai and Kulu 2022a) or have used multistate event history models (Mikolai and Kulu 2022b). We build upon on the research of Mikolai and Kulu (2022b), who, like us, use data from the UK Household Longitudinal Study (UKHLS). Our focus is specifically on differences between the Pakistani group and the native majority, and we include both men and women. Our analytical strategy applies multichannel sequence analysis (MCSA) to a sample of Pakistani immigrants, their descendants, and ancestral natives (a British-born group with two British-born parents) for a 20-year period from ages 15 to 35. This differs from multistate event history models as we do not measure rates of entry into specific states; rather we consider the entire early adult life course and create clusters of typical family formation trajectories.

This approach enables us to address the following research questions. First, how do the family trajectories differ between the ancestral native population and that of the Pakistani minority? Second, how similar are the trajectories between Pakistani immigrants and their descendants? Third, how have the trajectories of Pakistanis changed by birth cohort? Lastly, how does an individual's education level shape family trajectories of the Pakistani population?

2. Background

2.1 Changing family dynamics

Western Europe has witnessed the destandardisation of individuals' life courses (Ferrari and Pailhé 2017). These changes reflect what is referred to as a second demographic transition (Van De Kaa 1987; Lesthaeghe 1995), where delayed childbearing and cohabitation have become common, which is related to an increased desire for autonomy and self-actualisation at the expense of traditional family values. Further, it is argued that with rising empowerment in both the education and economy of women, voluntary childlessness becomes increasingly acceptable by society (Lesthaeghe 2014). Evidence from the United Kingdom supports this behavioural shift: More children are born outside

of marriages to both cohabiting parents and to lone mothers than ever before (Perelli-Harris et al. 2010; Thomson 2014), and cohabitation rather than direct marriages has become common (Beaujouan and Ní Bhrolcháin 2011; Pelikh, Mikolai, and Kulu 2022). Whilst most cohabitations do convert to marriages eventually, cohabitating unions are more prone to dissolution compared to marriages (Beaujouan and Ní Bhrolcháin 2011; Wilson and Stuchbury 2010). The extent of these destandardised behaviours can be related to early life experience and intergenerational transmissions of preferences (Liefbroer and Elzinga 2012). But prevalence of these patterns varies across gender (Pelikh, Mikolai, and Kulu 2022), education (Mikolai, Berrington, and Perelli-Harris 2018), and immigrant background and over time.

2.2 Migrant and minority family formation

Across Europe and other Western countries differences between family patterns of natives and immigrant generations have been observed between destinations and between origins within countries (Hannemann et al. 2020). What is clear is that societal changes relating to family formation are not necessarily consistent across immigrant and minority groups (De Valk and Liefbroer 2007). There are contextual differences between origin and destination countries relating to policy and cultural differences in values and preferences which influence both union formation and fertility. Whilst measurement of culture is difficult, general cultural proximity of a migrant's origin to the dominant native culture seems to correlate with behaviours more typical of natives, as studies in France (Pailhé 2015), Sweden (Andersson, Obućina, and Scott 2015), and the United Kingdom (Hannemann and Kulu 2015; Mikolai and Kulu 2022b) suggest. Several theories exist which attempt to explain immigrant native differentials; these can apply to both union formation and fertility due to their intertwined nature (Rahnu et al. 2015). Please see these prior studies for detailed overviews: Kulu (2005), Kulu and González-Ferrer (2014), Milewski (2010b), and Wilson (2015).

Selection into migration is a central hypothesis underpinning research on migrants and their descendants. Those who migrate differ from those who remain in the country of origin, typically those who are younger, in better health, and have higher human capital (Borjas 1987; Chiswick 1999; Chiswick, Lee, and Miller 2008). The effects of social selection can contribute to observed migrant fertility being higher than natives or mean a closer alignment with native levels (Kahn 1988). The selection processes affecting Pakistani immigration to the United Kingdom has changed over time (Luthra and Platt 2017). Earlier waves in the 1950s and 1960s were related to specific labour shortages, leading to low-skilled men being predominant (Shaw 2000). These men arrived as temporary migrants; however, many remained, resulting in the subsequent immigration

of wives and children (Dahya 1972). Whilst family reunification does remain important in more recent immigration during the 1990s and later, there is stronger positive socioeconomic selection, often comprising of young Pakistanis moving for study and work purposes (Larsen and Di Stasio 2019). Thus, more recent immigrants – in terms of their fertility and family building preferences and patterns – may more closely approximate native patterns, having lower fertility and later transitions than those in their native Pakistan (Gangadharan and Maitra 2003).

Socialisation theory posits that early age experiences shape the preferences which determine future outcomes (Andersson 2004; Dubuc 2012; Goldberg 1959; Milewski 2010a; Toulemon 2004). In Pakistan the fertility transition occurred later (Sathar and Casterline 1998; Sathar and Framurz Kiani 1999), with those born there exposed to cultural norms of larger families, such as earlier and more often direct marriage (when compared to UK native levels). This theory therefore suggests that the timing of migration through the life course is crucial for understanding differentials between Pakistanis and ancestral natives. On one hand, migration after spending the early years in Pakistan may mean that, even after decades in the United Kingdom, Pakistani family norms prevail. On the other hand, migration to the United Kingdom during the 'sensitive period' of childhood/adolescence, and subsequent early life exposure to education institutions and residential contexts, which expose them to native norms, may mean Pakistani family behaviours converge more with UK ancestral natives (Adserà et al. 2012).

A third explanation for migrant/native disparities (complementary to the second) posits that segmented assimilation (Portes and Zhou 1993) can lead certain groups to become a minority subculture, which can explain high fertility and early marriage behaviour amongst some groups of migrant descendants (Kulu et al. 2019). The United Kingdom's historical migration patterns have resulted in residential segregation of some ethnic groups, including Pakistanis (Peach 1998, 2006). This segregation means socialisation for the second generation at early ages remains primarily with others of the same origin; if cultural value is placed on large families, these preferences are intergenerationally transmitted (Booth and Kee 2009; Lichter et al. 2012; Wilson and Kuha 2018; Zorlu and Mulder 2010). In the United Kingdom the Pakistani population reports preferences for large families across multiple generations (Kulu and Hannemann 2016), and this is associated with experiences of residential segregation (Wilson and Kuha 2018).

A contrasting process of immigrant adaptation suggests that over time behaviour alters to converge with the majority native population regardless of the context of early life socialisation (Ford 1990; Goldstein and Goldstein 1981; Gordon 1964; Kahn 1988; Lee and Farber 1985; Milewski 2007). This adaptation is related to experiences in other domains of the life course such as labour market success (Dupray and Pailhé 2018;

Lundström and Andersson 2012), education (Dubuc 2012, 2018), and housing (Kulu 2005), which shape norms and decision-making. This also implies that those who migrate earlier in the life course would be more likely to exhibit native-like family behaviours as they have longer for this adaptation process to take effect (Adserà et al. 2012; Ford 1990). This may be a less salient explanation for Pakistani family behaviours in the United Kingdom because the continued socioeconomic deprivation (Li and Heath 2020) and housing disadvantage (Shankley and Finney 2020) experienced by Pakistanis (relative to UK natives) suggests that adaptive processes in other domains have not materialised. However, it may be important for understanding behaviours in subgroups: For example, more-educated Pakistani women display more native-like family behaviours than less educated Pakistanis (Dale and Ahmed 2011; Dubuc 2018).

Disruption is another theory relating to migrant families, where the economic and time investments associated with migration lead to postponement of family formation (Bean et al. 1984; Hervitz 1985; Mayer and Riphahn 2000; Milewski 2007, 2010b). Migration can be a cause of temporary separation from partners, which creates a barrier to fertility. However, these disruptions may only temporarily cause changes in tempo, not quantum (Ford 1990). Disruption highlights the interrelation of life events (Milewski 2007, 2010b; Mussino and Strozza 2012), a final theory of migrant family dynamics. Migration and mobility are responses to both individual circumstances and changes in those circumstances. Hence it is important to consider the interplay of multiple life course domains. Given the migration flows of Pakistanis to the United Kingdom, disruption could be a factor in family formation amongst the oldest immigrants. Among recent Pakistani arrivals, family formation and reunification is commonly given as a reason for migration, hence elevated fertility being observed around the time of arrival (Robards and Berrington 2016).

2.3 Pakistani families in the United Kingdom

Previous research on family dynamics of Pakistanis in the United Kingdom finds that most enter direct marriages and have low divorce rates (Hannemann and Kulu 2015). Typically, the transition into unions takes place at earlier ages compared to natives (Berrington 1994). Overwhelmingly, unions are formed with members of the same origin, and this has only decreased slightly amongst younger birth cohorts (Kulu and Hannemann 2019). Many immigrants arrive having already married in Pakistan, and although the second generation do experience looser ties to Pakistan (Dale and Ahmed 2011), even amongst them over half have spouses who arrived in the United Kingdom as adults (Georgiadis and Manning 2011). This suggests that socialisation and the minority subculture hypothesis are important explanations for family behaviour.

Qualitative research on the cohorts covered in this study finds that the prospect of arranged transnational marriages were considered as a way for many young Pakistanis to appease family in Pakistan and the United Kingdom (Shaw and Charsley 2006). Research suggests this family pressure is diminishing and freer choice is emerging (Charsley and Bolognani 2021); however, this influence is less relevant since these birth cohorts are not observed in this analysis. Recent research on second-generation Pakistanis suggests that they still maintain the expectations of direct marriage, albeit delayed compared to earlier birth cohorts, in contrast to ancestral natives, who anticipate entering cohabitations for longer periods of time (Berrington 2020). Later marriage and smaller families in Pakistani women is related to them having higher education (Dale and Ahmed 2011; Dubuc 2018), demonstrating that adaptation can be context specific. This postponement may not be down to personal choice but rather an inability to find a partner due to being perceived as 'over-qualified' or 'too old' (Ahmad 2012). Unions formed by Pakistanis are observed to be stable with low divorce and remarriage rates (Hannemann and Kulu 2015), yet we recognise that this does not necessarily mean marriages are of better quality. Specific norms may alter the acceptability of divorce and the ease of obtaining one (Qureshi, Charsley, and Shaw 2014). Long-term separation is often negotiated by Pakistani couples in place of a formal divorce (Qureshi, Charsley, and Shaw 2014), thus avoiding the stigmatisation of being divorced (Qureshi 2016) but ultimately meaning data sources do not reflect dissolution.

Fertility amongst the Pakistani group is high compared to both other minority groups and natives (Berrington 1994; Dubuc 2012; Kulu et al. 2017; Kulu and Hannemann 2016; Wilson 2015, 2019). Although fertility has fallen, the total fertility rate amongst the British Pakistani population fell from almost 5.0 in the 1970s to approximately 3.0 in 1997 (Coleman and Dubuc 2010). Similarly, the number of children per household of this group fell in the last decade of the 20th century from 2.35 to 1.72 (Catney and Simpson 2014). Still transitions to higher order births remain far more common amongst Pakistani women, including British born, compared to ancestral natives (Kulu et al. 2017; Kulu and Hannemann 2016). For those who arrive as children, evidence shows that an earlier arrival results in childbearing behaviour more alike that of ancestral natives (Adserà et al. 2012). However, Adserà and colleagues (2012) do not isolate Pakistanis specifically and homogenise them amongst a South Asian group.

Fertility remains elevated for the second generation compared to ancestral natives, with mean completed fertility of around 3.0 for Pakistanis and Bangladeshis combined (Wilson 2019), although there is evidence of some convergence (Georgiadis and Manning 2011). This population level convergence can be a result of averaging divergent subpopulations within the second generation, where early family formation and large families is one option and childlessness another (Kulu et al. 2019). Divergence is visible across education levels with high education increasing amongst the second generation

associated with lower fertility (Dubuc 2018). Childlessness as a preference is not observed amongst the second-generation Pakistanis; younger generations expect to become parents at some point in time (Berrington 2020), and their ideal family sizes are larger than natives (Penn and Lambert 2002). These potential divergences are interrelated to divergences in education and socioeconomic status and can materially affect knowledge and use of contraception (Hennink, Diamond, and Cooper 1999). Pakistani-born women in the United Kingdom on average have lower education compared to Indian women (Dale et al. 2002) and are more likely to fall into the non-professional group that Hennink and colleagues (1999) describe as using contraceptives less often. However, changes in selection processes of Pakistani immigrants likely mean that more recent, younger arrivals are better educated (Larsen and Di Stasio 2019; Luthra and Platt 2017) and thus more likely to use contraception.

3. Hypotheses

Based on previous research we expect to find Pakistani first-generation immigrants to exhibit more conservative trajectories compared to natives, with early transitions into marriage and larger number of children due to their socialisation in Pakistan (Hypothesis 1). For the second generation, under the adaptation hypothesis trajectories should be more aligned with natives, although not necessarily converged (Hypothesis 2a). The socialisation and minority subculture hypothesis would be supported if there is a persistence of conservative trajectories between the first and second generation (Hypothesis 2b). Although, given that we do not observe how individuals have been socialised in their formative years, there could be support for socialisation even if the second generation have converged to behaviours akin to natives.

Since selection into migration has changed over time, we expect to see temporal and cohort differences in Pakistani trajectories, with later-born Pakistanis expected to be more recent positively selected migrants and thus more likely to postpone transitions (Hypothesis 3). Finally, the second demographic transition theory would suggest that education will act as a moderator, making more-educated Pakistani groups more likely to display postponement behaviours and have less standardised trajectories, aligning them to the ancestral native population (Hypothesis 4).

4. Data and sample

The data used comes from the first ten waves of Understanding Society/UK Household Longitudinal Study (UKHLS) collected between 2009 and 2019 (University of Essex

Institute for Social and Economic Research 2021). This dataset has retrospective fertility and partnership histories for all adult members of the sample, regardless of how many waves they appear in. Sample members are asked for retrospective histories at the time they are first interviewed, and this is updated using subsequent waves.

4.1 Sample

For this study we follow people for 20 years from age 15 to 35. We restrict the sample to those born between 1950 and 1979, including only ancestral natives or members of the Pakistani minority community. Ancestral natives were identified as those who were born in the United Kingdom with two British-born parents. For the Pakistani group, the second generation were defined as those born in the United Kingdom with a father born in Pakistan. For those without information relating to the father, a Pakistani-born mother was used. Instances of intermarriage between ancestral natives and Pakistani born are still low among observed cohorts (Kulu and Hannemann 2019) with the risk of exogamous marriage for both Pakistanis and their descendants at less than one per 1,000 person years. Therefore, bias stemming from prioritising the father's place of birth is unlikely. To increase sample numbers for those who lacked information on parental country of birth, self-reported ethnicity was used. Those who reported their ethnicity as White British were deemed ancestral natives, providing they were born in the United Kingdom. Those who migrated to the United Kingdom at some point and reported their ethnicity as Pakistani were assumed to be born in Pakistan and first-generation immigrants. Similarly, those born in the United Kingdom who defined their ethnicity as Pakistani were assumed to be of the second generation. Theoretically, those defined through this imputation could be grandchildren of immigrants or the third generation; however, given the migration history from Pakistan to the United Kingdom, the likelihood of a third-generation individual being born prior to 1980 is low. Complete histories were gathered for 22,067 individuals. Five were dropped due to ambiguous gender, leaving a final sample of 22,062.

4.2 Descriptive statistics

Table 1 shows the sample descriptive statistics. We see a higher proportion of women in the native sample with the reverse amongst the Pakistanis. Birth cohorts are slightly skewed towards earlier cohorts for natives primarily due to the survey design. Older members of the sample require only one appearance at any wave to secure enough retrospective information for entry into the final sample, whereas for younger members,

born in the 1970s, multiple survey appearances are required, therefore fewer from those cohorts make the final sample. Second-generation Pakistanis are skewed towards later birth cohorts, which is expected given the migration history of Pakistanis to the United Kingdom. The first generation are also skewed towards younger ages; we emphasise that this group combines different selection mechanisms, including the arrival of child who migrated with parents soon after their birth and adults who recently arrived (Luthra and Platt 2017).

Table 1: Descriptive statistics of full sample

	Native	2nd generation	1st generation	Total
Gender: %				
Male	46	51	51	46
Female	54	49	49	54
Cohort: %				
1950–1959	33	4	24	32
1960–1969	39	27	34	39
1970–1979	28	70	42	29
Highest qualification: %				
Degree or equivalent	33	33	22	32
A-Level or equivalent	30	1	3	19
GCSE or equivalent	19	16	15	18
Other qualifications	9	6	11	9
No qualifications	9	11	30	10
Missing	0.1	0.3	1	0.2
Total: N	20,848	256	958	22,062

Education levels are similar for natives and British-born Pakistanis, with first-generation immigrants reporting lower educational attainment than both. The Pakistani born had a relatively large proportion with missing data for qualification obtained (approximately 14%); thus, we have imputed the qualification achieved based on a combination of school-leaving age, further-education-leaving age, and school attendance information. We coded those who left education before age 15 or never attended school as 'no qualifications,' those who left school or further education at age 15 or 16 have GCSE level or equivalent, those who left between 17 and 20 have A-Level or equivalent, and those who left education at age of 21 and above have degree-level education. We retain a missing category for those with no information about qualifications obtained, school attendance or leaving school, in total less than 1% of the sample. We accept that while there may be minor misclassifications (e.g., individuals can leave education without obtaining any qualifications), the trade-off is a larger sample to work with. For robustness we repeated the analysis with a larger missing category (i.e., without this

imputation process), and the substantive message of the results does not change. We anticipate that education levels will differ by gender (Khattab and Modood 2018), therefore gender stratified education statistics are presented in Appendix A.

5. Methodology

5.1 Sequence analysis and optimal matching

Sequence analysis allows for the consideration and ordering of life events, adding dynamic context to life course analysis that cross-sectional measures lack (Abbott 1995). The benefit is that it allows for the study of life course complexities as they take place (Aassve, Billari, and Piccarreta 2007). Over time, sequence analysis has increasingly been used to model multiple domains of the life course in a process called multichannel sequence analysis (MCSA). MCSA has some notable advantages over single channel analysis; first, it avoids the need for widespread recoding and combining of multiple trajectories (Gauthier et al. 2010), and second, it allows for a more holistic overview of the life course trajectories by taking into consideration multiple variables over time (Pollock 2007).

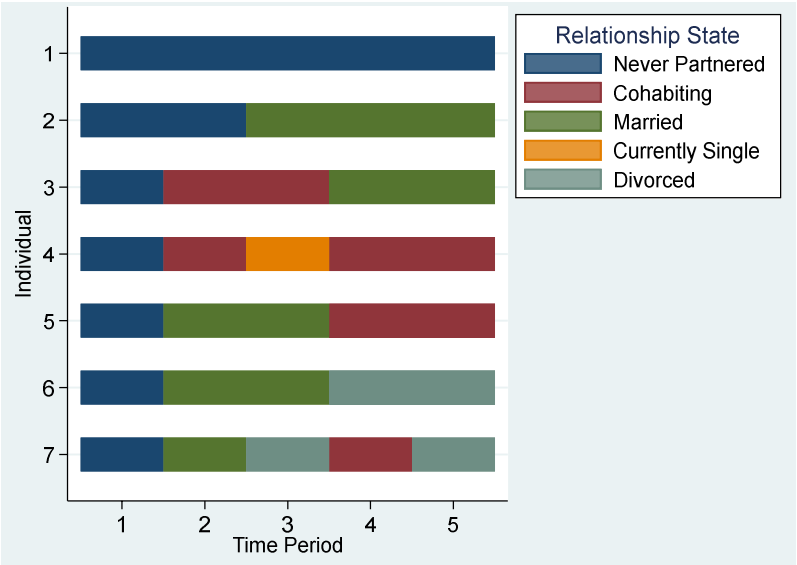
In this study sequences were created across two domains, one showing the partnership state of individuals and the other their childbearing. Individuals were observed monthly from age 15 to 35, meaning 240 states for each sequence was recorded. The relationship trajectory was described using six categories: 'Never partnered,' 'Cohabiting,' 'Married,'[4] 'Divorced,' 'Widowed,' and 'Currently single.' Currently single are defined as those who have only been in cohabiting unions previously but are not currently in one. We consider it important to distinguish between those with experience of marital and cohabitation dissolution due to the differing characteristics that determine entry (Perelli-Harris et al. 2010) and exit (Lampard 2014) of such unions.

The partnership trajectories could move in a variety of ways, as illustrated in Figure 1. Individual 1 remains without a partner throughout observation. Individual 2 enters a direct marriage. Individual 3 enters a cohabiting union, which then transitions to marriage. Individual 4 cohabits, dissolves that union, becomes currently single, then re-enters a cohabiting state. Individual 5 is a specific case, whereby their marriage dissolves during time-period three and immediately afterwards they enter a cohabiting union, thus failing to register a period of divorce. This is a possible cause of underestimation of divorce in the sample; however, this exact scenario is rare – less than 1% experience this direct transition in our sample (all except one being ancestral natives). Individual 6

[4] Married includes civil partnerships.

marries and then becomes divorced. Individual 7 experiences a marriage, then divorce, a period of cohabitation, and once that cohabitation dissolves, returns to being divorced. The rationale behind this process is to ensure that previous experiences which may stigmatise the individual are considered. Again, this scenario is experienced by only 1% of the sample (all natives) given the relatively short period of the life course that we observe.

Figure 1: Examples of relationship sequences



Fertility trajectories were coded as a count of children ever born with six states in total, from 'childless' to 'five children or more.' The number of children could therefore only increase over time. For multiple births, the parent moves directly from childless to two children, for example. Mortality of children was not considered. Table 2 shows the percentage of those who have ever experienced each of the states described above, by immigrant background. Most do transition into a married state across the observation period. Experiencing cohabitation and being currently single or divorced is more common among natives, the rarest relationship transitions are entries into widowhood. The transition to higher parities (especially parity 3 and above) is common amongst Pakistanis compared to natives (Kulu and Hannemann 2016).

Table 2: Percentage (unweighted) ever experiencing each union and fertility state

	Native	2nd generation	1st generation	Total
Ever experienced 'union state': %				
Never partnered	100	99	98	100
Cohabiting	48	10	1	46
Married	67	70	72	67
Currently single	10	2	0.2	9
Divorced	17	11	4	16
Widow	0.4	0.4	1	0.4
Ever experienced 'fertility state': %				
Childlessness	100	100	100	100
One child	61	71	78	62
Two children	42	64	64	43
Three children	14	45	44	16
Four children	4	21	21	5
Five or more children	1	10	8	1
Total: N	20,848	256	958	22,062

The pairwise difference between sequences is derived through a process of optimal matching, which involves calculating the most efficient manner of converting one sequence into another using a combination of insertion and deletion (indel) and substitution when costs are assigned to each of these processes (Abbott and Forrest 1986; Piccarreta and Lior 2010). All unique sequences are compared to each other, resulting in a dissimilarity matrix which defines the total distance between any pair of sequences. Using this matrix similar sequences can be identified and clustered.

There is much debate in sequence analysis research about how to assign these costs (Abbott and Tsay 2000). Our substitution costs are derived from the transition rates between states generating two 6×6 substitution matrices, one for each domain, using the TraMineR R package (Gabadinho et al. 2011). Indel costs are set to 1, which is seen as an increasingly standard method and used in similar studies (Aassve, Billari, and Piccarreta 2007; Piccarreta and Lior 2010).

5.2 Clustering

To cluster the trajectories, we used agglomerative nesting, also known as hierarchal clustering under Ward's method (Ward 1963). Hierarchical clustering uses a dissimilarity matrix created through optimal matching. Initially all unique sequences are clustered individually, and the two most similar merge into a larger cluster. At each fusion the

within-group dispersion is minimised (Murtagh and Legendre 2014). This proceeds until all sequences have been merged into one cluster containing all sequences. To cluster the data, we used the cluster R package (Maechler et al. 2021). We identified solutions from three clusters to nine clusters. This upper limit was chosen to avoid too much complexity when it comes to describing the typologies and ensure that there is sufficient membership in each cluster for multinomial modelling.

A quandary for researchers clustering data is that there is an element of subjectivity in the choice of total number of clusters (Piccarreta and Lior 2010). The optimal number of clusters will "minimise within-cluster and maximise the between-cluster distance" (Mikolai and Lyons-Amos 2017). Statistical measures do exist to guide this decision-making process, which are highlighted in Appendix B, but they often do not support the same solution. We use the WeightedCluster[5] package in R to calculate these indices; detailed mathematical descriptions of the indices can be found in the package manual (Studer 2013).

The main body of the results will show a four-cluster solution. This was deemed optimal based on the Average Silhouette Width (Kaufman and Rousseeuw 1990). Appendix D features a supplementary analysis of the three-cluster solution, which the Caliński-Harabasz index (Caliński and Harabasz 1974) deemed optional. In general, different cluster solutions will yield little variation across the main groups (Aassve, Billari, and Piccarreta 2007). Other measures highlighted larger cluster numbers as optimal. However, fewer clusters highlighted heterogeneity between clusters better and maintained sample size for subsequent modelling. Using more clusters resulted in the differences observed between the clusters becoming of little substantive value.

5.3 Multinomial logistic regression

Sequence and cluster analysis are merely descriptive methods for categorising data (Pollock, Antcliff, and Ralphs 2002). Therefore, we use a multinomial logistic regression to calculate the likelihood of belonging to each of the clusters. Results are presented in the form of average marginal effects due to the relative ease of interpretation (Ferrari and Pailhé 2017) compared to a relative risk ratio where one of the clusters must be the baseline risk.

The dependent variable is the identified cluster with independent variables: immigrant background, gender, ten-year birth cohort, and highest education ever reported. We apply cross-sectional weights to the analysis and adjust standard errors to account for the clustering of respondents at household level (Mikolai and Kulu 2022b),

[5] For the avoidance of doubt whilst this package allows for weighted data, weights were not used in assigning cluster membership.

and the use of ethnic minority boosts in the UKHLS. For robustness we ran unweighted models, which produce comparable results for the differences between migrant generations and natives.

5.4 Pakistani-only sample

Due to the dominance of natives in the sample we expect clusters to be determined by the behaviours of the native population. While this allows for analysis of differences between the immigrant populations and the majority population, it hides the heterogeneity within the Pakistani group. Therefore, additional analysis will repeat the above methods with a sample restricted to only the Pakistani born and their descendants.

For consistency we again show the four-cluster solution in the main results, with the three-cluster solution in the appendix. To avoid empty cells some minor changes were made, notably the combining of the widowed and divorced and top coding fertility at 'four or more children.' As Table 2 shows, the prevalence of widowhood before age 35 is low, thus a transition to that state is unlikely to be a defining characteristic of a cluster membership.

6. Results

6.1 Four-cluster solution

The four-cluster solution broken down by immigrant generation is presented in Table 3. The four clusters identified can be characterised as:

(1) Later transitions and later (or no) childbearing,
(2) Cohabitors,
(3) Long-term single and childless, and
(4) Direct marriage and large families.

Figure 2 presents chronograms for each cluster (sequence index plots, which show individual sequences can be found in Appendix C). We characterise cluster one, 'Later transitions and later (or no) childbearing,' as a mixture of different union types but mostly resulting in marriage by age 35 with some cohabitation and dissolution. Childbearing is delayed with less than 50% transitioning to parenthood before age 35 and no fertility transitions before age 25. The second cluster is 'Cohabitors'; this is the smallest cluster and is populated by those who enter a cohabitating relationship at some point with few

of them transitioning to marriage. The unions formed appear less stable, with fluctuations between cohabiting and being currently single common. Transitions to childbearing are still common, all have at least one child by the end of the observation. Cluster three is 'Long-term single and childless,' which contains primarily those that have no children and never enter any form of union. Those that do, do so late into the observation time. The final cluster is 'Direct marriage and large families'; this group primarily transitions directly from never being partnered to being married, almost all before age 25, and remain married until the end of the observation time. Fertility trajectories suggests a high parity reached. All have transitioned to childbearing by age 30, and multiple children is the norm.

Table 3: Cluster membership by immigrant generation, four-cluster solution (unweighted %)

Cluster	Native	2nd generation	1st generation	Total
Later transitions and later (or no) childbearing	37	21	23	37
Cohabitors	6	1	0	5
Long-term single and childless	28	34	35	29
Direct marriage and large families	29	44	41	29
Total (N)	20,848	256	958	22,062

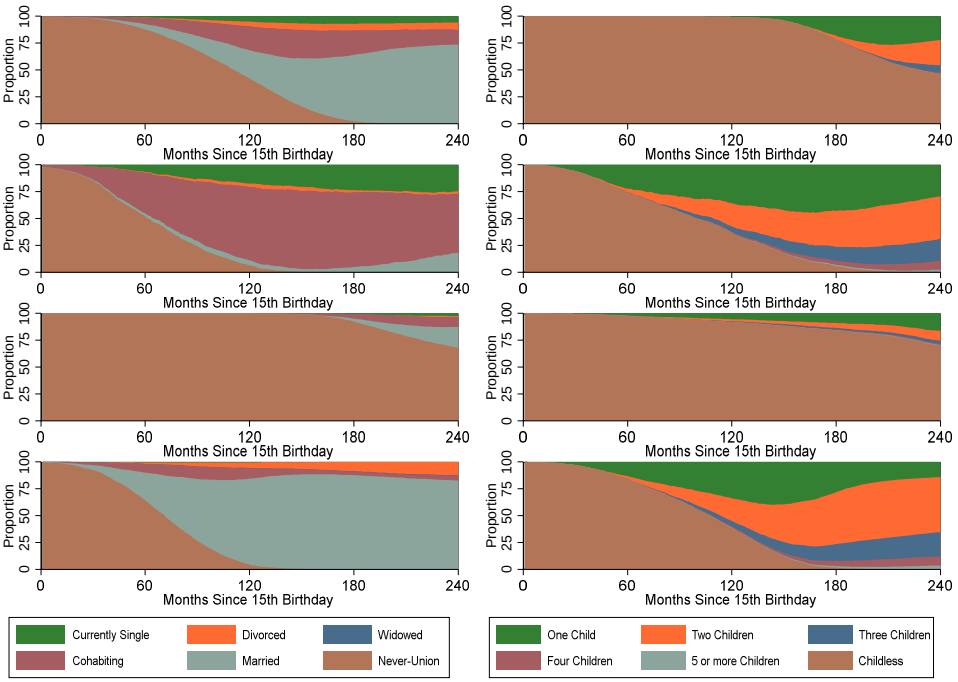
The breakdown by immigrant generation suggests an increased likelihood of remaining long-term single and childless or entering direct marriage and having large families for Pakistanis compared to natives. The cohabitors cluster is almost entirely populated by natives; only a handful of second-generation Pakistanis enter this trajectory and no Pakistani-born individuals. Moreover, we see that later transitions and late childbearing is more common amongst natives than Pakistanis.

Figure 3 presents the average marginal effects of the multinomial logistic regression. This shows that compared to natives, Pakistanis of both generations have higher probabilities of entering the 'Direct marriage and large family' cluster. Moreover, they are less likely to belong to 'Later transitions and later (or no) childbearing.' Cohabitation is also found to be less common among the Pakistani population; the marginal effects appear small due to it being an uncommon cluster for ancestral natives too.

The education gradient suggests that decreasing levels of education are associated with increased probability of engaging in cohabitation as an alternative to marriage. Similarly, later transitions and childbearing is associated with increasing education levels. Having no qualifications is associated with belonging to the long-term single and childless cluster. Women are less likely to be single and childless at 35 or to experience delayed transitions to unions and parenthood. This finding is expected given biological pressures on fertility and the general norm that women are younger than their partners

(Gustafson and Fransson 2015). Women are slightly more likely than men to be a member of the 'Cohabitator' cluster.

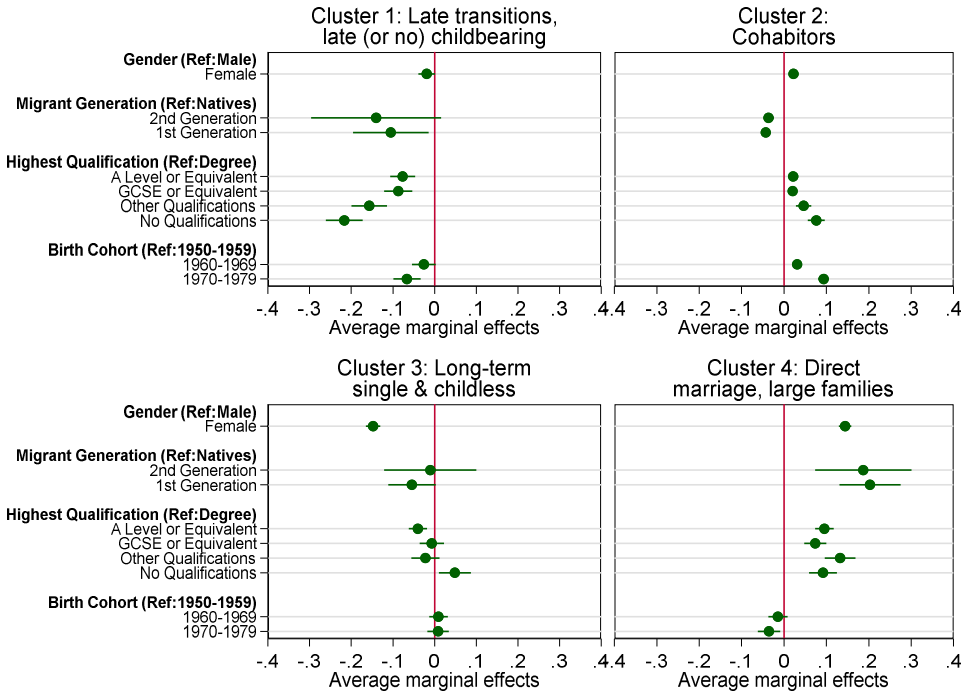
Figure 2: Chronogram of four-cluster solution, whole sample



Note: Left panels show relationship states, right panels show fertility states. Top to bottom rows are clusters one to four. Indel costs = 1.
Source: Authors own calculations, based on UKHLS.

Among later-born cohorts, the likelihood of being in the 'Direct marriage and large family' trajectory is lower, and they are more likely to be in the 'Cohabitors' cluster. The increase in cohabitation over time also results in decreased likelihood of having later transitions and delayed childbearing. The likelihood of belonging to the 'Long-term single and childless' cluster did not vary significantly by birth cohort.

Figure 3: Average marginal effects of four-cluster membership with 95% CIs



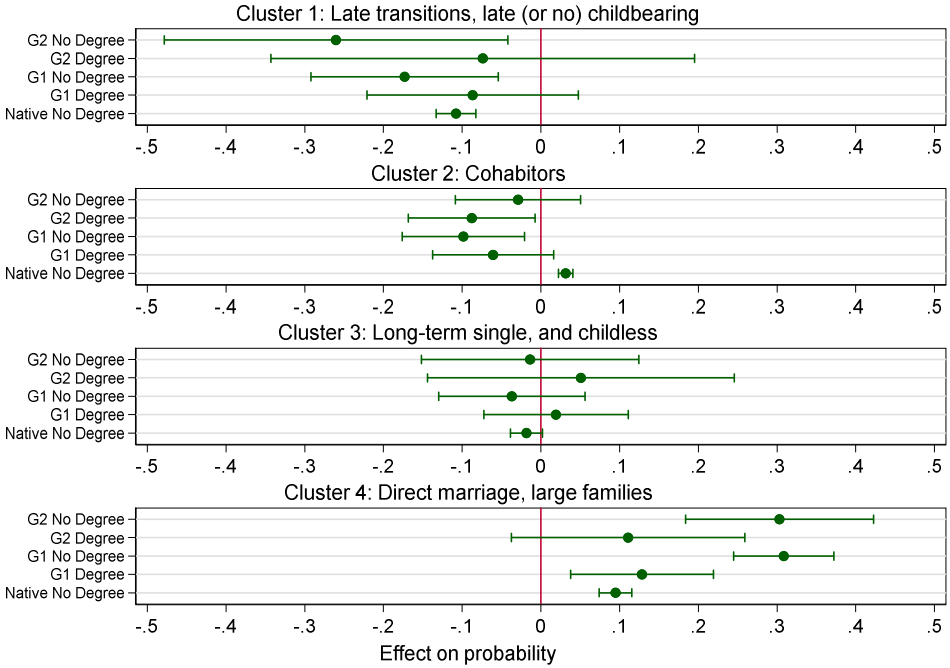
Note: Indel costs =1. Red line = 0 (no marginal effect). Survey weighted.
Source: Authors own calculations, based on UKHLS.

6.2 Interactions between migrant status and other characteristics

To study if the influence of immigrant generation differs by gender, birth cohort, or education, we used interactions of these variables. Likelihood ratio tests suggested that neither gender nor cohort interacted with migrant status led to improved model fit. We dichotomised the education variable to preserve observations within each interaction and found that degree versus no degree, interacted with migrant generation, did improve the model fit (albeit only at 90% significance level). Figure 4 shows the average marginal effects of these interactions, with the model controlled for cohort and gender. The results show distinct differences between Pakistani immigrants who have a degree and those who do not. Those who have a degree are more aligned with the native group in terms of a reduced likelihood of belonging to the 'Direct marriage and large families' trajectory

and an increased likelihood of being in the 'Later transitions and later (or no) childbearing' cluster. The 'Long-term single and childless' and 'Cohabitor' clusters see minimal variation for Pakistanis based on higher education.

Figure 4: Average marginal effects of interaction between immigrant generation and having a degree on probability of cluster membership, 95% CIs



Note: Indel costs =1 Red line = 0 (no marginal effect). Due to zero occurrence of cohabitors cluster in Pakistani population manual imputation of one observation was done. Survey weighted.
Source: Authors own calculations, based on UKHLS.

6.3 Pakistani only

The results from the full sample suggest a strong similarity between Pakistani-born immigrants and British-born descendants. However, due to the high proportion of natives in the sample there could be heterogeneity within the Pakistani group that is undetectable in the results. Thus, we restrict the sample to only Pakistanis, allowing the clusters to be formed as a reflection of their trajectories.

We present a four-cluster solution again, with the three-cluster solution in Appendix E. Table 4 shows the percentage breakdown within each cluster and Figure 5 the chronograms which show the cluster make-up visually. The four clusters can be defined as:

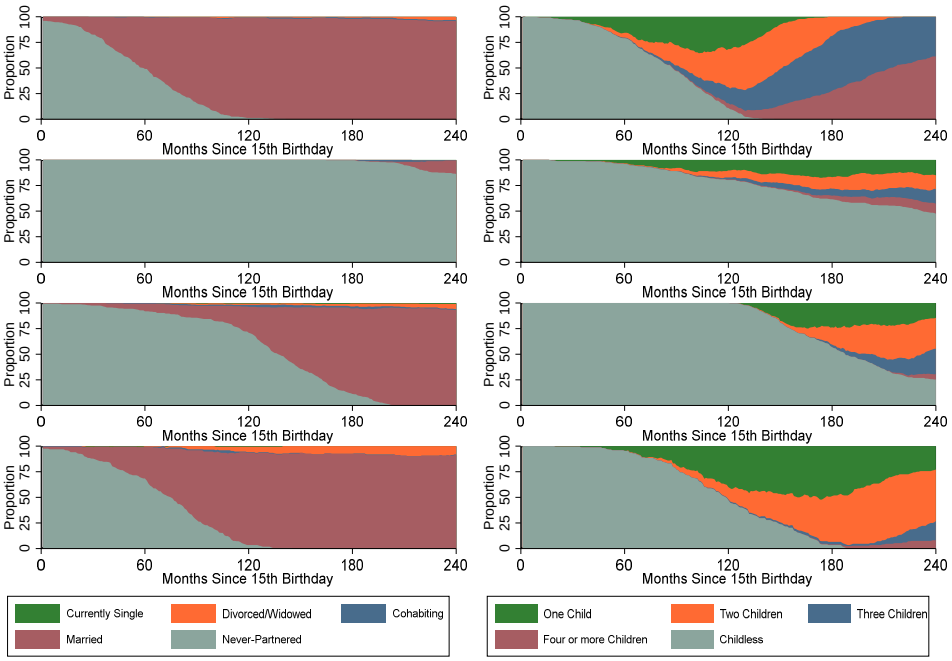
(1) Early marriage, large families;
(2) Never partnered;
(3) Later marriage, smaller families; and
(4) Early marriage, small families.

First, 'Early marriage, large families' is a cluster where all individuals enter direct marriage before age 25, and all transition into having three or more children by the end of the observation period. Second, 'Never partnered' is where members remain unpartnered, although around half of these individuals do eventually transition into parenthood. Third, 'Later marriage, smaller families' is a cluster where direct marriage is still dominant, but the transitions do not take place until their late 20s and where childbearing occurs at a much slower pace with lower parities compared to those in cluster one. Finally, 'Early marriage, small families' a cluster with transitions to unions happening at a similar rate as cluster one, but overall fertility is limited to one or two children. This cluster also features individuals who experience divorce and widowhood (although this proportion is negligible).

Table 4: Breakdown of cluster membership, Pakistani-only sample (unweighted %)

Cluster	1st generation	2nd generation	Total
Early marriage, large families	25	27	26
Never partnered	32	32	32
Later marriage, smaller families	28	26	28
Early marriage, small families	14	15	14
Total (N)	958	256	1,214

Figure 5: Chronograms of the four-cluster solution, Pakistani-only sample



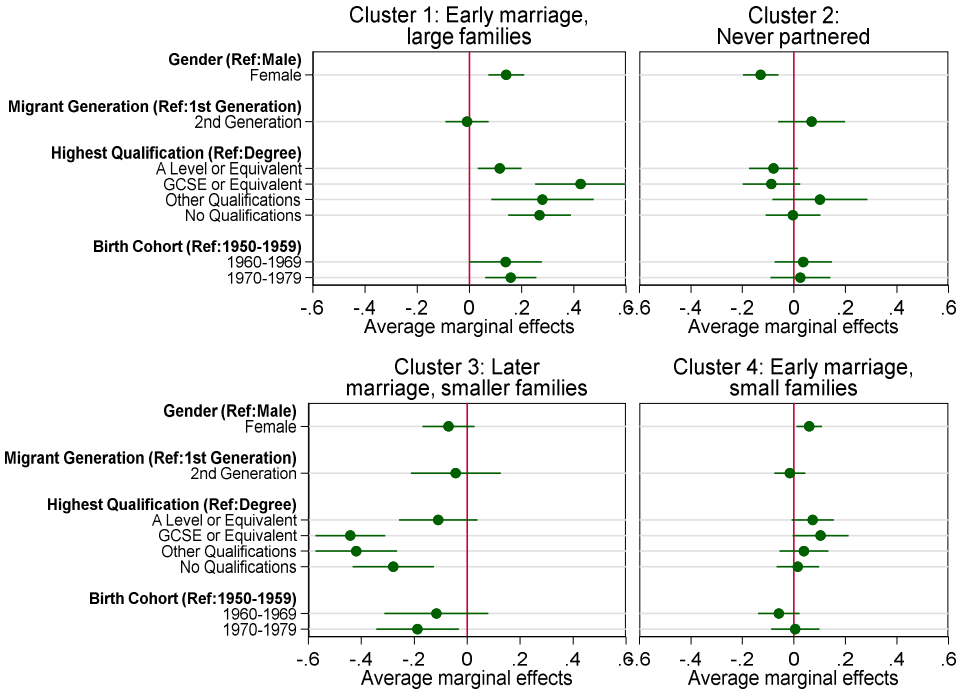
Note: Left panels show relationship states. Right panels show fertility states. Top to bottom are clusters one to four. Indel costs = 1.
Source: Authors own calculations, based on UKHLS.

Figure 6 highlights limited differences between the first- and second-generation Pakistanis. Post-16 education (A-Level and higher) is associated with increased likelihood of having 'Later marriage, smaller families.' Those who obtain lower qualifications are more likely to take a trajectory of 'Early marriage, large families.' 'Early marriage, small families' and 'Never partnered' clusters do not show a clear gradient with education.

Gender effects indicate that women of Pakistani background are less likely to end up 'Never partnered,' but there is seemingly little difference between men and women relating to the likelihood of entering clusters with smaller families, both early and later marriage. Women do have increasing likelihoods of entry into the 'Early marriage, large families' cluster, indicating that earlier transitions are more common amongst women. For cohort we also see little indication of change over time for the Pakistani group. There is some indication of more recent cohorts having increased likelihood of belonging to

'Early marriage, large families' and a reduced probability of belonging to 'Later marriage, smaller families.'

Figure 6: Average marginal effects of four-cluster membership, Pakistani-only sample, 95% CIs



Note: Indel costs =1. Red line = 0 (no marginal effect).
Source: Authors own calculations, based on UKHLS.

6.4 Robustness and sensitivity

6.4.1 Indel costs

Decision-making regarding the choice of indel and substitution costs in optimal matching can appear somewhat arbitrary, a commonly raised criticism of sequence analysis (Pollock, Antcliff, and Ralphs 2002). The choices made in our analysis are consistent with those in similar previous research (see Aassve, Billari, and Piccarreta 2007;

Delaporte and Kulu 2022; Mikolai and Lyons-Amos 2017; Piccarreta and Lior 2010). However, substitution costs and indel costs are interrelated, which can alter the results of optimal matching and clustering (Bison 2009). We repeated the analysis with indel costs of 1.5 and 2, which have been used as sensitivity analyses in optimal matching (Mikolai and Kulu 2019; Mikolai and Lyons-Amos 2017). Both yielded similar results to the analysis presented above, where indel cost is 1 (see Appendix F for results where indel cost is 2). Interpretation and description of the clusters remain the same with minimal variation on membership. The main differences were the association between lower education and belonging in the cohabitation cluster, and between first-generation immigrants and belonging to the 'Later marriages, smaller families' cluster diminished. Nevertheless, the interpretation of the results that Pakistani life courses are more conservative and that differences between the first and second generation are limited remains.

6.4.2 Child migrants

In this sample around 25% of the Pakistani-born group arrived in the United Kingdom before the age of 15. Studies of immigrants take a variety of approaches when it comes to the categorisation of those who migrated as children, with differences in family dynamics found relating to age at arrival (Adserà et al. 2012). Our approach took a strict definition that being born in Pakistan, regardless of age at migration, constituted a first-generation migrant. However, we accept that there could be nuance in this definition and those who migrate in childhood might be more culturally aligned with the second generation. We also know that the selection process into being a child who arrived with their parents, or rather the selection factors of their parents, are different from adult immigrants from the same birth cohort (Luthra and Platt 2017). As a sensitivity analysis we recategorised those first as their own distinct group and then combined them with the second generation. Replicating the analysis using this sampling method found no substantive change in either the direction or the magnitude of the effects, only that the confidence interval estimates became wider due to reduced precision.

7. Discussion

This study extends previous analysis by Mikolai and Kulu (2022b) on immigrant/native differences in family behaviour in the United Kingdom. By focussing on the Pakistani group specifically, we find evidence for the persistence of conservative family formation patterns (direct marriage) compared to ancestral natives, supporting previous findings

which have combined Pakistani and Bangladeshi populations (Berrington 1994; Dubuc 2012; Kulu and Hannemann 2016; Wilson 2019). There is limited evidence of changes in fertility and partnership of Pakistanis across immigrant generations or birth cohorts, providing support for the minority subculture hypothesis and cultural entrenchment of behaviours (Wilson 2020). In fact, we find evidence that more recent cohorts of Pakistanis display even more conservative behaviour, with those born after 1960 more likely to have a trajectory of 'Early marriage, large families.' We attribute this to changes in the selection and the lack of disruption faced by younger cohorts whose partnership formation years are more likely to be spent in one location. Lastly, we find that higher education levels are associated with partial convergence to native family building patterns, implying that there is a relationship between processes of adaptation, socialisation, and education institutions.

Our first aim was to identify differences between Pakistanis and the ancestral natives. We find similarities in the likelihood of being single and childless by age 35 between natives and Pakistanis. This supports the idea that forming a union and having at least one child some time before age 35 is the norm for both groups. In the full sample, most Pakistanis are in the 'Long-term single and childless' or 'Early transition with large families' cluster. Implying that the elevated fertility found in this group is associated with higher parity transitions and not a consistent increase across all Pakistanis, which has been alluded to in previous research (Kulu et al. 2017). Amongst natives there are changes consistent with the second demographic transition (Van De Kaa 1987; Lesthaeghe 1995), increased likelihood of cohabitation as an alternative to marriage is strongly associated with later birth cohorts, but there is no evidence that this has occurred for Pakistanis, almost none of whom experience cohabitation for long periods of time. Overall, the differences observed between natives and Pakistanis provide support for Hypothesis 1.

The second research question was to identify differences between the Pakistani immigrant generation and their descendants. We find limited evidence of assimilation through generations, therefore accepting Hypothesis 2b supporting an existence of a minority subculture and within-group socialisation being dominant (Kulu et al. 2019; Lichter et al. 2012). Speculatively we believe this can be related to wider issues such as residential segregation faced by the group (Peach 2006), this segregation inhibits socialisation with the majority and so preferences for large families become culturally entrenched (Wilson 2019; Wilson and Kuha 2018). Previous research suggests that fertility has reduced from first to second generation (Kulu and Hannemann 2016) but results here counter this. The use of a more holistic approach such as MCSA, finds relative consistency in the distribution of family trajectories between generations. These results could be considered a sign of disadvantage; however, it is important to emphasise that the cultural preferences that seem to be transmitted between generations do not

necessarily reflect disadvantage in the same way it does in the majority population (Robson and Berthoud 2006).

Despite limited assimilation between generations, the analysis does reveal that there is heterogeneity within the Pakistani group overall. The clusters which emerge from analysis of the Pakistani subpopulation clearly demonstrate differences in the tempo of life events such as union formation and childbearing. Moreover, there is a sizeable proportion who remain 'Never partnered.' The second demographic transition (Van De Kaa 1987; Lesthaeghe 1995) suggests that this becomes increasingly common over time, although membership of this cluster is not apparently associated with birth cohort. Even within this cluster more evidence of heterogeneity can be found with many transitioning to parenthood, whilst unpartnered. We considered if this could be a data error, yet others have explored this data and find no reason to suspect this (Mikolai and Kulu 2022b). UK census results also find around 8.8% Pakistani households are 'lone parent with children'[6] (Office for National Statistics 2019). We offer two explanations, first instances of couples living apart, possibly one remaining in Pakistan; second, non-standard family trajectories existing in the UK Pakistani population, that previous research has not sufficiently identified.

Our third research question was interested in the differences over time. Whilst differences between generations are not clearly identifiable, there are differences between birth cohorts in the Pakistani sample. 'Early marriage, large families' is associated with more recent birth cohorts and the converse true with reduced likelihood of belonging to 'Later marriage, smaller families' for younger members of the sample, this thereby counters what we proposed in Hypothesis 3. We believe this is an effect of different selection regimes and the changing make-up of the Pakistani population over time (Luthra and Platt 2017). Older birth cohorts are primarily the immigrant generation who have experienced the disruptive effects of migration involving separation from spouses or entry to a new network (Bean et al. 1984; Milewski 2007). Conversely, more recent birth cohorts comprise of more child migrants who do not face that disruption. Even amongst adult arrivals born in the 1970's disruption is less of a factor as they are primarily either migrating to form a union (Georgiadis and Manning 2011; Robards and Berrington 2016) or positively selected and arrive with a spouse they married in Pakistan. We do acknowledge that there could be an unobserved catch-up period after age 35 (Ford 1990), where those who face disruption eventually reach higher parities or form a union. Thus, we can consider only following individuals until age 35 as a limitation of this study.

Our final research question was about the influence of education. In the full sample, we see clear gradients of higher education being associated with increased likelihood of entering the 'Later transitions and later (or no) childbearing' cluster a consequence of

[6] The census category is not specific to never-partnered childbearing but shows that the resulting household composition is found.

delayed transitions to union and fertility due to time spent in education (Billari, Hiekel, and Liefbroer 2019). When studying the Pakistani minority alone we see that education has little association with the likelihood of being 'Never partnered' or having an 'Early marriage, small families' trajectory. This implies that there is some element of personal preferences and choice of family structure that operates externally to education obtained. However, we still observe high education associated with increased likelihood of 'Later marriage, smaller families' and low education associated with 'Early marriage, large families.'

We used interaction terms to see how the effect of degree-level education varied between generations. We found that having a degree for both the immigrant generation and descendants was predictive of exhibiting distribution of life trajectories more like natives, ceteris paribus, supporting previous evidence (Dale and Ahmed 2011; Dubuc 2018). It increased likelihoods of belonging to the 'Later transitions and later (or no) childbearing' cluster and was negatively associated with a 'Direct marriage and large families' trajectory, providing support for Hypothesis 4. Importantly, education alone is not a sufficient explanation of assimilation to native processes. The results reveal that even with a degree-level education, Pakistani-born individuals still have an increased likelihood of earlier marriage and childbearing than ancestral natives of any education level. Additional factors are at play: personal preferences related to culture, socioeconomic factors, and education determine the life course, and these operationalise differently between the Pakistani minority and the British majority.

There are some limitations in our study: First, highest qualification/education is endogenous to the family processes under study. We justify including it as a cross-sectional measure as necessary given data restraints. Future research should consider additional domains such as labour market participation (Mikolai and Kulu 2022a). Second, we do not observe high rates of union dissolution. The unions we observe are relatively stable; however, attrition in UKHLS is highly related to separation and subsequent mobility (Mitchell, Collins, and Brown 2015), leaving sequences incomplete.

Whilst we find evidence for higher fertility and earlier direct marriage as being typical trajectories of Pakistanis in the United Kingdom, we do find glimpses of heterogeneity that should continue to be explored, having been less studied in previous literature. To our knowledge this is the first application of MCSA on Pakistani life courses in the United Kingdom, and we recommend that MCSA and approaches like multistate modelling (Mikolai and Kulu 2022b) continue to be expanded and refined as they have much to offer in longitudinal research of migrants and their descendants.

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References

Aassve, A., Billari, F.C., and Piccarreta, R. (2007). Strings of adulthood: A sequence analysis of young British women's work-family trajectories. *European Journal of Population* 23(3–4): 369–388. doi:10.1007/s10680-007-9134-6.

Abbott, A. (1995). Sequence analysis: New methods for old ideas. *Annual Review of Sociology* 21: 93–113. doi:10.1146/annurev.soc.21.1.93.

Abbott, A. and Forrest, J. (1986). Optimal matching methods for historical sequences. *Journal of Interdisciplinary History* 16(3): 471. doi:10.2307/204500.

Abbott, A. and Tsay, A. (2000). Sequence analysis and optimal matching methods in sociology. *Sociological Methods and Research* 29(1): 3–33. doi:10.1177/0049124100029001001.

Adserà, A., Ferrer, A.M., Sigle-Rushton, W., and Wilson, B. (2012). Fertility patterns of child migrants: Age at migration and ancestry in comparative perspective. *Annals of the American Academy of Political and Social Science* 643(1): 160–189. doi:10.1177/0002716212444706.

Ahmad, F. (2012). Graduating towards marriage? Attitudes towards marriage and relationships among university-educated British Muslim women. *Culture and Religion* 13(2): 193–210. doi:10.1080/14755610.2012.674953.

Andersson, G. (2004). Childbearing after migration: Fertility patterns of foreign-born women in Sweden. *International Migration Review* 38(2): 747–774. doi:10.1111/j.1747-7379.2004.tb00216.x.

Andersson, G., Obućina, O., and Scott, K. (2015). Marriage and divorce of immigrants and descendants of immigrants in Sweden. *Demographic Research* 33(2): 31–64. doi:10.4054/DemRes.2015.33.2.

Balbo, N., Billari, F.C., and Mills, M. (2013). Fertility in advanced societies: A review of research. *European Journal of Population* 29: 1–38. doi:10.1007/s10680-012-9277-y.

Bean, F.D., Cullen, R.M., Stephen, E.H., and Swicegood, C.G. (1984). Generational differences in fertility among Mexican Americans: Implications for assessing the effects of immigration. *Social Science Quarterly* 65(2): 573–582.

Beaujouan, É. and Ní Bhrolcháin, M. (2011). Cohabitation and marriage in Britain since the 1970s. *Population Trends* 145: 35–59. doi:10.1057/pt.2011.16.

Berrington, A. (1994). Marriage and family formation among the white and ethnic minority populations in Britain. *Ethnic and Racial Studies* 17(3): 517–546. doi:10.1080/01419870.1994.9993837.

Berrington, A. (2020). Expectations for family transitions in young adulthood among the UK second generation. *Journal of Ethnic and Migration Studies* 46(5): 913–935. doi:10.1080/1369183X.2018.1539276.

Billari, F.C., Hiekel, N., and Liefbroer, A.C. (2019). The social stratification of choice in the transition to adulthood. *European Sociological Review* 35(5): 599–615. doi:10.1093/esr/jcz025.

Bison, I. (2009). OM Matters: The interaction effects between indel and substitution costs. *Methodological Innovations Online* 4(2): 53–67. doi:10.1177/205979910900400205.

Booth, A.L. and Kee, H.J. (2009). Intergenerational transmission of fertility patterns. *Oxford Bulletin of Economics and Statistics* 71(2): 183–208. doi:10.1111/j.1468-0084.2008.00524.x.

Borjas, G.J. (1987). Self-selection and the earnings of immigrants. *The American Economic Review* 77(4): 531–553. doi:10.3386/w2248.

Caliński, T. and Harabasz, J. (1974). A dendrite method for cluster analysis. *Communications in Statistics* 3(1): 1–27. doi:10.1080/03610927408827101.

Catney, G. and Simpson, L. (2014). How persistent is demographic variation between ethnic groups? The case of household size in England and Wales. *Population, Space and Place* 20(3): 201–221. doi:10.1002/psp.1762.

Charsley, K. and Bolognani, M. (2021). Marrying 'in'/marrying 'out'? Blurred boundaries in British Pakistani marriage choices. *Journal of Ethnic and Migration Studies* 47(2): 361–378. doi:10.1080/1369183X.2019.1625131.

Chiswick, B.R. (1999). Are immigrants favorably self-selected? *American Economic Review* 89(2): 181–185. doi:10.1257/aer.89.2.181.

Chiswick, B.R., Lee, Y.L., and Miller, P.W. (2008). Immigrant selection systems and immigrant health. *Contemporary Economic Policy* 26(4): 555–578. doi:10.1111/j.1465-7287.2008.00099.x.

Coleman, D.A. and Dubuc, S. (2010). The fertility of ethnic minorities in the UK, 1960s–2006. *Population Studies* 64(1): 19–41. doi:10.1080/00324720903391201.

Dahya, B. (1972). Pakistanis in England. *Journal of Ethnic and Migration Studies* 2(1): 25–33. doi:10.1080/1369183X.1972.9975169.

Dale, A. and Ahmed, S. (2011). Marriage and employment patterns amongst UK-raised Indian, Pakistani, and Bangladeshi women. *Ethnic and Racial Studies* 34(6): 902–924. doi:10.1080/01419870.2011.564058.

Dale, A., Fieldhouse, E., Shaheen, N., and Kalra, V. (2002). The labour market prospects for Pakistani and Bangladeshi women. *Work, Employment and Society* 16(1): 5–25. doi:10.1177/09500170222119227.

De Valk, H.A.G., and Liefbroer, A.C. (2007). Timing preferences for women's family-life transitions: Intergenerational transmission among migrants and Dutch. *Journal of Marriage and Family* 69(1): 190–206. doi:10.1111/j.1741-3737.2006.00353.x.

Delaporte, I. and Kulu, H. (2022). Interaction between childbearing and partnership trajectories among immigrants and their descendants in France: An application of multichannel sequence analysis. *Population Studies*. doi:10.1080/00324728.2022.2049856.

Dubuc, S. (2012). Immigration to the UK from high-fertility countries: Intergenerational adaptation and fertility convergence. *Population and Development Review* 38(2): 353–368. doi:10.1111/j.1728-4457.2012.00496.x.

Dubuc, S. (2018). Fertility and education among British Asian women: A success story of social mobility? *Vienna Yearbook of Population Research* 1: 269–291. doi:10.1553/populationyearbook2017s269.

Dupray, A. and Pailhé, A. (2018). Does employment uncertainty particularly impact fertility of children of North African immigrants in France? A gender perspective. *Journal of Ethnic and Migration Studies* 44(3): 401–424. doi:10.1080/1369183X.2017.1313107.

Ferrari, G. and Pailhé, A. (2017). Transition to adulthood in France: Do children of immigrants differ from natives? *Advances in Life Course Research* 31: 34–56. doi:10.1016/j.alcr.2016.10.001.

Ford, K. (1990). Duration of residence in the United States and the fertility of US immigrants. *International Migration Review* 24(1): 34–68. doi:10.2307/2546671.

Gabadinho, A., Ritschard, G., Müller, N.S., and Studer, M. (2011). Analyzing and visualizing state sequences in R with TraMineR. *Journal of Statistical Software* 40(4): 1–37. doi:10.18637/jss.v040.i04.

Gangadharan, L. and Maitra, P. (2003). The effect of education on the timing of marriage and first birth in Pakistan. *Journal of Quantitative Economics* 1: 114–133. doi:10.1007/BF03404653.

Gauthier, J.A., Widmer, E.D., Bucher, P., and Notredame, C. (2010). Multichannel sequence analysis applied to social science data. *Sociological Methodology* 40(1): 1–38. doi:10.1111/j.1467-9531.2010.01227.x.

Georgiadis, A. and Manning, A. (2011). Change and continuity among minority communities in Britain. *Journal of Population Economics* 24(2): 541–568. doi:10.1007/s00148-009-0288-x.

Glick, J.E. (2010). Connecting complex processes: A decade of research on immigrant families. *Journal of Marriage and Family* 72(3): 498–515. doi:10.1111/j.1741-3737.2010.00715.x.

Goldberg, D. (1959). The fertility of two-generation urbanites. *Population Studies* 12(3): 214–222. doi:10.1080/00324728.1959.10405021.

Goldstein, S. and Goldstein, A. (1981). The impact of migration on fertility: An 'own children' analysis for Thailand. *Population Studies* 35(2): 265–284. doi:10.1080/00324728.1981.10404967.

Gordon, M.M. (1964). *Assimilation in American life: The role of race, religion, and national origins*. New York: Oxford University Press. doi:10.2307/3510186.

Gustafson, P. and Fransson, U. (2015). Age differences between spouses: Sociodemographic variation and selection. *Marriage and Family Review* 51(7): 610–632. doi:10.1080/01494929.2015.1060289.

Hannemann, T. and Kulu, H. (2015). Union formation and dissolution among immigrants and their descendants in the United Kingdom. *Demographic Research* 33(10): 273–312. doi:10.4054/DemRes.2015.33.10.

Hannemann, T., Kulu, H., González-Ferrer, A., Pailhé, A., Rahnu, L., and Puur, A. (2020). Partnership dynamics among immigrants and their descendants in four European countries. *Population, Space and Place* 26(5): 1–19. doi:10.1002/psp.2315.

Harding, S. (2003). Mortality of migrants from the Indian Subcontinent to England and Wales: Effect of duration of residence. *Epidemiology* 14(3): 287–292. doi:10.1097/01.EDE.0000050369.88416.82.

Heath, A.F. and Di Stasio, V. (2019). Racial discrimination in Britain, 1969–2017: A meta-analysis of field experiments on racial discrimination in the British labour market. *British Journal of Sociology* 70(5): 1774–1798. doi:10.1111/1468-4446.12676.

Hennink, M., Diamond, I., and Cooper, P. (1999). Contraceptive use dynamics of Asian women in Britain. *Journal of Biosocial Science* 31(4): 537–554. doi:10.1017/S0021932099005374.

Hervitz, H.M. (1985). Selectivity, adaptation, or disruption? A comparison of alternative hypotheses on the effects of migration on fertility: the case of Brazil. *International Migration Review* 19(2): 293–317. doi:10.2307/2545774.

Kahn, J.R. (1988). Immigrant selectivity and fertility adaptation in the United States. *Social Forces* 67(1): 108–128. doi:10.2307/2579102.

Kaufman, L. and Rousseeuw, P.J. (1990). *Finding groups in data*. *An introduction to cluster analysis*. New York: Wiley. doi:10.1002/9780470316801.

Khattab, N. and Modood, T. (2018). Accounting for British Muslim's educational attainment: Gender differences and the impact of expectations. *British Journal of Sociology of Education* 39(2): 242–259. doi:10.1080/01425692.2017.1304203.

Khoudja, Y. and Platt, L. (2018). Labour market entries and exits of women from different origin countries in the UK. *Social Science Research* 69(October 2017): 1–18. doi:10.1016/j.ssresearch.2017.10.003.

Kulu, H. (2005). Migration and fertility: Competing hypotheses re-examined. *European Journal of Population* 21: 51–87. doi:10.1007/s10680-005-3581-8.

Kulu, H. and González-Ferrer, A. (2014). Family dynamics among immigrants and their descendants in Europe: Current research and opportunities. *European Journal of Population* 30(4): 411–435. doi:10.1007/s10680-014-9322-0.

Kulu, H. and Hannemann, T. (2016). Why does fertility remain high among certain UK-born ethnic minority women? *Demographic Research* 35(49): 1441–1488. doi:10.4054/DemRes.2016.35.49.

Kulu, H. and Hannemann, T. (2019). Mixed marriage among immigrants and their descendants in the United Kingdom: Analysis of longitudinal data with missing information. *Population Studies* 73(2): 179–196. doi:10.1080/00324728.2018.1493136.

Kulu, H. and Milewski, N. (2007). Family change and migration in the life course: An introduction. *Demographic Research* 17(19): 567–590. doi:10.4054/DemRes.2007.17.19.

Kulu, H., Hannemann, T., Pailhé, A., Neels, K., Krapf, S., González-Ferrer, A., and Andersson, G. (2017). Fertility by birth order among the descendants of immigrants in selected European countries. *Population and Development Review* 43(1): 31–60. doi:10.1111/padr.12037.

Kulu, H., Milewski, N., Hannemann, T., and Mikolai, J. (2019). A decade of life-course research on fertility of immigrants and their descendants in Europe. *Demographic Research* 40(46): 1345–1374. doi:10.4054/DemRes.2019.40.46.

Lampard, R. (2014). Stated reasons for relationship dissolution in Britain: Marriage and cohabitation compared. *European Sociological Review* 30(3): 315–328. doi:10.1093/esr/jct034.

Larsen, E.N. and Di Stasio, V. (2019). Pakistani in the UK and Norway: Different contexts, similar disadvantage. Results from a comparative field experiment on hiring discrimination. *Journal of Ethnic and Migration Studies* 47(6): 1201–1221. doi:10.1080/1369183X.2019.1622777.

Lee, B.S. and Farber, S.C. (1985). The influence of rapid rural-urban migration on Korean national fertility levels. *Journal of Development Economics* 17(1–2): 47–71. doi:10.1016/0304-3878(85)90020-3.

Lesthaeghe, R. (1995). The second demographic transition in Western countries: An interpretation. In: Mason, K.O. and Jensen, A.-M. (eds.). *Gender and family change in industrialized countries*. Oxford: Oxford University Press: 17–62.

Lesthaeghe, R. (2014). The second demographic transition: A concise overview of its development. *Proceedings of the National Academy of Sciences* 111(51): 18112–18115. doi:10.1073/pnas.1420441111.

Li, Y. and Heath, A. (2008). Minority ethnic men in British labour market (1972–2005). *International Journal of Sociology and Social Policy* 28(5–6): 231–244. doi:10.1108/01443330810881277.

Li, Y. and Heath, A. (2020). Persisting disadvantages: a study of labour market dynamics of ethnic unemployment and earnings in the UK (2009–2015). *Journal of Ethnic and Migration Studies* 46(5): 857–878. doi:10.1080/1369183X.2018.1539241.

Lichter, D.T., Johnson, K.M., Turner, R.N., and Churilla, A. (2012). Hispanic assimilation and fertility in New U.S. destinations. *International Migration Review* 46(4): 767–791. doi:10.1111/imre.12000.

Liefbroer, A.C. and Elzinga, C.H. (2012). Intergenerational transmission of behavioural patterns: How similar are parents' and children's demographic trajectories? *Advances in Life Course Research* 17(1): 1–10. doi:10.1016/j.alcr.2012.01.002.

Lundström, K.E. and Andersson, G. (2012). Labor-market status, migrant status and first childbearing in Sweden. *Demographic Research* 27(25): 719–742. doi:10.4054/DemRes.2012.27.25.

Luthra, R.R. and Platt, L. (2017). The changing face of Pakistani migration to the United Kingdom. *AAPI Nexus: Policy, Practice and Community* 15(1–2): 15–56. doi:10.17953/1545-0317.15.1.15.

Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M., Studer, M., and Hornik, K. (2021). cluster: Cluster analysis basics and extensions. R package version 2.1.2. https://cran.r-project.org/package=cluster.

Mayer, J. and Riphahn, R.T. (2000). Fertility assimilation of immigrants: Evidence from count data models. *Journal of Population Economics* 13(2): 241–261. doi:10.1007/s001480050136.

Mikolai, J. and Kulu, H. (2019). Union dissolution and housing trajectories in Britain. *Demographic Research* 41(7): 161–196. doi:10.4054/DemRes.2019.41.7.

Mikolai, J. and Kulu, H. (2022a). Heterogeneity or disadvantage in partnership, childbearing, and employment trajectories of the descendants of immigrants in the United Kingdom? A multi-channel sequence analysis of longitudinal data. (MigrantLife Working Paper 12).

Mikolai, J. and Kulu, H. (2022b). Partnership and fertility trajectories of immigrants and descendants in the United Kingdom: A multilevel multistate event history approach. *Population Studies*: 1–20. doi:10.1080/00324728.2022.2144639.

Mikolai, J. and Lyons-Amos, M. (2017). Longitudinal methods for life course research: A comparison of sequence analysis, latent class growth models, and multi-state event history models for studying partnership transitions. *Longitudinal and Life Course Studies* 8(2): 191–208. doi:10.14301/llcs.v8i2.415.

Mikolai, J., Berrington, A., and Perelli-Harris, B. (2018). The role of education in the intersection of partnership transitions and motherhood in Europe and the United States. *Demographic Research* 39(27): 753–794. doi:10.4054/DemRes.2018.39.27.

Milewski, N. (2007). First child of immigrant workers and their descendants in West Germany: Interrelation of events, disruption, or adaptation? *Demographic Research* 17(29): 859–896. doi:10.4054/DemRes.2007.17.29.

Milewski, N. (2010a). Fécondité des immigrées en Allemagne de l'Ouest: Existe-t-il un effet de la socialization dans le passage du premier au deuxieme enfant et dans celui du deuxieme au troisieme enfant? *European Journal of Population* 26(3): 297–323. doi:10.1007/s10680-010-9211-0.

Milewski, N. (2010b). *Fertility of immigrants: A two-generational approach in Germany*. Berlin Heidelberg: Springer.

Mitchell, M., Collins, D., and Brown, A. (2015). Factors affecting participation in Understanding Society: Qualitative study with panel members. (Understanding Society Working Paper Series 2015–04).

Modood, T., Berthoud, R., Lakey, J., Nazroo, J., Smith, P., Virdee, S., and Beishon, S. (1997). *Ethnic minorities in Britain: Diversity and disadvantage*. London: Policy Studies Institute.

Murtagh, F. and Legendre, P. (2014). Ward's hierarchical agglomerative clustering method: Which algorithms implement Ward's criterion? *Journal of Classification* 31(3): 274–295. doi:10.1007/s00357-014-9161-z.

Mussino, E. and Strozza, S. (2012). The fertility of immigrants after arrival: The Italian case. *Demographic Research* 26(4): 99–130. doi:10.4054/DemRes.2012.26.4.

Office for National Statistics (2019). Ethnicity facts and figures [electronic resource]. (England and Wales 2011 Census). Newport: ONS. https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/families-and-households/latest#household-types-by-ethnicity.

Office for National Statistics (2020). *Population of the UK by country of birth and nationality*. Newport: ONS.

Pailhé, A. (2015). Partnership dynamics across generations of immigration in France: Structural vs. Cultural factors. *Demographic Research* 33(16): 451–498. doi:10.4054/DemRes.2015.33.16.

Peach, C. (1998). South Asian and Caribbean ethnic minority housing choice in Britain. *Urban Studies* 35(10): 1657–1680. doi:10.1080/0042098984097.

Peach, C. (2006). South Asian migration and settlement in Great Britain, 1951–2001. *Contemporary South Asia* 15(2): 133–146. doi:10.1080/09584930600955234.

Pelikh, A., Mikolai, J., and Kulu, H. (2022). Make up or break up? Partnership transitions among young adults in England and Wales. *Advances in Life Course Research* 52(100475). doi:10.1016/j.alcr.2022.100475.

Penn, R. and Lambert, P. (2002). Attitudes towards ideal family size of different ethnic/nationality groups in Great Britain, France and Germany. *Population Trends* 108: 49–58.

Perelli-Harris, B., Sigle-Rushton, W., Kreyenfeld, M., Lappegård, T., Keizer, R., and Berghammer, C. (2010). The educational gradient of childbearing within cohabitation in Europe. *Population and Development Review* 36(4): 775–801. doi:10.1111/j.1728-4457.2010.00357.x.

Piccarreta, R. and Lior, O. (2010). Exploring sequences: A graphical tool based on multi-dimensional scaling. *Journal of the Royal Statistical Society. Series A: Statistics in Society* 173(1): 165–184. doi:10.1111/j.1467-985X.2009.00606.x.

Pollock, G. (2007). Holistic trajectories: A study of combined employment, housing and family careers by using multiple-sequence analysis. *Journal of the Royal Statistical Society. Series A: Statistics in Society* 170(1): 167–183. doi:10.1111/j.1467-985X.2006.00450.x.

Pollock, G., Antcliff, V., and Ralphs, R. (2002). Work orders: Analysing employment histories using sequence data. *International Journal of Social Research Methodology* 5(2): 91–105. doi:10.1080/13645570110062432.

Portes, A. and Zhou, M. (1993). The new second generation: Segmented assimilation and its variants. *The ANNALS of the American Academy of Political and Social Science* 530(1): 74–96. doi:10.1177/0002716293530001006.

Qureshi, K. (2016). *Marital breakdown among British Asians: Conjugality, legal pluralism and new kinship*. London: Palgrave Macmillan. doi:10.1057/978-1-137-57047-5.

Qureshi, K., Charsley, K., and Shaw, A. (2014). Marital instability among British Pakistanis: Transnationality, conjugalities and Islam. *Ethnic and Racial Studies* 37(2): 261–279. doi:10.1080/01419870.2012.720691.

Rahnu, L., Puur, A., Sakkeus, L., and Klesment, M. (2015). Partnership dynamics among migrants and their descendants in Estonia. *Demographic Research* 32(56): 1519–1566. doi:10.4054/DemRes.2015.32.56.

Rees, P., Wohland, P., Norman, P., and Boden, P. (2012). Ethnic population projections for the UK, 2001–2051. *Journal of Population Research* 29: 45–89. doi:10.1007/s12546-011-9076-z.

Robards, J. and Berrington, A. (2016). The fertility of recent migrants to England and Wales. *Demographic Research* 34(36): 1037–1052. doi:10.4054/DemRes.2016.34.36.

Robinson, L. (2009). Cultural identity and acculturation preferences among South Asian adolescents in Britain: An exploratory study. *Children and Society* 23(6): 442–454. doi:10.1111/j.1099-0860.2008.00179.x.

Robson, K. and Berthoud, R. (2006). Age at first birth and disadvantage among ethnic groups in Britain. *Ethnic and Racial Studies* 29(1): 153–172. doi:10.1080/01419870500352702.

Sathar, Z.A. and Casterline, J.B. (1998). The onset of fertility transition in Pakistan. *Population and Development Review* 24(4): 773. doi:10.2307/2808024.

Sathar, Z.A. and Framurz Kiani, M. (1999). Some consequences of rising age at marriage in Pakistan. *Pakistan Development Review* 38(4): 541–556. doi:10.30541/v37i4IIpp.541-556.

Shankley, W. and Finney, N. (2020). Ethnic minorities and housing in Britain. In: Byrne, B., Alexander, C., Khan, O., Nazroo, J., and Shankley, W. (eds.). *Ethnicity, Race and Inequality in the UK: State of the Nation*. Bristol: Bristol University Press: 149–166. doi:10.2307/j.ctv14t47tm.13.

Shaw, A. (2000). *Kinship and continuity: Pakistani families in Britain*. Amsterdam: Harwood Academic Publishers. doi:10.4324/9781315080062.

Shaw, A. and Charsley, K. (2006). Rishtas: Adding emotion to strategy in understanding British Pakistani transnational marriages. *Global Networks* 6(4): 405–421. doi:10.1111/j.1471-0374.2006.00152.x.

Studer, M. (2013). WeightedCluster library manual: A practical guide to creating typologies of trajectories in the social sciences with R. (LIVES Working Papers Volume 24). Lausanne: Swiss Centre of Experience in Life Course Research. doi:10.12682/lives.2296-1658.2013.24.

Thomson, E. (2014). Family complexity in Europe. *Annals of the American Academy of Political and Social Science* 654(1): 245–258. doi:10.1177/0002716214531384.

Toulemon, L. (2004). Fertility among immigrant women: New data, new approach. *Population and Societies* 400(April): 1–4. https://www.ined.fr/fichier/s_rubrique/18833/publi_pdf2_pop_and_soc_english_400.en.pdf.

University of Essex Institute for Social and Economic Research (2021). Understanding Society: Waves 1–10, 2009–2019 and Harmonised BHPS: Waves 1–18, 1991–2009: Special Licence Access. doi:10.5255/UKDA-SN-6931-11.

Van De Kaa, D.J. (1987). Europe's second demographic transition. *Population Bulletin* 42(1): 1–59. http://www.ncbi.nlm.nih.gov/pubmed/12268395.

Van Hook, J. and Glick, J.E. (2020). Spanning borders, cultures, and generations: A decade of research on immigrant families. *Journal of Marriage and Family* 82(1): 224–243. doi:10.1111/jomf.12621.

Ward, J.H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association* 58(301): 236–244. doi:10.1080/01621459.1963.10500845.

Wild, S.H., Fischbacher, C.M., Brock, A., Griffiths, C., and Bhopal, R. (2006). Mortality from all cancers and lung, colorectal, breast and prostate cancer by country of birth in England and Wales, 2001–2003. *British Journal of Cancer* 94(7): 1079–1085. doi:10.1038/sj.bjc.6603031.

Wild, S.H., Fischbacher, C.M., Brock, A., Griffiths, C., and Bhopal, R. (2007). Mortality from all causes and circulatory disease by country of birth in England and Wales 2001–2003. *Journal of Public Health* 29(2): 191–198. doi:10.1093/pubmed/fdm010.

Wilson, B. (2015). *Origin, destination and convergence: Understanding the fertility of international migrants and their descendants*. London School of Economics and Political Science.

Wilson, B. (2019). The intergenerational assimilation of completed fertility: comparing the convergence of different origin groups. *International Migration Review* 53(2): 429–457. doi:10.1177/0197918318769047.

Wilson, B. (2020). *Understanding how immigrant fertility differentials vary over the reproductive life course*. Dordrecht: Springer. doi:10.1007/s10680-019-09536-x.

Wilson, B. and Kuha, J. (2018). Residential segregation and the fertility of immigrants and their descendants. *Population, Space and Place* 24(3): e2098. doi:10.1002/psp.2098.

Wilson, B. and Stuchbury, R. (2010). Do partnerships last? Comparing marriage and cohabitation using longitudinal census data. *Population Trends* 139: 37–63. doi:10.1057/pt.2010.4.

Zorlu, A. and Mulder, C.H. (2010). Location choices of migrant nest-leavers: Spatial assimilation or continued segregation? *Advances in Life Course Research* 15(2–3): 109–120. doi:10.1016/j.alcr.2010.06.001.

Appendix

Appendix A: Further descriptive statistics

Table A-1: Breakdown of highest education by immigrant status for men (unweighted %)

Highest qualification	Native	2nd generation	1st generation	Total
Degree or equivalent	33	40	28	33
A-Level or equivalent	31	37	22	31
GCSE or equivalent	18	8	15	17
Other qualifications	9	5	10	9
No qualifications	9	9	23	9
Missing	0.1	0	1	0.1
Total (N)	9,615	131	487	10,233

Table A-2: Breakdown of highest education by immigrant status for women (unweighted %)

Highest qualification	Native	2nd generation	1st generation	Total
Degree or equivalent	33	26	15	32
A-Level or equivalent	30	29	18	29
GCSE or equivalent	20	23	15	19
Other qualifications	8	7	13	9
No qualifications	10	14	38	11
Missing	0.1	1	1	0.1
Total (N)	11,233	125	471	11,829

Appendix B: Cluster validity indices

Table B-1: Cluster validity indices for different cluster size

	Point Biserial Correlation	Hubert's Gamma	Hubert's C	Average Silhouette Width	Caliński-Harabasz index
Min/Max	Max	Max	Min	Max	Max
3 Cluster	0.433	0.517	0.214	0.267	4819.4
4 Cluster	0.498	0.618	0.165	0.289	3807.8
5 Cluster	0.472	0.620	0.165	0.255	3361.2
6 Cluster	0.500	0.690	0.135	0.257	2967.6
7 Cluster	0.510	0.728	0.120	0.270	2694.5
8 Cluster	0.507	0.754	0.109	0.278	2530.5
9 Cluster	0.486	0.767	0.107	0.276	2452.9

Note: Gold cells indicate the optimal result in the three to nine cluster range within that given validity index.

Appendix C: Sequence index plots

Figure C-1: Sequence index plots of relationship states for full sample by cluster

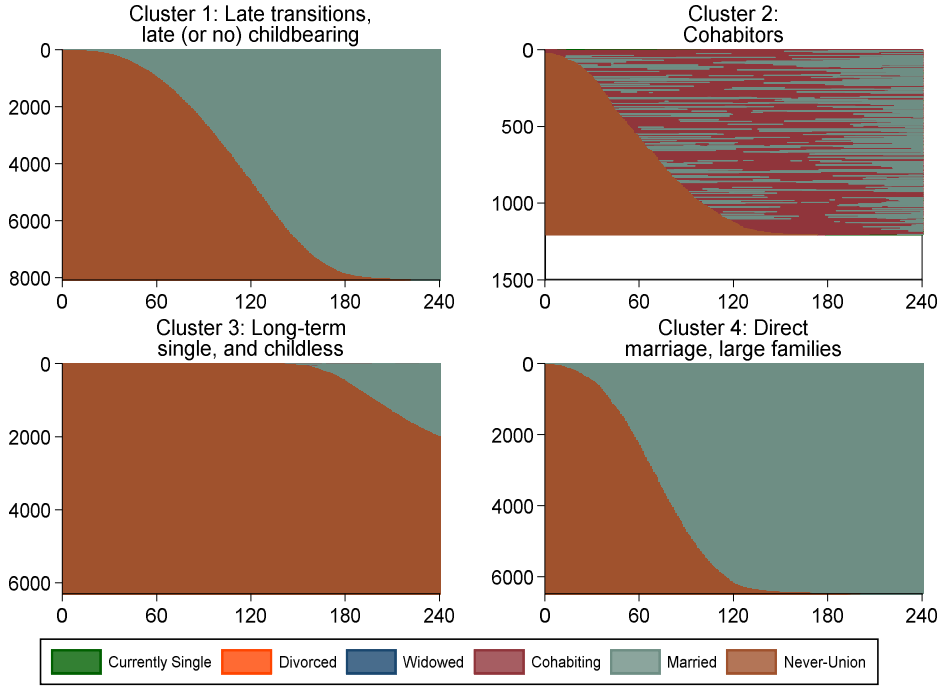
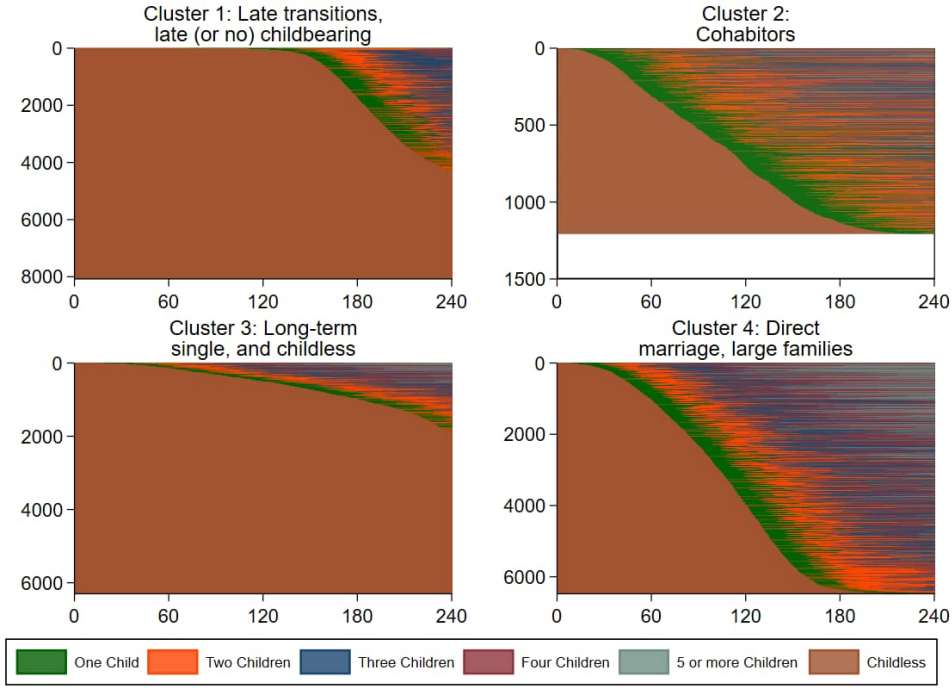


Figure C-2: Sequence index plots of fertility states for full sample by cluster



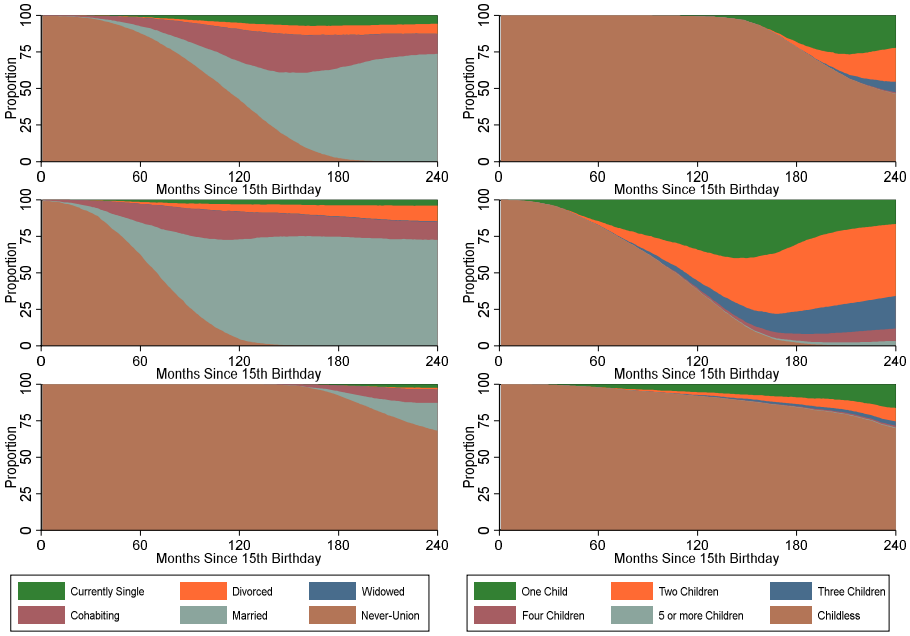
Appendix D: Three-cluster solution, full sample

The nature of hierarchal clustering means that the three-cluster solution sees the 'Cohabitors' and 'Direct marriage and large families' clusters merged. We name this cluster 'Early transitions, large families.' The breakdown by immigrant generation is in Table D-1.

Table D-1: Full sample clustering results by immigrant generation, three clusters (unweighted %)

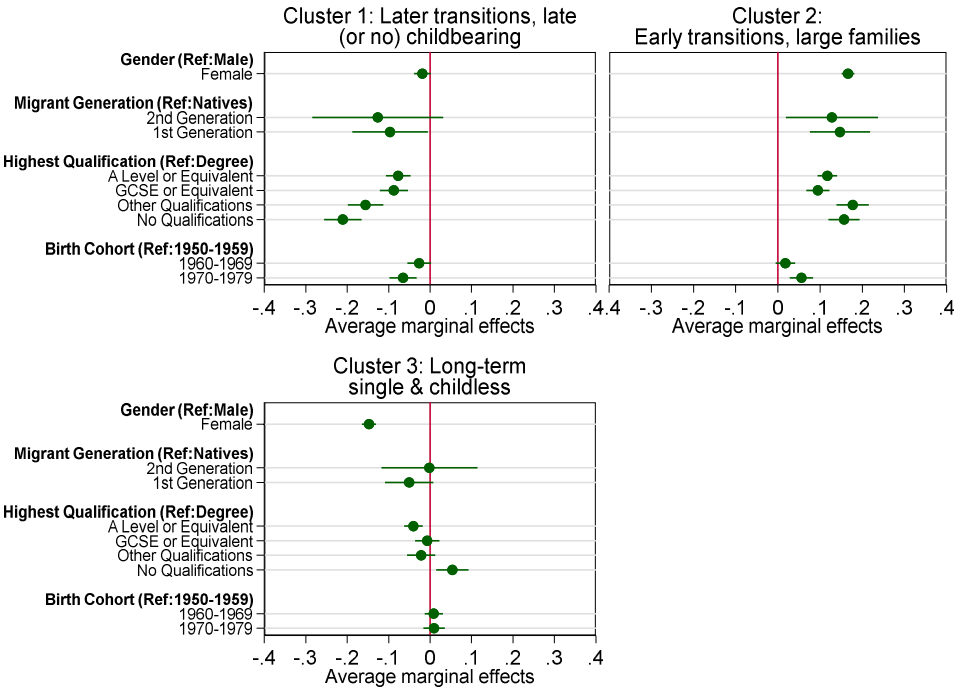
Cluster	Native	2nd generation	1st generation	Total
Later transitions and **later (or no) childbearing**	37	21	23	37
Early transitions, large families	34	45	41	35
Long-term single and childless	28	34	35	29
Total (N)	20,848	256	958	22,062

Figure D-1: Chronograms of three-cluster solution, full sample



Note: Left panels show relationship states, right panels show fertility states. Top to bottom are clusters one to three. Indel costs = 1.
Source: Authors own calculations, based on UKHLS.

Figure D-2: Average marginal effects of three-cluster membership, with 95% CIs



Note: Indel costs =1. Red line = 0 (no marginal effect).
Source: Authors own calculations, based on UKHLS.

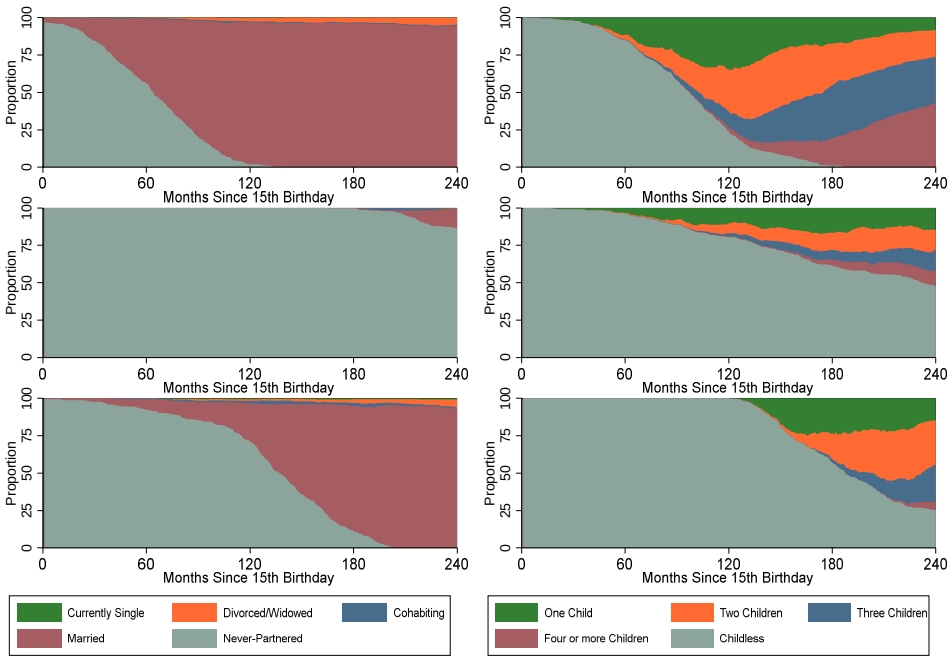
Appendix E: Three-cluster solution, Pakistani-only sample

A three-cluster solution within the Pakistani-only sample is in Table E-1. The use of three clusters sees the 'Early marriage, large families' and 'Early marriage, small families' from the four-cluster solution merged into a cluster which we name 'Early marriage.'

Table E-1: Cluster membership, Pakistani-only sample, three-cluster solution (unweighted %)

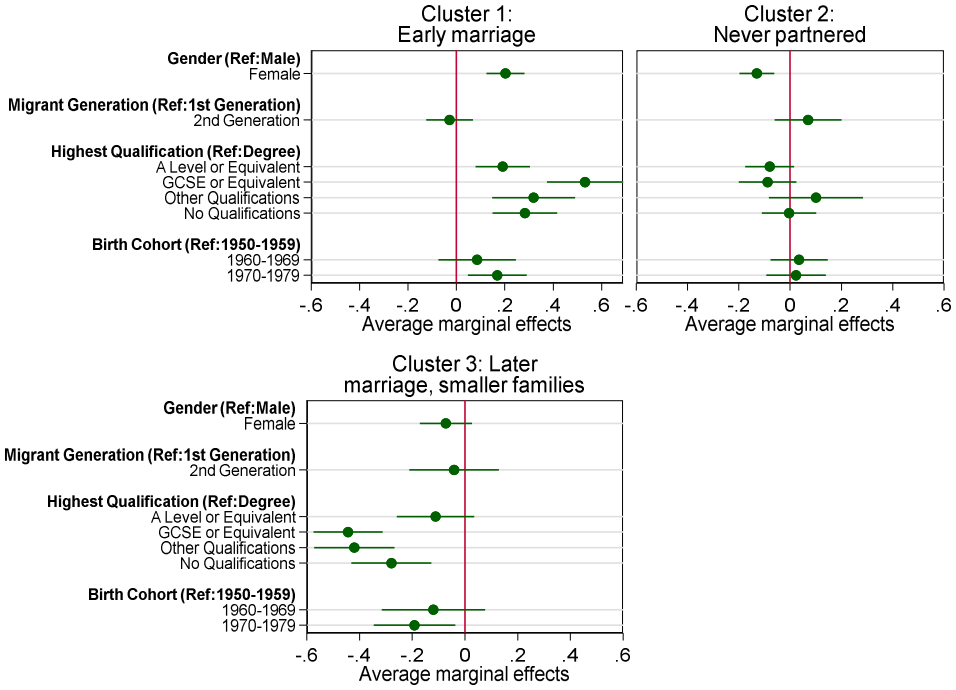
Cluster	1st generation	2nd generation	Total
Early marriage	39	42	40
Never partnered	32	32	32
Later marriage, smaller families	28	26	28
Total (N)	958	256	1,214

Figure E-1: Chronograms of three-cluster solution, Pakistani-only sample



Note: Left panels show relationship states, right panels show fertility states. Top to bottom are clusters one to three. Indel costs = 1.
Source: Authors own calculations, based on UKHLS.

Figure E-2: Average marginal effects of probability of cluster membership, three-cluster solution, Pakistani-only sample, 95% CIs



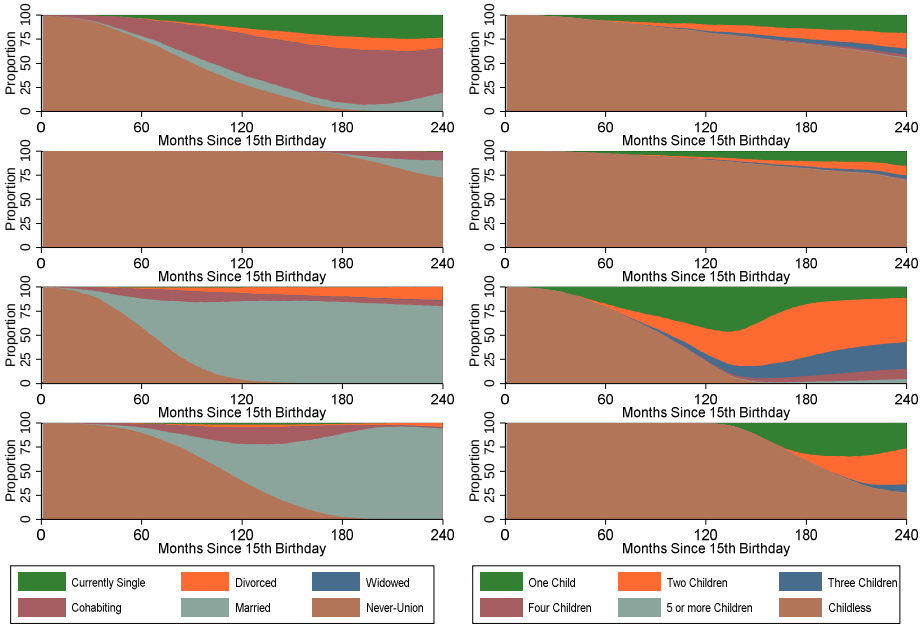
Note: Indel costs =1. Red line = 0 (no marginal effect).
Source: Authors own calculations, based on UKHLS.

Appendix F: Sensitivity analysis indel costs = 2

Table F-1: Cluster membership by immigrant generation: indel cost = 2 (unweighted %)

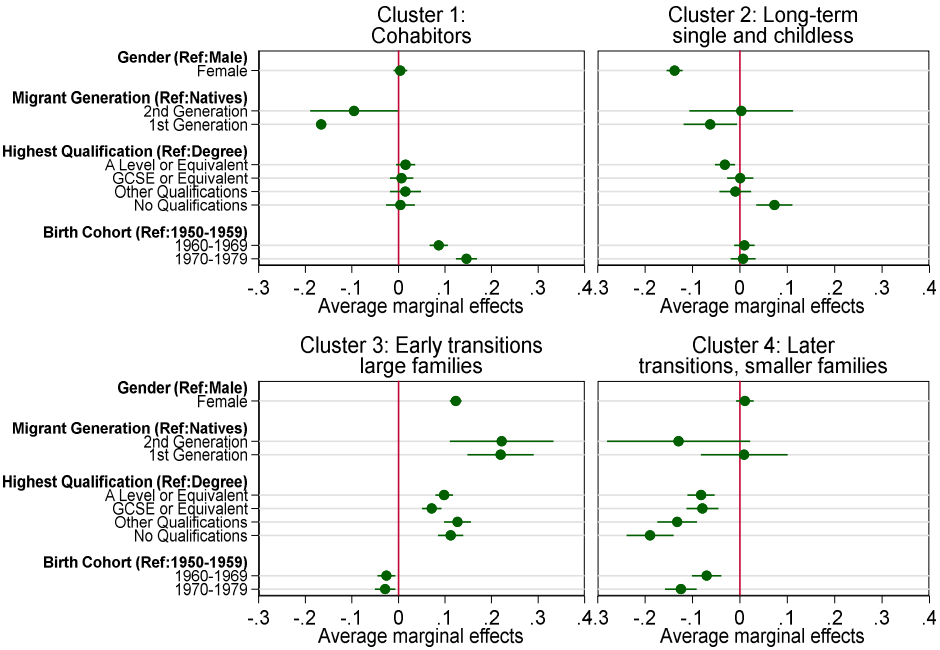
Cluster	Native	2nd generation	1st generation	Total
Cohabitors	18	4	1	17
Long-term single and childless	27	33	33	27
Earlier transitions and childbearing	23	39	48	24
Later transitions, small families	33	23	28	32
Total (N)	20,848	256	958	22,062

Figure F-1: Chronogram of four-cluster solution, whole sample: indel cost = 2



Note: Left panels show relationship states, right panels show fertility states. Top to bottom are clusters one to four. Indel cost = 2.
Source: Authors own calculations, based on UKHLS.

Figure F-2: Average marginal effects of four-cluster solution, indel cost = 2, with 95% CIs



Note: Indel costs = 2. Red line = 0 (no marginal effect).
Source: Authors own calculations, based on UKHLS.