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# Residential segregation and the fertility of immigrants and their descendants

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## ABSTRACT

Measures of community population composition, like residential segregation, are important theoretical mechanisms that have the potential to explain differences in fertility between immigrants, their descendants, and destination natives. However, only a handful of studies explore these mechanisms, and most are limited by the fact that they carry out cross-sectional analysis. This study proposes a new approach, which focuses on community composition in childhood. It uses longitudinal census data and registered births in England and Wales to investigate the relationship between completed fertility and multiple measures of community composition, including residential segregation. The results show that the fertility of immigrants is closer to native fertility if they grow up in less segregated areas. This provides evidence in support of the childhood socialisation hypothesis. Furthermore, residential segregation explains some of the variation in completed fertility for second generation women from Pakistan and Bangladesh, the only second generation group to have significantly higher completed fertility than natives. This suggests one reason why the fertility of some South Asians in England and Wales may remain 'culturally entrenched'. All of these findings are consistent for different measures of community composition. They are also easier to interpret than the results of previous research because exposure is measured before childbearing has commenced, therefore avoiding many issues relating to selection, simultaneity and conditioning on the future.


## INTRODUCTION

In most high-income countries, there is a considerable body of empirical research that demonstrates the existence of immigrant fertility differentials – differences between the fertility of immigrants and 'natives' – at least for some culturally distinct origin groups (Milewski, 2010). Since the early 1900s, researchers have tried to explain the existence of these differentials (e.g. Kuczynski, 1901, 1902; Hill, 1913). More recently, a similar effort has been made to explain the existence of fertility differentials for the descendants of immigrants (e.g. Kulu et al., 2017). The increasing importance of this topic for research and policy is driven by the growing share of births to immigrant mothers, and births to native-born mothers with a foreign background, in many high-income countries (Sobotka, 2008). A more nuanced understanding of the determinants of fertility differentials, for both immigrants and their descendants, can therefore help to enhance our ability to understand the long-run impact of migration on fertility (and population dynamics), both over the life course of immigrants, and for subsequent generations (Kulu & González-Ferrer, 2014).

A variety of theories have attempted to explain the fertility of immigrants and their descendants (Milewski, 2010). However, despite the existence of a rich literature, covering a range of contexts, there is a lack of research that has tested the theoretical mechanisms that may explain the existence of fertility differentials (Forste & Tienda, 1996; Milewski, 2010; Kulu & González-Ferrer, 2014). As described below, this includes a lack of research that examines whether differentials can be explained by community population composition, which is an important mechanism in most theories that relate to the fertility of immigrants and their descendants (including ethnic minority groups). For example, research has yet to examine the role of residential segregation during childhood in explaining immigrant fertility, despite the fact that residential segregation is not only an important source of variation in exposure to childbearing norms, but also an important determining factor in the overall process of immigrant integration, such that it may impact childbearing in a number of different ways (Forste & Tienda, 1996; Hill & Johnson, 2004).

Our research seeks to address this, and a number of other issues. It develops the existing literature by focusing on community population composition during childhood, and using multiple measures of this composition. In common with previous research, and as outlined below, we argue that community population composition is a measure of exposure to cultural norms. Our central question is whether migrant fertility differentials are associated with the normative environment that immigrants and their descendants are exposed to during childhood. Furthermore, we posit that the magnitude of these differentials depends on the strength of exposure to a native or non-native normative environment, as measured by the population composition of an individual's childhood community. For example, we would expect migrant fertility differentials to be smaller if the descendants of migrants spend their childhood residing in a community that has a predominantly native population.

The analysis extends previous research by combining a number of other methodological developments, most of which are made possible by the use of longitudinal data for England and Wales. These data allow a link to be made between aggregate-level census data (from 1971) and individual-level census data and registered births (from 1971-2009), which in turn allows an investigation of the associations between childhood community and completed fertility. In our analyses, the population composition of a childhood community is measured in several different ways, in terms of absolute numbers, proportions, or levels of segregation. This allows us to explore the reliability of each of these measures and the robustness of our empirical findings. Unlike previous research, exposure is measured prior to childbearing, thereby avoiding issues of simultaneity or the possibility of conditioning on the future, which might be the case if population composition were measured after childbearing had started. In addition, the use of completed fertility means that the results are not affected by missing data on future childbearing or by differences between groups in the timing of childbearing. Results are obtained for several samples, including child migrants, and the descendants of immigrants from South Asian origins, so that the analysis allows comparisons to be made within and between these groups, as well as with the native population.

## BACKGROUND

### The theoretical importance of community population composition during childhood

Most theories of the childbearing of immigrants and their descendants imply that residential segregation will be highly correlated with fertility, in particular because residential segregation determines levels of exposure to the childbearing norms of origins and destinations (Forste & Tienda, 1996; Simpson, 2007). Moreover, almost all theories that are relevant to explaining the fertility of immigrants and their descendants (with the exception of the effect of the migration event itself) are founded on the influence of exposure to cultural norms (Milewski, 2010). For example, the 'childhood socialisation' hypothesis predicts that migrant fertility will be affected by the norms of the location in which migrants spend their childhood (Goldberg, 1959, 1960; Hervitz, 1985). A different theory, although not mutually exclusive, refers to 'cultural entrenchment', which predicts that the fertility of immigrants (and their descendants) depends upon exposure to origin subcultures (Forste & Tienda, 1996; Abbasi-Shavazi & McDonald, 2002; Milewski, 2010). Similarly, theories of 'assimilation' and 'acculturation' (toward mainstream norms) have been used to explain the existence of fertility differentials after arrival or across generations (e.g. among Mexican Americans in the US: Bean, Swicegood, & Berg, 2000; Hill & Johnson, 2004; Parrado & Morgan, 2008). In order to understand these theories, it is important to examine the mechanisms by which they operate – the mechanisms that enable differences in exposure to norms – and one of the most prominent mechanisms in each of these theories is community population composition, for example as measured by residential segregation.

There are a number of different measures that can be based on the population composition of communities. Moreover, there are a range of different concepts that can be represented by these measures, including: *"geographical evenness of groups, exposure to other groups, movement towards one's own group, and local diversity"* (Simpson, 2007: 407). Although these concepts are interrelated, and often highly correlated, they have also been shown to capture distinct dimensions of 'community' (or other spatial units) (Massey & Denton, 1988). This implies that any examination of the relationship between fertility and community composition has the potential of being influenced by the choice of concept, and measure, that is used.

Nonetheless, and irrespective of the measure that is used, community population composition has many causal pathways to other determinants of fertility. Various demographic theories propose that fertility behaviour is influenced by exposure to cultural norms and preferences, which themselves are at least partly determined by communities of residence (Cleland & Wilson, 1987; Davis & Blake, 1956; Fernández & Fogli, 2009; Forste & Tienda, 1996; Gjerde & McCants, 1995; Johnson-Hanks, Bachrach, Morgan, & Kohler, 2011; La Ferrara, Chong, & Duryea, 2012; Lesthaeghe & Surkyn, 1988; Lorimer, 1956). For example, residential segregation can determine the ways in which immigrant children socialise with peer-groups and role models, how they engage with religious institutions, and how much time they spend interacting with native-born adults (Forste & Tienda, 1996). All of these are potential sources of influence with respect to family formation norms, either due to exposure to immigrant or native (cultural) preferences. Of course, not all aspects of community population composition are linked to normative exposure, and not all normative exposure is necessarily cultural (although the latter might be challenged by anthropologists: Hammel, 1990). For example, residential segregation is also indicative of current living arrangements, and the 'structures' that immigrants are exposed to, including social, familial, and institutional environments – which may determine partnership choice ('marriage markets') or other dimensions of socio-economic integration. This is in addition to the role of community population composition as a (proxy) measure of exposure to fertility norms – conceptualised on a continuum between an immigrant or descendant's ancestral culture, and the mainstream norms of a given destination (Hill & Johnson, 2004).

Given the potential importance of this topic, and the need for more empirical research, this article considers the relationship between community population composition and the fertility of immigrants and their descendants. As well as providing a test of theoretical explanations for fertility variation, an investigation of this relationship is important for helping to predict the impact of migration on population change. Nevertheless, it is rare that empirical research has used measures of cultural difference, like community population composition, to investigate this topic. As Forste & Tienda point out, with reference to ethnic fertility, *"few studies have attempted to discern how cultural influences produce fertility differences"* (1996, p. 112). Where studies do include measures of culture, beyond indicators of ethnicity or country of birth, they usually focus on either language (Adserà & Ferrer, 2014; Bean & Swicegood, 1985; Marin, Gomez, & Hearst, 1993; Sorenson, 1988; Swicegood, Bean, Stephen, & Opitz, 1988), or an individual's exposure to cultural norms based on the population composition of their community (Abma & Krivo, 1991; Fischer & Marcum, 1984; Gurak, 1980; Hill & Johnson, 2004; Lopez & Sabagh, 1978). However, the results of this research are very hard to interpret. In particular, it is difficult to evaluate associations between population composition and fertility when composition is measured after childbearing has commenced, as is the case in all of these papers. Individuals are usually at risk of having a child over more than 30 years, which raises questions about how and when to measure population composition, how and when to measure fertility, and which method should be used to test the relationship between them.

## The relationship between culture and fertility

Although hard to define, culture has been conceptualised as a *"nested network of meanings"* (Bachrach, 2013, p. 1), which is continually evaluated by individuals through a process of social interaction (Hammel, 1990). As suggested by Davis and Blake (1956), the most important cultural factors for fertility are usually those that have the greatest influence on proximate determinants (Bongaarts, 1978), such as those that influence sexual behaviour, contraception, or partnership (Marin et al., 1993; Soler et al., 2000; Stephen, Rindfuss, & Bean, 1988). This aligns with the conceptual framework for migrant (and ethnic) fertility proposed by Forste and Tienda (1996). Their framework indicates that cultural factors may influence individual perceptions and goals relating to: early childbearing, the sequencing of marriage and fertility, and completed fertility. As such, perceptions and goals can be seen as mediators in the relationship between culture and completed fertility. Culture has an influence on an individual's perceptions and goals through their exposure to a normative environment, which in turn has an influence on their childbearing, via the proximate determinants of fertility. For many researchers, this process of environmentally-driven norm development is believed to take place largely during childhood. In particular, the *childhood socialisation* hypothesis predicts that migrant fertility levels will be driven by the norms of the location in which migrants spend their childhood (Goldberg, 1959, 1960; Hervitz, 1985).

## The relationship between community composition and culture

The influence of culture is an inherently spatial process, not least because residential location has an influence on individual interactions with sources of cultural norms, such as social networks, families, and institutions (Coleman, 1994; Findley, 1980; Forste & Tienda, 1996). In its original formulation, segregation was seen as a barrier to the process by which all ethnic groups (including natives) may come to share a common culture (Burgess, 1928). With the development and revision of assimilation theory, this formulation has become more nuanced, but it remains clear that culture and residential context are intertwined (Alba & Nee, 2005; Portes & Zhou, 1993).

Despite this clarity, it is less clear how culture and context are related, and how they interact to influence individual behaviour. As a first step, it may be important to recognise that culture is (at least partially) created through the dynamic relationship between individuals and social/macro environments

(Bachrach, 2013). More specifically, it can be argued that individuals select their behaviour from a 'cultural repertoire' based upon the context in which they live (Hammel, 1990). In this sense, neighbourhood can be seen as a source of cultural influence (for some relevant discussions, see Knox & Pinch, 2006; Yancey, Ericksen, & Juliani, 1976; Zhou, 1997), which in turn has an influence on the processes by which individual preferences and norms are developed and expressed.

One of the most prominent assumptions of segregation research is that the population composition of a community, by ethnicity or country of birth, is indicative of the cultural milieu to which its residents are exposed (Forste & Tienda, 1996; Peach, 1996). It is worth noting that this assumption depends on at least two further conjectures: that community composition is a suitable proxy for cultural exposure (Simpson, 2004), and that actual exposure is the same as potential exposure (Hewstone, 2009; Sturgis, Brunton-Smith, Kuha, & Jackson, 2014). When interpreting the findings of research, it is important to note that: *"ethnicity is not a bag of norms producing automatic responses"* (Lopez & Sabagh, 1978, p. 1496), segregation might not lead to a failure to integrate (Vang, 2012), and evenness might not lead to contact (Massey & Denton, 1988). But despite these caveats, community composition and cultural exposure are expected to be strongly associated, and this assumption is embedded within many of the theories and conceptual frameworks that have been developed by previous research on assimilation, segregation and ethnicity (e.g. Alba & Nee, 2005; Gordon, 1964; Park & Burgess, 1921).

## The relationship between community composition and migrant fertility

Past research has described in detail how community composition is expected to influence childbearing due to exposure to cultural norms (Abma & Krivo, 1991; Forste & Tienda, 1996; Hill & Johnson, 2004). These include the influence of community environment and community resources, both of which are related to the population composition of the community (e.g. the proportion of migrants, or the level of residential segregation). As such, community composition has an influence on adult supervision, peer groups, and role models, each of which may be particularly important for the development of perceptions and norms during childhood and adolescence (Brewster, 1994; Brewster, Billy, & Grady, 1993; Forste & Tienda, 1996; Hogan, Astone, & Kitagawa, 1985; Hogan & Kitagawa, 1985). In addition to shaping the uptake of cultural norms, the influences of local community factors and social context are likely to impact most stages of the reproductive life course (Findley, 1980). Similarly, previous research has anticipated a relationship between residential segregation and migrant fertility (Coleman, 1994), not least because they both relate to the processes of assimilation and integration (Duncan & Lieberson, 1959; Massey, 1981).

A small number of studies have explored the links between community culture and migrant fertility, almost all in the US. These studies can be further separated into those that measure fertility indirectly by studying adolescent sexual behaviour and contraceptive use (Brewster, 1994; Brewster et al., 1993; Hogan et al., 1985; Hogan & Kitagawa, 1985), and those that measure fertility directly. Of these, almost all studies have focussed on Mexican Americans (Abma & Krivo, 1991; Fischer & Marcum, 1984; Gurak, 1980; Hill & Johnson, 2004; Lopez & Sabagh, 1978).

There is very little research on this topic outside the US. Perhaps the only study that has come close to studying this topic in the UK context is an examination of changes in household size by ethnic group (Catney & Simpson, 2013). However, despite the fact that they find some correlations between household size and residential concentration by ethnic group, this finding remains hard to interpret with respect to the fertility of immigrants and descendants for a number of reasons. First, ethnicity is self-identified, and their analysis does not distinguish between first and later generations. Second, household size is only an approximate proxy measure of fertility, especially for ethnic groups who are likely to live in extended family households. Third, they carry out an analysis of repeated cross-sections at the area level, making it hard to interpret the direction of any association at the individual level.

Studies using direct measures of fertility have focussed on a combination of cultural context and normative context (Abma & Krivo, 1991). In other words, they consider the community cultural norms relating to specific combinations of migrant origin, ancestry, and destination (which themselves explain much of the variation in migrant fertility differentials, e.g. Ford, 1990; Haug, Compton, & Courbage, 2002; Kahn, 1994; Sobotka, 2008; Zarate & Zarate, 1975). One of the first papers to study migrant fertility using measures of community culture was a study of Chicanos (Mexican Americans) living in Los Angeles. This study concluded that high Chicano fertility was explained, among other things, by community culture (Lopez & Sabagh, 1978). This study explored the fertility of a sample of women who had yet to complete their childbearing, and used a bespoke measure of community culture based on the *"ethnic homogeneity of neighborhood and husbands' fellow workers"* (Lopez & Sabagh, 1978, p. 1493). Similarly, a study of Mexican Americans in Austin (Texas) found a positive correlation between neighbourhood ethnic composition and Mexican American fertility (Fischer & Marcum, 1984).

Further evidence has been provided by research using nationally representative samples of Mexican Americans. One of the first of these found that fertility was positively associated with the percentage of Mexican Americans living in a neighbourhood (Gurak, 1980). A later study showed a significantly higher probability of having of a birth within the last three years for Mexican Americans living in an area with a higher proportion of Mexican Americans (Abma & Krivo, 1991). More recently, a study of Mexican and Central Americans used data from the US Current Population Survey in 1995 and 1998 to explore the relationship, for different migrant generations, between fertility and a series of neighbourhood characteristics based on the US Census in 1990 (Hill & Johnson, 2004). Somewhat surprisingly, the results suggest that the number of children ever born may be lower in neighbourhoods with a higher percentage of

Hispanics (or Asians). However, this result was not consistent for different migrant generations.

## METHOD

The results of previous research suggest an ambiguous picture of the relationship between community composition and migrant fertility. As we argue here, one of the main reasons for this is the use of methods that are not the most appropriate for testing this relationship. In this section, we discuss five decisions relating to research design and methodology, both with regard to previous research, and with regard to the analysis undertaken here.

The first decision is how to measure fertility. We argue that completed fertility is the most appropriate measure for investigating the direct links between community population composition and migrant fertility. Previous studies have analysed populations of women who have yet to complete their childbearing, and only one of them has attempted to consider completed fertility (by combining actual births with fertility intentions: Fischer & Marcum, 1984). If only part of childbearing life course is considered, then research on migrant fertility is particularly susceptible to variations in birth timing between groups, and this can lead to erroneous conclusions about migrant fertility differentials (Parrado, 2011; Parrado & Morgan, 2008; Toulemon, 2004, 2006; Toulemon & Mazuy, 2004). When comparing immigrants and natives, it is also likely that there will be differences in the timing of births because immigrant fertility is highly correlated with age at migration (Adserà, Ferrer, Sigle-Rushton, & Wilson, 2012; Andersson, 2004). These issues can be avoided by studying a sample of women who have completed their fertility.

The second decision to consider is when, during an individual's life course, to measure community population composition. In the analysis that follows we use childhood measures, for two reasons. The first is theoretical. It is expected that exposure to norms during childhood will have a strong influence on migrant fertility across the life course (Adserà et al., 2012), and that childhood is a critical period for the development of cultural norms and preferences relating to childbearing (Forste & Tienda, 1996). The second is methodological. In previous research, community composition is measured at only one period of time, and this measurement occurs at different stages of the life course for different women in the study. This makes it difficult to interpret any association between community composition and fertility, which will depend upon the composition of the sample at a given moment in time. Although some migrants will remain resident in the same community after arrival, others will experience a variety of community contexts across their childbearing years (both before and after any specific time-point). One way around this might be to use a time-varying measure of community context, but this would not resolve the selection problem that a migrant's fertility may affect their migration between communities (e.g. Hedman & Van Ham, 2012; Kulu, 2005; Zarate & Zarate, 1975). For example, if community context is measured during childbearing then its relationship with fertility outcomes could be confounded by selective migration from cities to suburbs (Kulu & Boyle, 2009; Kulu, Boyle, & Andersson, 2009; Kulu & Washbrook, 2014). These issues are avoided by investigating community population composition during childhood, prior to the commencement of childbearing. As argued by Zuccotti & Platt (2016), this approach is beneficial because it minimises the number of competing explanations, not least those due to selection.

As a third consideration, it is necessary to decide how to measure community population composition in a way that is appropriate for investigating migrant fertility. In the US studies discussed above, the most commonly used measure is the proportion of Mexican Americans living in the migrant's residential community. But a range of alternative measures can be proposed, not least when considering the many other candidates that are discussed in the literature on residential segregation (Massey, 1985; Massey & Denton, 1988). In this research, we use and compare a range of different measures, as explained later in this section.

The fourth consideration is how to define migrant and native generations, and which generations to consider in the analysis. Here, we focus on child migrants, defined as foreign-born women who arrived when under 16, and on the second generation, who are born in England and Wales but have at least one foreign-born parent. In general, it can be argued that a more nuanced understanding of assimilation can be gained by distinguishing between the first and second generation (Hill & Johnson, 2004). This includes the advantage that the fertility of native-born women can be calculated without the inclusion of the second generation, who may otherwise distort the native norm. In the context of this study, the examination of second generation fertility has a further advantage because they are likely to have lived in native communities for the whole of their lives. This implies that any effect of community composition is less likely to be confounded as compared with child migrants, who will have lived abroad for at least part of their childhood.

The fifth methodological consideration is how to carry out the analysis in order to investigate the impact of community composition on migrant fertility differentials. As explained below, our analysis uses statistical multilevel models to account for community characteristics, with specific community-level and individual-level variables included as control variables. The use of a multilevel model (with an area-level random effect) implies that a comparison is made between (a) immigrants or their descendants who live in a given area during childhood, and (b) ancestral natives who spent their childhood living in the same area. When investigating the relationship between cultural norms and fertility, we consider this to be a more appropriate comparison than one which uses the national mainstream norm. In addition, by controlling for parental socio-economic status, we hope to further narrow our analysis to represent a comparison of immigrants and ancestral natives in the same area and with the same socio-economic status.

## Data

Our analysis uses individual-level data from the Office for National Statistics Longitudinal Study (LS) (CeLSIUS, 2014; Dale, Creeser, Dodgeon, Gleave, & Filakti, 1993; ONS, 2014). The LS data set links decennial census data from 1971 for a sample of around 1% of the population of England and Wales. The LS contains register data on vital events, including births registered in England and Wales since 1971. The accuracy of the LS data has been investigated, both in general (Blackwell, Lynch, Smith, & Goldblatt, 2003; Hattersley & Creeser, 1995), and with respect to migration and fertility (Hattersley, 1999; Robards, Berrington, & Hinde, 2011, 2013; Wilson, 2011). Although the quality of the data is very good, the immigration and emigration of LS members is sometimes not recorded (Robards et al., 2013). However, this issue is avoided here by restricting the sample to a specific cohort, namely those women who were aged under 16 in 1971 and who were included in the 1971 census. The analysis therefore excludes adult migrants who arrived after 1971.

Our sample also excludes women who were not recorded in the 2001 census (due to death or emigration), and a small proportion of those who were recorded in the 2001 census (4%) who had missing values in the focal variables. Appendix table A1 shows the derivation of the final analytical sample, which includes 50,152 women. Of these, 44,168 are ancestral natives (UK-born women whose parents are both UK-born), 1,074 are first generation child migrants (women born outside the UK who had moved to the UK by the time they were recorded in the 1971 census), and 4,910 are from the second generation (UK-born women with at least one foreign-born parent - 96% of whom had parents from the same non-UK country of birth group, and 4% of whom had parents from different groups, one of whom may have been born in the UK).

## Variables

The dependent variable used throughout the analyses is completed fertility, defined as the total number of children that a woman has had by 2009 (when the age of women in our sample ranges from 38 to 53). This is calculated using the 'maximum method', which is the maximum number of births identified using either registered births or the own-child method (anonymous). For the own-child method we calculated children ever born using the number of biological children resident in the same household as each sample member in the 2001 census (i.e. excluding non-resident children).

Building upon previous research, we use several different measures of community composition. Each of these attempts to capture variation in childhood exposure to cultural norms, and is measured using aggregate data for the entire census population from the 1971 Census (when all sample members are under 16) (UK Data Service, 2014). Before creating these variables, it was necessary to decide which level of geography should represent a community. Four alternatives were available in the 1971 census data. With approximate average population size in England in brackets, these were: county (1,000,000), local authority (38,000), ward (3,000) or enumeration district (450) (Martin, 2008). Local authorities were chosen because this was felt to be the most appropriate area within which an individual would experience and absorb norms that relate to fertility. This included consideration of the likely range of individual mobility, including for travel to work, community activities, social activities, and partnership behaviour (e.g. marriage markets). For example, London is subdivided into 33 local authorities (32 boroughs and the City of London). We also noted that previous research has cautioned against the use of small areas because of neighbourhood selectivity by family type (Abma & Krivo, 1991).

In previous research the most commonly used measure of community composition has been the proportion of total community population that share the same country of birth or ethnicity as the group being studied. This can either be thought of as a measure of exposure to the same group, or as its inverse, a lack of exposure to other groups (Simpson, 2007, p. 407). We also use this approach, with some developments. It has been argued that studies of minority fertility should consider the size of the minority population (Kennedy, 1973), and that there may be an effect of community population size on fertility (Findley, 1980), so we consider both the absolute size and relative proportion of the migrant group. Also, we use country of birth instead of ethnicity as the variable on which the calculations are based, in order to focus on the influence of non-native or origin culture irrespective of self-identification. The use of ethnic community composition would mean that results may be confounded by selection out of (and into) ethnic groups.

In this analysis, it was decided to use two different definitions of place of birth. The first is a crude measure which defines individuals as UK-born or not, thus placing the whole foreign-born population in one group. The second defines place of birth as the country of birth of each individual, and uses the most detailed country of birth groups that were available in the data (which are shown later in table 1 and figure 1).

In addition to using measures of population size or proportion, we also used residential segregation. This can be loosely defined as the geographical evenness of groups in an area (Simpson, 2007, p. 407), and it shows how the population of a group is distributed across smaller areas (in this case, wards) within a larger area of interest (local authorities or LAs). To our knowledge, this measure has not been considered before in research on migrant fertility. The measure of residential segregation that we use is the index of dissimilarity (ID; see e.g. Simpson, 2007), which is defined as follows. Let $N_{igk}$ denote the total population size of group $g$ in Ward $k$ in LA $i$, and $N_{ig} = \sum_k N_{igk}$ the size of the group in the LA overall, and let $N_{i\bar{g}k}$ and $N_{i\bar{g}} = \sum_k N_{i\bar{g}k}$ be the population sizes similarly of those who are not members of group $g$. The index of dissimilarity of group $g$ in LA $i$ is defined as

$$ID_{ig} = 0.5 \sum_k \left| N_{igk}/ N_{ig} - N_{i\bar{g}k}/ N_{i\bar{g}}) \right|. \quad (1)$$

Here $g$ depends upon the statistical model being estimated, and is either the entire foreign-born population (model A5, as defined later), or the foreign-born population in the same country of birth (or parental country of birth) group as each migrant woman in the model (models A6, B3 and C3). The index of dissimilarity can take on values between 0 and 1. Including this indicator, the measures of community composition used here are therefore:

1. *The population of each Local Authority that is foreign-born, measured according to: (a) size, and (b) proportion*
2. *The population of each Local Authority that is in the same country of birth (or parental country of birth) group, by: (a) size, and (b) proportion*
3. *The index of dissimilarity at Local Authority level using Ward-level data, for: (a) the foreign-born population, and (b) the population in the same country of birth (or parental country of birth) group*

In all of the models, community composition is only measured for migrant women, although this measure is used for the analysis of both child migrants and the second generation. In other words, non-migrant women are placed in a single group, and are not distinguished according to levels of community composition. This is because we are focussed on the effect of community composition on the fertility of immigrants and their descendants, although a parallel focus on 'native' women would be a very interesting topic for future research.

Another important consideration is the fact that regression results using the size or proportion of area-level populations are affected by the distribution of these measures over the areas themselves. This may be less of an issue if only one area-level measure is used, but it creates issues for studies like this which seek to compare measures and (for some indicators) match people to their country of birth groups. For example, the proportion of the population that is Irish in 1971 is on average far larger than the proportion that is Pakistani. As such, the magnitude of a variable that matches individuals to the proportion of their country of birth group will be far greater for the Irish-born, irrespective of whether the area has relatively high or relatively low levels of Irish population compared to the England and Wales average.

Given this issue, and the desire to compare results across measures, each measure was standardised by: (a) ranking the local authorities, (b) placing each local authority in one of three percentile groups to represent high, medium, and low levels of immigrant community composition, and (c) assigning the percentile group as the measure of an individual's local authority composition. In most cases, the percentile groups that are used are: top 5%, 5-25%, and bottom 75%. These 'top-heavy' groupings are chosen because migrants are, on average, more likely to be resident in areas that have a higher number or proportion of migrants, or higher levels of residential segregation. We have therefore chosen these groupings in order to maintain a broadly even allocation into the three groups (as shown in Table A3), while also endeavouring to retain the same relative groups in order to facilitate a consistent comparison across measures. In some analyses, for example when focusing on South Asian migrants only, different groupings were used because almost all individuals would otherwise have been classified into a single category.

The other variables used in the analysis are age in 1971 and parental social class. These are measured for all sample members. Age is included as an indicator of birth cohort, and in particular because sample members have different ages in 1971, when the childhood indicators are measured. Parental social class is included in order to represent the socio-economic background in which children are raised, which may in turn affect their completed fertility. In addition to being constrained by the variables that are available in the LS data, the choice of covariates is informed by the fact that we are investigating area of residence in childhood. This means that mediating variables, which occur between childhood and the completion of fertility, are excluded.

## Models

Let $Y_{igj}$ denote the completed fertility of individual $j$ in area (local authority) $i$, where the individual belongs to ethnic group $g$. Conditional on the explanatory variables, $Y_{igj}$ is taken to follow a Poisson distribution. To define explanatory variables for $Y_{igj}$, let $Z_{1igj}$ be an indicator variable for whether or not a woman is a foreign-born child migrant, $Z_{2igj}$ is a similar indicator for the second generation (so both of these are 0 for ancestral natives), and $\boldsymbol{X}_{ig}$ is a vector of indicator variables for the percentile groups, as defined above, for a particular measure of community composition of area $i$ with respect to group $g$. The models also include other individual-level explanatory variables $\boldsymbol{W}_{igj}$, here age in 1971 and indicators for parental social class. Letting $\mu_{igj}$ denote the expected value of $Y_{igj}$, this is modelled as:

$$\log(\mu_{igj}) = \alpha_0 + \boldsymbol{\beta}_1[Z_{1igj}\boldsymbol{X}_{ig}] + \boldsymbol{\beta}_2[Z_{2igj}\boldsymbol{X}_{ig}] + \boldsymbol{\alpha}_1\boldsymbol{W}_{igj} + u_i \quad (2)$$

where $u_i$ is a normally distributed random variable with mean 0 and variance $\sigma_u^2$, independent of the explanatory variables. The model is thus a Poisson log-linear model with a random intercept, a multilevel model (Goldstein, 1999; Jones, 1991) where the purpose of the random intercept $u_i$ is to account for the remaining area-level variation. All models were estimated using Stata 11.

In model (2), the elements of $\boldsymbol{\beta}_1$ are the regression coefficients associated with being a child migrant rather than ancestral native, for individuals in areas with different community compositions (as defined by $\boldsymbol{X}_{ig}$) and $\boldsymbol{\beta}_2$ are the corresponding coefficients for being a member of the second generation. The exponentiated value of an element $\boldsymbol{\beta}_1$ or $\boldsymbol{\beta}_2$ is the ratio of the expected completed fertility of a child migrant or a member of the second generation in an area of a particular composition, relative to an ancestral native woman with the same characteristics $\boldsymbol{W}_{igj}$ in the same area. These ratios, labelled `IRR' in the tables below, are the quantities of foremost interest in our analyses.

## RESULTS

Table 1 shows the number of ancestral natives in the sample, as well as the distribution of first generation child migrants and the second generation by ancestral group. The analysis is limited to the country groups shown in table 1 because these are the most detailed groups available in the aggregate data for the

1971 Census. The groupings reflect international geography in 1971. For example, present-day Pakistan and Bangladesh are grouped together because Bangladesh was still in the process of being recognised as independent.

[Table 1 about here]

[Figure 1 about here]

On average, child migrants have a higher completed fertility (2.06 children per woman) than ancestral natives (1.85), whereas second generation women have a lower completed fertility (1.77). Following the rationale for our methodology set out earlier, our first analysis focuses on child migrants as a group, studying all country groups, such that we consider the extent to which childhood socialisation can explain the higher completed fertility of this group. Then, in order to reduce the amount of heterogeneity in our sample, and examine the extent to which our analysis can explain within-group variation in completed fertility, our second analysis focuses on the two specific country groups whose completed fertility is most different from that of ancestral natives.

There is considerable variation by ancestral country in average levels of completed fertility. Figure 1 shows the completed fertility of different ancestry and generation groups relative to ancestral natives. The most distinct ancestral group is Pakistanis and Bangladeshis, who have around 50% higher completed fertility than natives for first generation child migrants, and around 30% higher for the second generation. Also notable is the completed fertility of child migrants from India which is 30% higher than the native average. We therefore focus on these two groups, which are of interest because they have higher fertility than natives, and have the advantage of being more culturally homogenous than other groups like Africa (Commonwealth). If more detailed country of birth data were available, then it would also be interesting to study groups who have lower fertility than natives.

## Completed fertility and community composition

Based on the childhood socialisation hypothesis, one of our central questions is whether completed fertility is closer to the native norm for immigrants (or their descendants) who grow up in areas where they are more likely to be exposed to native norms. Table 2 shows the results of six different models, specified as already explained. The models use different measures of community composition. For example, the results of the first model (A1) show that there is no significant difference between the completed fertility of natives and child migrants who live in (the 75% of) local authorities that had the smallest number of foreign-born residents (IRR=0.94). For this, and all other area rank results, the completed fertility of natives is the reference category (IRR=1.0), and we compare groups of immigrants (or their descendants) versus natives who grow up in areas that are otherwise similar, (i.e. they have an equal value of the random effect).

[Table 2 about here]

Using a significance level of 5% (which is used throughout unless stated otherwise), there is also no significant difference between the completed fertility of natives and child migrants living in the top 5-25% of local authorities in terms of foreign-born population size (IRR=1.05). This is in contrast to those who are ranked in the top 5%, who do have significantly higher completed fertility (IRR=1.14). As such, we can conclude that a higher completed fertility than the native norm is more likely for child migrants who arrived in England and Wales as children, and spent (some of) their childhood in the local authorities that had the largest numbers of foreign-born residents.

As with the rest of the models in table 2, this first model includes controls for age and parental social class. The effects of each of these are fairly constant across models. Women who were older in 1971 have a slightly higher completed fertility, whereas women have fewer children if either of their parents were in a professional or intermediate social class in 1971.

## First generation child migrants

The results of model A1 in table 2 suggest that child migrants are less likely to have the same level of fertility as natives if they spend their childhood in an area where they are less likely to be exposed to native culture. This interpretation depends upon the extent to which foreign-born population size is a valid indicator of exposure to native culture, and this issue of 'construct validity' (Shadish, Cook, & Campbell, 2002) is one motivation for testing a series of different measures, each of which is intended to represent exposure to cultural norms.

Considering child migrants alone, the models in table 2 each provide some evidence in support of the childhood socialisation hypothesis. In the first five models, there is no significant difference between the completed fertility of natives and migrants who spent some of their childhood in local authorities where they were more likely to be exposed to native norms (in model A6 the result is just significant at 5% for migrants in the least segregated areas). This is in contrast to the significantly higher completed fertility for migrants who were least likely to be exposed to native norms (e.g. ranked in the top 5% of exposure to <u>non</u>-native norms). This is irrespective of the variable that is used to measure exposure to native norms, (although there is some variation in point estimates and standard errors).

For example, migrants who spent their childhood in one of the 5% most segregated local authorities gave birth to 25% more children (on average) than natives in those areas, which was significantly more than both natives and migrants who spent their childhood in one of the 75% least segregated local authorities (model A5). This is substantively similar to the results using the proportion of the population that has the same country of birth group as the respondent (model A4). With this measure, migrants who spent their childhood in a local authority that was ranked in the top 5% gave birth to 13% more children than natives.

In addition to these comparisons, this analysis allows a direct (statistical) comparison between child migrants who have different levels of community composition, but are otherwise similar (including with respect to area-level characteristics). For example, as may be apparent from model A1 in table 2, the results show that child migrants who grow up in the top 5% local authorities (with the largest numbers of foreign-born residents) have a significantly higher completed fertility than child migrants who grow up in the lower 75% (with the smallest numbers of foreign-born residents). Similar comparisons can be made in all the models in table 2, and with the exception of model A2, these all show that child migrants who grow up in the most concentrated areas have significantly higher completed fertility than those who grow up in the least concentrated areas.

**South Asians**

In order to take better account of cultural differences between migrant groups in a test of childhood socialisation, it is desirable to focus on singular ancestral origin groups. We therefore focus on South Asians, who are of particular interest in England and Wales because their fertility is known to be higher than that of natives (Coleman, 1994; Coleman & Dubuc, 2010; Dubuc, 2012; Dubuc & Haskey, 2010; Sigle-Rushton, 2008). This is confirmed by the results that are shown in figure 1.

In the following section, we not only focus on South Asians, but also extend our analysis to examine second generation South Asians (UK-born women with South Asian parents), as well as first generation child migrants. The inclusion of the second generation provides an additional examination of socialisation, and facilitates a comparison across generations. Moreover, in the context of this study there is an additional advantage that (unlike child migrants) the second generation are likely to have lived in native communities for the whole of their lives. This implies that any effect of community composition is less likely to be confounded as compared with child migrants, who will have lived abroad for at least part of their childhood.

[Table 3 about here]

[Table 4 about here]

The results for Pakistanis and Bangladeshis provide further evidence in support of the childhood socialisation hypothesis (table 3). Using area level variables that are matched to the same ancestral group – i.e. the size or proportion of population from Pakistan/Bangladesh – there is a significant and substantial difference in completed fertility between natives and child migrants who lived in the top 2% of local authorities. (Here we chose to use different area rank categories from those used in table 2 because to do otherwise would mean allocating the majority of women to the top 5% category, or the bottom 75% in the case of the index of dissimilarity.) This result can be contrasted with those Pakistanis/Bangladeshis who lived in local authorities with the lowest number or proportion of Pakistanis/Bangladeshis, whose completed fertility is not significantly higher than the native norm (in the case of population size) and is comparatively smaller (in the case of both size and proportion).

The results for second generation Pakistani/Bangladeshi women follow a similar and more striking pattern, such that growing up in an area with a higher concentration of Pakistani/Bangladeshis is associated with having significantly higher completed fertility than natives. Those who grew up in the top 2% of local authorities (by size and proportion) had 50% more children than natives, whereas the completed fertility of those in the lowest 95% was very similar to (and not significantly different from), the native norm. This pattern is similar when the analysis is repeated using the ranked index of dissimilarity. Based on a qualitative comparison of the IRRs across area-rank groups, it would appear that the higher fertility of both first and second generation women from Pakistan/Bangladesh may be partially explained by childhood socialisation.

Similar results for women of Indian ancestry are shown in table 4. On average, Indian child migrants have higher fertility than natives, and at least some of this difference can be explained by the population composition of the community in which they spend their childhood. The results for second generation Indians show similar qualitative patterns to the results for Pakistanis/Bangladeshis, including the gradient across area-rank groups. However, none of the area level variables are significant at the 5% level, except for the index of dissimilarity, and in general the gradients for Indians appear to be weaker than for Pakistanis/Bangladeshis.

## DISCUSSION

Despite the fact that culture is implicit in the majority of theories that have been used to explain migrant fertility, very few studies of migrant fertility have explored measures that can capture cultural differences, beyond indicators of ethnicity and country of birth. Spatial dimensions of cultural difference have rarely been considered, and when they have, studies have derived conflicting conclusions about the existence, and the direction, of an association between migrant fertility and exposure to normative cultural environments.

In this paper, we have considered the link between childhood community population composition and completed fertility. In addition, and in common with previous research, we have argued that community population composition is a measure of exposure to cultural norms. Even if the construct validity of community population composition (as a measure of exposure to cultural norms) is called into question, research has yet to examine the extent to which it can explain the fertility of immigrants and their descendants. This research set out to address this issue, and to also test the childhood socialisation hypothesis, which predicts that the fertility of immigrants and their descendants will be closer to native fertility if they grow up in areas where they are more likely to be exposed to native norms (and native childbearing outcomes).

We used a range of measures for childhood community composition, and applied several other methodological developments. This included strategies to take account of migrant heterogeneity by ancestry: differentiating between the first and second generation, using a measure of community composition that matches each individual's country of birth group, and carrying out separate analyses of two South Asian groups, Indians and Pakistanis/Bangladeshis. Although the findings here are subject to uncertainty, and are specific to particular groups of migrants in England and Wales, they nevertheless provide consistent evidence in support of the childhood socialisation hypothesis.

For example, child migrants who lived in more highly segregated areas as children were more likely to have significantly higher completed fertility than the native norm. The same is true for South Asian child migrants. Moreover, the results suggest that exposure to ancestral culture may explain some of the variation in completed fertility for Pakistanis/Bangladeshis, the only second generation group to have significantly higher completed fertility than natives. These results suggest one reason why the fertility of some immigrants and their descendants may remain culturally entrenched. Given the novelty of this finding for the descendants of Pakistani/Bangladeshi immigrants, it is recommended that further work be carried out to explore the links between community composition, culture, and fertility for this group. Residential segregation is expected to reduce over time for the children of immigrants (Massey & Denton, 1985; Waters & Jiménez, 2005), so it would also be useful to incorporate a changing measure of community culture in this analysis.

As discussed prior to the analysis however, there are several potential challenges to some of the conclusions that are given above. Chief among these is the extent to which community composition represents exposure to cultural norms. It is true to say that exposure does not necessarily imply either contact or changing fertility preferences. This inference is provided by theory, and further evidence is required in order to test the assumption that community composition is an appropriate proxy measure of cultural influences on fertility behaviour.

Further research is also required to determine the extent to which these results might be susceptible to their reliance upon the measurement of childhood community culture in a single year (which cannot be tested using the LS data because it only allows this to be measured for 1971). This suggests one important avenue for new research, which is to investigate the links between age at arrival and residential segregation, and their joint relationship with fertility. It may be that arrival at critical ages, for example prior to language acquisition (Bleakley & Chin, 2010), has an effect on the relationship between community composition and fertility. It may be that the results are also affected, to a greater extent than is assumed here, by changing population composition, area social contiguity, and migration. It could be argued that some communities are more established than others, and better able to transmit cultural norms, irrespective of population composition. Another reason for a cautious interpretation of the findings is the 'modifiable areal unit problem', which suggests that the result may be influenced by the choice of areal unit (Flowerdew, 2011; Openshaw, 1984).

This analysis shows the importance of area-based cultural variation for explaining migrant fertility, but it does not incorporate factors relating to parental selection into childhood residential area, as well as other (non-area-based) aspects of cultural variation. Parental intermarriage was very rare in our study (as shown in Table 1, only 4% of all second generation women have parents from different country of birth groups), but this is also likely to be an important factor for more recent migration cohorts. More generally, confounding factors are theoretically important because 'exposure to cultural norms' is just one of the mechanisms that may explain migrant fertility, and several others are provided by assimilation theory. With this in mind, one fruitful avenue for further research is to identify the range of mechanisms for migrant (fertility) assimilation, and the connection between different assimilation outcomes. Our analysis highlights the value of considering the association between two dimensions of assimilation, namely residential segregation and fertility, and offers some support for the fact that assimilation outcomes are interconnected.

It is interesting to note that more recent incarnations of assimilation theory have argued for a notion of composite culture, which moves beyond the consideration of static cultural groups delineated by ethnic boundaries (Alba & Nee, 2005). The ancestry groups in this research are restricted by data availability, but it would certainly be desirable to have more detailed groups. In addition, future research could develop new insights by including measures of preferences, norms, and attitudes relating to ancestral culture. Similarly, it would also be insightful to focus on the relationships between community and fertility for the wider population (e.g. as in Dribe, Juárez, & Scalone, 2017), for example to contrast the role of community in explaining ancestral native fertility, alongside that of immigrants and their descendants.

Finally, despite the methodological challenges, it is recommended that research be carried out to investigate the influence of factors that are on the mediating pathway between childhood and the ages at which fertility is assumed to be completed. This could include an examination of partnership behaviour and intermarriage, as well as studying changes in community composition over the childbearing life course, and how these mediators relate to the level and timing of the fertility of immigrants and their descendants. As shown here, the analysis of community composition and its relationship to later life outcomes has the potential to provide a better understanding of the links between spatial variation and demographic events. More research on the changing nature of links between community and fertility can only serve to develop this further.

## REFERENCES

Abbasi-Shavazi M. J., & McDonald P. (2002). A comparison of fertility patterns of European immigrants in Australia with those in the countries of origin. *Genus* **58**(1): 53–76. http://www.jstor.org/stable/29788713

Abma J. C., & Krivo L.J. (1991). The Ethnic Context of Mexican American Fertility. *Sociological Perspectives*, **34**(2), 145–164. https://doi.org/10.2307/1388988

Adserà A, & Ferrer A. (2014). Factors influencing the fertility choices of child immigrants in Canada. *Population Studies*, **68**(1), 65–79. https://doi.org/10.1080/00324728.2013.802007

Adserà, A., Ferrer, A. M., Sigle-Rushton, W., & Wilson, B. (2012). Fertility Patterns of Child Migrants Age at Migration and Ancestry in Comparative Perspective. *The ANNALS of the American Academy of Political and Social Science*, 643(1), 160–189. http://doi.org/10.1177/0002716212444706

Alba R, & Nee V. (2005). *Remaking the American mainstream: Assimilation and contemporary immigration*. Harvard University Press.

Andersson G. (2004). Childbearing after Migration: Fertility Patterns of Foreign-born Women in Sweden. *International Migration Review*, **38**(2), 747–774. http://doi.org/10.1111/j.1747-7379.2004.tb00216.x

Bachrach C. A. (2013). Culture and Demography: From Reluctant Bedfellows to Committed Partners. *Demography,* **51**(1), 3–25. https://doi.org/10.1007/s13524-013-0257-6

Bean, F. D., & Swicegood, G. (1985). *Mexican American fertility patterns*. University of Texas Press Austin.

Bean F. D., Swicegood C. G., & Berg R. (2000). Mexican-Origin Fertility: New Patterns and Interpretations. *Social Science Quarterly* **81**(1): 404–420. http://www.jstor.org/stable/42864390

Blackwell L., Lynch K., Smith J., & Goldblatt P. (2003). *Longitudinal study 1971-2001: completeness of census linkage*. London: Office for National Statistics. Retrieved from http://www.census2001.gov.uk/downloads/theme-population/LS-no.10.pdf

Bleakley H., & Chin A. (2010). Age at arrival, English proficiency, and social assimilation among US immigrants. American economic journal. *Applied economics* **2**(1): 165–192. https://doi.org/10.1257/app.2.1.165

Bongaarts J. (1978). A Framework for Analyzing the Proximate Determinants of Fertility. *Population and Development Review*, **4**(1), 105–132. https://doi.org/10.2307/1972149

Brewster K. L. (1994). Neighborhood context and the transition to sexual activity among young black women. *Demography*, **31**(4), 603–614. https://doi.org/10.2307/2061794

Brewster K. L., Billy J. O. G., & Grady W. R. (1993). Social Context and Adolescent Behavior: The Impact of Community on the Transition to Sexual Activity. *Social Forces*, **71**(3), 713–740. https://doi.org/10.2307/2579892

Burgess E. W. (1928). Residential Segregation in American Cities. *Annals of the American Academy of Political and Social Science*, **140**: 105–115. https://doi.org/10.1177/000271622814000115

Catney G., & 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. https://doi.org/10.1002/psp.1762

CeLSIUS. (2014). Centre for Longitudinal Study Information and User Support. Retrieved January 2, 2014, from http://www.ucl.ac.uk/celsius

Cleland J., & Wilson C. (1987). Demand Theories of the Fertility Transition: An Iconoclastic View. *Population Studies*, **41**(1), 5–30. https://doi.org/10.1080/0032472031000142516

Coleman D. A. (1994). Trends in fertility and intermarriage among immigrant populations in Western Europe as measures of integration. *Journal of Biosocial Science*, **26**(1), 107–136. https://doi.org/10.1017/S0021932000021106

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

Dale A., Creeser R., Dodgeon B., Gleave S., & Filakti H. (1993). An introduction to the OPCS Longitudinal Study. *Environment and Planning A*, **25**(10), 1387 – 1398. https://doi.org/10.1068/a251387

Davis K., & Blake J. (1956). Social Structure and Fertility: An Analytic Framework. *Economic Development and Cultural Change*, **4**(3), 211–235. https://doi.org/10.1086/449714

Dribe, M., Juárez, S. P., & Scalone, F. (2017). Is It Who You Are or Where You Live? Community Effects on Net Fertility at the Onset of Fertility Decline: A Multilevel Analysis Using Swedish Micro-Census Data. *Population, Space and Place*, **23**(2), e1987. https://doi.org/10.1002/psp.1987

Dubuc S. (2012). Immigration to the UK from High-Fertility Countries: Intergenerational Adaptation and Fertility Convergence. *Population and Development Review*, **38**(2), 353–368. https://doi.org/10.1111/j.1728-4457.2012.00496.x

Dubuc S., & Haskey J. (2010). Ethnicity and Fertility in the United Kingdom. In J. Stillwell & M. Ham (Eds.), *Ethnicity and Integration* (pp. 63–81). Dordrecht: Springer Netherlands.

Duncan O. D., & Lieberson S. (1959). Ethnic segregation and assimilation. *American Journal of Sociology*, **64**(4), 364–374. https://doi.org/10.1086/222496

Fernández R., & Fogli A. (2009). Culture: An Empirical Investigation of Beliefs, Work, and Fertility. *American Economic Journal: Macroeconomics*, **1**(1), 146–177. https://doi.org/10.1257/mac.1.1.146

Findley S. E. (1980). A suggested framework for analysis of urban-rural fertility differentials with an illustration of the Tanzanian case. *Population and Environment*, **3**(3-4), 237–261. https://doi.org/10.1007/BF01255341

Fischer N. A., & Marcum J. P. (1984). Ethnic Integration, Socioeconomic Status, and Fertility Among Mexican Americans. *Social Science Quarterly*, **65**(2), 583–593. http://www.jstor.org/stable/42861664

Flowerdew R. (2011). How serious is the Modifiable Areal Unit Problem for analysis of English census data? *Population Trends*, **145**: 102–14. https://doi.org/10.1057/pt.2011.20

Ford K. (1990). Duration of Residence in the United States and the Fertility of US Immigrants. *International Migration Review*, **24**(1), 34–68. https://doi.org/10.2307/2546671

Forste R., & Tienda M. (1996). What's Behind Racial and Ethnic Fertility Differentials? *Population and Development Review*, **22**: 109–133. https://doi.org/10.2307/2808008

Gjerde J., & McCants A. (1995). Fertility, marriage, and culture: Demographic processes among Norwegian immigrants to the rural middle west. *The Journal of Economic History*, **55**(04), 860–888. https://doi.org/10.1017/S0022050700042194

Goldberg D. (1959). The Fertility of Two-Generation Urbanites. *Population Studies*, **12**: 214–222. https://doi.org/10.2307/2171971

Goldberg D. (1960). Another Look at the Indianapolis Fertility Data. *The Milbank Memorial Fund Quarterly*, **38**: 23–36. https://doi.org/10.2307/3348618

Goldscheider C., & Uhlenberg P. R. (1969). Minority Group Status and Fertility. *American Journal of Sociology*, **74**(4), 361–372. https://doi.org/10.1086/224662

Goldstein, H. (1999). *Multilevel statistical models*. Institute of Education, Multilevel Models Project, London. Retrieved from http://www.ats.ucla.edu/stat/examples/msm_goldstein/goldstein.pdf

Gordon M. M. (1964). *Assimilation in American life: The role of race, religion, and national origins*. Oxford University Press, USA.

Gurak D. T. (1980). Assimilation and fertility: A comparison of Mexican American and Japanese women. *Hispanic Journal of Behavioral Sciences*, **2**(3), 219–239. https://www.ncbi.nlm.nih.gov/pubmed/12340209

Hammel E. A. (1990). A Theory of Culture for Demography. *Population and Development Review*, **16**(3), 455–485. https://doi.org/10.2307/1972832

Hattersley L. (1999). *LS User Guide 18: International migration data in the Longitudinal Study*. Retrieved from: http://www.celsius.lshtm.ac.uk/documents/userguide18.pdf

Hattersley L, & Creeser R. (1995). *Longitudinal study 1971-1991: history, organisation and quality of data*. Office of Population Censuses and Surveys, HMSO, London. Retrieved from: https://www.ons.gov.uk/ons/about-ons/who-we-are/services/longitudinal-study/resources-and-definitions/history--organisation-and-quality-of-data/introduction.pdf

Haug W., Compton P., & Courbage Y. (2002). *The demographic characteristics of immigrant populations*. Council of Europe.

Hedman L., & Van Ham M. (2012). Understanding Neighbourhood Effects: Selection Bias and Residential Mobility. In M. Van Ham, D. Manley, N. Bailey, L. Simpson, & D. Maclennan (Eds.), *Neighbourhood Effects Research: New Perspectives*. Springer.

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. https://doi.org/10.2307/2545774

Hewstone M. (2009). *Living Apart, Living Together?: The Role of Intergroup Contact in Social Integration*. Max Planck Institute for the Study of Religious and Ethnic Diversity.

Hill J. A. (1913). Comparative Fecundity of Women of Native and Foreign Parentage in the United States. *Publications of the American Statistical Association*, **13**(104), 583–604. https://doi.org/10.2307/2965013

Hill L. E, & Johnson H. P. (2004). Fertility Changes Among Immigrants: Generations, Neighborhoods, and Personal Characteristics. *Social Science Quarterly*, **85**(3), 811–827. https://doi.org/10.1111/j.0038-4941.2004.00246.x

Hogan D. P., Astone N. M., & Kitagawa E. M. (1985). Social and Environmental Factors Influencing Contraceptive Use Among Black Adolescents. *Family Planning Perspectives*, **17**(4), 165–169. https://doi.org/10.2307/2135241

Hogan D. P., & Kitagawa E. M. (1985). The Impact of Social Status, Family Structure, and Neighborhood on the Fertility of Black Adolescents. *American Journal of Sociology*, **90**(4), 825–855. https://doi.org/10.1086/228146

Johnson-Hanks J., Bachrach C. A., Morgan S. P., & Kohler H-P. (2011). *Understanding family change and variation: toward a theory of conjunctural action*. Dordrecht; New York: Springer.

Jones K. (1991). Specifying and Estimating Multi-Level Models for Geographical Research. *Transactions of the Institute of British Geographers*, **16**(2), 148–159. https://doi.org/10.2307/622610

Kahn J. R. (1994). Immigrant and native fertility during the 1980s: adaptation and expectations for the future. *International Migration Review*, **28**(3), 501–519. https://doi.org/10.2307/2546818

Kennedy R. E. (1973). Minority Group Status and Fertility: The Irish. *American Sociological Review*, **38**(1), 85–96. https://doi.org/10.2307/2094333

Kertzer D. I. (1997). The proper role of culture in demographic explanation. In G. W. Jones, R. M. Douglas, J. C. Caldwell, & R. M. D'Souza (Eds.), *The Continuing Demographic Transition* (pp. 137–157). Oxford: Oxford University Press.

Knox P. L., & Pinch S. (2006). *Urban social geography: an introduction*. Pearson Education.

Kuczynski R. R. (1901). The Fecundity of the Native and Foreign born Population in Massachusetts (I.). *The Quarterly Journal of Economics*, **16**(1), 1–36. https://doi.org/10.2307/1882901

Kuczynski R. R. (1902). The Fecundity of the Native and Foreign born Population in Massachusetts (II.). *The Quarterly Journal of Economics*, **16**(2), 141. http://www.jstor.org/stable/1882742

Kulu H. (2005). Migration and Fertility: Competing Hypotheses Re-examined. *European Journal of Population / Revue Européenne de Démographie*, **21**(1), 51–87. http://www.jstor.org/10.1007/s10680-005-3581-8

Kulu H., & Boyle P. J. (2009). High Fertility in City Suburbs: Compositional or Contextual Effects? *European Journal of Population / Revue Européenne de Démographie*, **25**(2), 157–174. http://www.jstor.org/ 10.1007/s10680-008-9163-9

Kulu H., Boyle P. J., & Andersson G. (2009). High Suburban Fertility: Evidence from Four Northern European Countries. *Demographic Research*, **21**: 915–944. https://doi.org/10.4054/DemRes.2009.21.31

Kulu H., & 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. https://doi.org/10.1007/s10680-014-9322-0

Kulu H., Hannemann T., Pailhé A., Neels K., Krapf S., González-Ferrer A., & Andersson G. (2017). Fertility by Birth Order among the Descendants of Immigrants in Selected European Countries. *Population and Development Review*. **43**(1): 31-60. https://doi.org/10.1111/padr.12037

Kulu H., & Washbrook E. (2014). Residential context, migration and fertility in a modern urban society. *Advances in Life Course Research*, **21**: 168–182. https://doi.org/10.1016/j.alcr.2014.01.001

La Ferrara E., Chong A., & Duryea S. (2012). Soap Operas and Fertility: Evidence from Brazil. *American Economic Journal: Applied Economics*, **4**(4), 1–31. https://doi.org/10.1257/app.4.4.1

Lee E. S., & Lee A. S. (1952). The Differential Fertility of the American Negro. *American Sociological Review*, **17**(4), 437–447. https://doi.org/10.2307/2087999

Lesthaeghe R., & Surkyn J. (1988). Cultural Dynamics and Economic Theories of Fertility Change. *Population and Development Review*, **14**(1), 1–45. https://doi.org/10.2307/1972499

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

Liefbroer A. C., & Billari F. C. (2010). Bringing norms back in: a theoretical and empirical discussion of their importance for understanding demographic behaviour. *Population, Space and Place*, **16**(4), 287–305. https://doi.org/10.1002/psp.552

Lopez D. E., & Sabagh G. (1978). Untangling structural and normative aspects of the minority status-fertility hypothesis. *American Journal of Sociology*, **83**(6), 1491–1497. https://doi.org/10.1086/226710

Lorimer F. (1956). Culture and Human Fertility. *Journal of School Health*, **26**(4), 136–136.

Marin B. V. O., Gomez C. A., & Hearst N. (1993). Multiple Heterosexual Partners and Condom Use among Hispanics and Non-Hispanic Whites. *Family Planning Perspectives*, **25**(4), 170–174. https://doi.org/10.2307/2135925

Martin D. (2008). *Census geography: England 1971*. Retrieved January 2, 2014, from http://www.restore.ac.uk/geo-refer/31425dengs00y19711980.php

Massey D. S. (1981). Dimensions of the New Immigration to the United States and the Prospects for Assimilation. *Annual Review of Sociology*, **7**: 57–85. https://doi.org/10.1146/annurev.so.07.080181.000421

Massey D. S. (1985). Ethnic residential segregation: A theoretical synthesis and empirical review. *Sociology and Social Research*, **69**(3), 315–350. http://www.popline.org/node/412371

Massey D. S., & Denton N. A. (1985). Spatial Assimilation as a Socioeconomic Outcome. *American Sociological Review*, **50**(1), 94–106. https://doi.org/10.2307/2095343

Massey D. S., & Denton N. A. (1988). The Dimensions of Residential Segregation. *Social Forces*, **67**(2), 281–315. https://doi.org/10.1093/sf/67.2.281

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

ONS. (2014). *The ONS Longitudinal Study*. Retrieved January 2, 2014, from http://www.ons.gov.uk/ons/guide-method/user-guidance/longitudinal-study/index.html

Openshaw S. (1984). Ecological fallacies and the analysis of areal census data. *Environment and Planning A*, **16**(1), 17 – 31. https://doi.org/10.1068/a160017

Park R. E., & Burgess E. W. (1921). *Introduction to the Science of Sociology*. Chicago: University of Chicago Press.

Parrado E. A. (2011). How High is Hispanic/Mexican Fertility in the United States? Immigration and Tempo Considerations. *Demography*, **48**(3), 1059–1080. https://doi.org/10.1007/s13524-011-0045-0

Parrado E. A., & Morgan S. P. (2008). Intergenerational Fertility Among Hispanic Women: New Evidence of Immigrant Assimilation. *Demography*, **45**(3), 651–671. https://doi.org/10.1007/10.1353/dem.0.0023

Peach C. (1996). Good segregation, bad segregation. *Planning Perspectives*, **11**(4), 379–398. https://doi.org/10.1080/026654396364817

Portes A., & 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. https://doi.org/10.1177/0002716293530001006

Robards J., Berrington A., & Hinde A. (2011). Estimating fertility rates using the ONS Longitudinal Study-what difference does the inclusion of non-continually resident members make? *Population Trends*, **144**. https://doi.org/10.1057/pt.2011.10

Robards J., Berrington A., & Hinde A. (2013). Identifying biases arising from combining census and administrative data – the fertility of migrants in the Office for National Statistics Longitudinal Study. *Longitudinal and Life Course Studies*, **4**(3), 258–267. http://dx.doi.org/10.14301/llcs.v4i3.244

Shadish W. R., Cook T. D., & Campbell D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.

Sigle-Rushton W. (2008). England and Wales: Stable fertility and pronounced social status differences. *Demographic Research*, **19**(15), 455–502. http://dx.doi.org/10.4054/DemRes.2008.19.15

Simpson L. (2004). Statistics of racial segregation: measures, evidence and policy. *Urban Studies*, **41**(3), 661–681. https://doi.org/10.1080/0042098042000178735

Simpson L. (2007). Ghettos of the mind: the empirical behaviour of indices of segregation and diversity. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, **170**(2), 405–424. https://doi.org/10.1111/j.1467-985X.2007.00465.x

Sobotka T. (2008). Overview Chapter 7: The rising importance of migrants for childbearing in Europe. *Demographic Research*, **19**: 225–248. https://doi.org/10.4054/DemRes.2008.19.9

Soler H., Quadagno D., Sly D. F., Riehman K. S., Eberstein I. W., & Harrison D. F. (2000). Relationship Dynamics, Ethnicity and Condom Use among Low-Income Women. *Family Planning Perspectives*, **32**(2), 82–101. https://doi.org/10.2307/2648216

Sorenson A. M. (1988). The Fertility and Language Characteristics of Mexican-American and Non-Hispanic Husbands and Wives. *The Sociological Quarterly*, **29**(1), 111–130. https://doi.org/10.2307/4121576

Stephen E. H., Rindfuss R. R., & Bean F. D. (1988). Racial differences in contraceptive choice: Complexity and implications. *Demography*, **25**(1), 53–70. https://doi.org/10.2307/2061477

Sturgis, P., Brunton-Smith, I., Kuha, J., & Jackson, J. (2014). Ethnic diversity, segregation and the social cohesion of neighbourhoods in London. *Ethnic and Racial Studies*, **37**(8), 1–21. http://doi.org/10.1080/01419870.2013.831932

Swicegood G., Bean F. D., Stephen E. H., & Opitz W. (1988). Language usage and Fertility in the Mexican-Origin Population of the United States. *Demography*, **25**(1), 17–33. https://doi.org/10.2307/2061475

Toulemon L. (2004). Fertility among immigrant women: new data, a new approach. *Population & Societies*, *400*. INED, France. Retrieved from http://www.ined.fr/en/publications/pop_soc/bdd/publication/540/

Toulemon L. (2006). *Fertility Among Immigrant Women in France: New Data, a New Approach*. paper presented at the Population Association of American 2006 Annual Meeting, Los Angeles, California, March 30-April 1, 2006.

Toulemon L, & Mazuy M. (2004). *Comment prendre en compte l'âge à l'arrivée et la durée de séjour en France dans la mesure de la fécondité des immigrants?* INED, France. Retrieved from http://www.ined.fr/fichier/t_publication/1053/publi_pdf1_120.pdf

UK Data Service. (2014). *Census Aggregate Data*, Casweb, UK Data Service Census Support. Retrieved January 2, 2014, from http://casweb.mimas.ac.uk/

Vang Z. M. (2012). The Limits of Spatial Assimilation for Immigrants' Full Integration Emerging Evidence from African Immigrants in Boston and Dublin. *The ANNALS of the American Academy of Political and Social Science*, **641**(1), 220–246. https://doi.org/10.1177/0002716211432280

Waters M. C., & Jiménez T. R. (2005). Assessing Immigrant Assimilation: New Empirical and Theoretical Challenges. *Annual Review of Sociology*, **31**(1), 105–125. https://doi.org/10.1146/annurev.soc.29.010202.100026

Wilson, B. (2011). Migrant fertility in England and Wales: Measuring fertility convergence (Masters dissertation). London School of Economics and Political Science, London.

Yancey W. L., Ericksen E. P., & Juliani R. N. (1976). Emergent Ethnicity: A Review and Reformulation. *American Sociological Review*, *41*(3), 391–403. https://doi.org/10.2307/2094249

Zarate A., & Zarate A. U. de. (1975). On the reconciliation of research findings of migrant-nonmigrant fertility differentials in urban areas. *International Migration Review*, **9**(2), 115–156. https://doi.org/10.2307/3002746

Zhou M. (1997). Segmented Assimilation: Issues, Controversies, and Recent Research on the New Second Generation. *International Migration Review*, **31**(4), 975–1008. https://doi.org/10.2307/2547421

Zuccotti C. V., & Platt L. (2016). Does Neighbourhood Ethnic Concentration in Early Life Affect Subsequent Labour Market Outcomes? A Study across Ethnic Groups in England and Wales. *Population, Space and Place*, Published online in Wiley Online Library. doi:10.1002/psp.2041

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TABLES

**Table 1: Frequencies by generation and (ancestral) country of birth**

| Ancestral country of birth: using 1971 codes | Second generation | % of total | Child migrants | % of total |
|---|---|---|---|---|
| Ireland | 1,776 | 36 | 58 | 5 |
| Old Commonwealth | 145 | 3 | 76 | 7 |
| Africa (Commonwealth) | 126 | 3 | 185 | 17 |
| America (Commonwealth) | 746 | 15 | 84 | 8 |
| Europe (Commonwealth) | 0 | - | 96 | 9 |
| India | 433 | 9 | 145 | 14 |
| Pakistan (incl. Bangladesh) | 115 | 2 | 72 | 7 |
| Asia/Oceania (Commonwealth) | 69 | 1 | 97 | 9 |
| Rest of Europe (excluding USSR) | 953 | 19 | 194 | 18 |
| Rest of the world | 334 | 7 | 67 | 6 |
| Parents from different COB groups | 213 | 4 | | |
| **Total** | **4,910** | | **1,074** | |

Note: The total number of ancestral natives is 44,168; "Old Commonwealth" includes Australia, Canada, and New Zealand. "Africa Commonwealth" includes Ghana, Kenya, Malawi, Nigeria, Rhodesia, Sierra Leone, Tanzania, Uganda, Zambia, and other African Commonwealth countries, "America Commonwealth" includes Barbados, Guyana, Jamaica, Trinidad and Tobago, as well as other Commonwealth countries in America, "Europe Commonwealth" includes Gibraltar, Malta, and Gozo, "Asia/Oceania Commonwealth" includes Ceylon, Cyprus, Hong Kong, Malaysia, Singapore, and other Commonwealth countries in Asia and Oceania.
Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

**Table 2: Exposure to community culture and its association with migrant fertility (models for all migrants)**

| | *model A1* | | *model A2* | | *model A3* | | *model A4* | | *model A5* | | *model A6* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ranked size of foreign-born population** | | **Ranked proportion of population that is foreign-born** | | **Ranked size of individual's COB group population** | | **Ranked proportion of population that is same COB group** | | **Ranked index of dissimilarity** | | **Ranked index of dissimilarity based on individual's COB group** | |
| **Variable** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** |
| **Factors measured for migrants only** | | | | | | | | | | | | |
| Area rank: foreign-born child migrants | | | | | | | | | | | | |
| Top 5% | 1.14*** | 0.03 | 1.09* | 0.04 | 1.15*** | 0.03 | 1.13*** | 0.03 | 1.25*** | 0.06 | | |
| 5-25% | 1.05 | 0.04 | 1.12** | 0.04 | 1.00 | 0.04 | 1.07 | 0.05 | 1.14*** | 0.04 | 1.16*** | 0.05 |
| Lower 75% | 0.94 | 0.05 | 1.02 | 0.04 | 0.96 | 0.05 | 1.00 | 0.04 | 0.97 | 0.03 | 1.05* | 0.03 |
| **Covariates (for all sample members)** | | | | | | | | | | | | |
| Parental social class (in 1971) | | | | | | | | | | | | |
| Either parent has high SEC (ref.) | 1.00 | - | 1.00 | - | 1.00 | - | 1.00 | - | 1.00 | - | 1.00 | - |
| Neither parent has high SEC | 1.12*** | 0.01 | 1.12*** | 0.01 | 1.12*** | 0.01 | 1.12*** | 0.01 | 1.12*** | 0.01 | 1.12*** | 0.01 |
| SEC unknown for both parents | 1.20*** | 0.02 | 1.20*** | 0.02 | 1.20*** | 0.02 | 1.20*** | 0.02 | 1.20*** | 0.02 | 1.20*** | 0.02 |
| Age (in 1971) | 1.01*** | 0.00 | 1.01*** | 0.00 | 1.01*** | 0.00 | 1.01*** | 0.00 | 1.01*** | 0.00 | 1.01*** | 0.00 |

Note: In this table p-values are indicated as †p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001; COB = Country of birth; The outcome for all models is completed fertility (the number of children born to each woman up to 2009); All results are obtained from hierarchical multilevel Poisson models where women are nested in Local Authorities; High SEC includes professional and non-manual occupations, low SEC includes manual as well as partly and unskilled occupations, whereas parental SEC is unknown for parents who are either retired, inactive, students, in the armed forces, or where SEC is inadequately stated; The top two area rank categories were combined in model A6 due to a small sample size in the top category; Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

**Table 3: Community culture and fertility - models for Pakistanis/Bangladeshis**

| | *model B1* | | *model B2* | | *model B3* | |
|---|---|---|---|---|---|---|
| | **Ranked size of Pakistani/ Bangladeshi population** | | **Ranked proportion of population that is Pakistani/ Bangladeshi** | | **Ranked index of dissimilarity for Pakistani/ Bangladeshi population** | |
| **Variable** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** |
| **Factors measured for Pakistanis/Bangladeshis only** | | | | | | |
| Area rank: foreign-born child migrants | | | | | | |
| Top 2% | 1.61*** | 0.16 | 1.74*** | 0.24 | | |
| 3-5% | 1.71*** | 0.17 | 1.63*** | 0.15 | | |
| Bottom 95% | 1.31 | 0.26 | 1.46** | 0.20 | | |
| Top 40% | | | | | 1.75*** | 0.15 |
| Bottom 60% | | | | | 1.40** | 0.16 |
| Area rank: second generation | | | | | | |
| Top 2% | 1.57*** | 0.13 | 1.56** | 0.20 | | |
| 3-5% | 1.29* | 0.14 | 1.49*** | 0.13 | | |
| Bottom 95% | 0.95 | 0.14 | 1.04 | 0.11 | | |
| Top 40% | | | | | 1.41*** | 0.10 |
| Bottom 60% | | | | | 1.18 | 0.13 |
| **Covariates (for all sample members)** | | | | | | |
| Age (in 1971) | 1.01*** | 0.00 | 1.01*** | 0.00 | 1.01*** | 0.00 |

Note: In this table p-values are indicated as †p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001; The outcome for all models is completed fertility (the number of children born to each woman up to 2009); All results are obtained from hierarchical multilevel Poisson models where women are nested in Local Authorities; Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

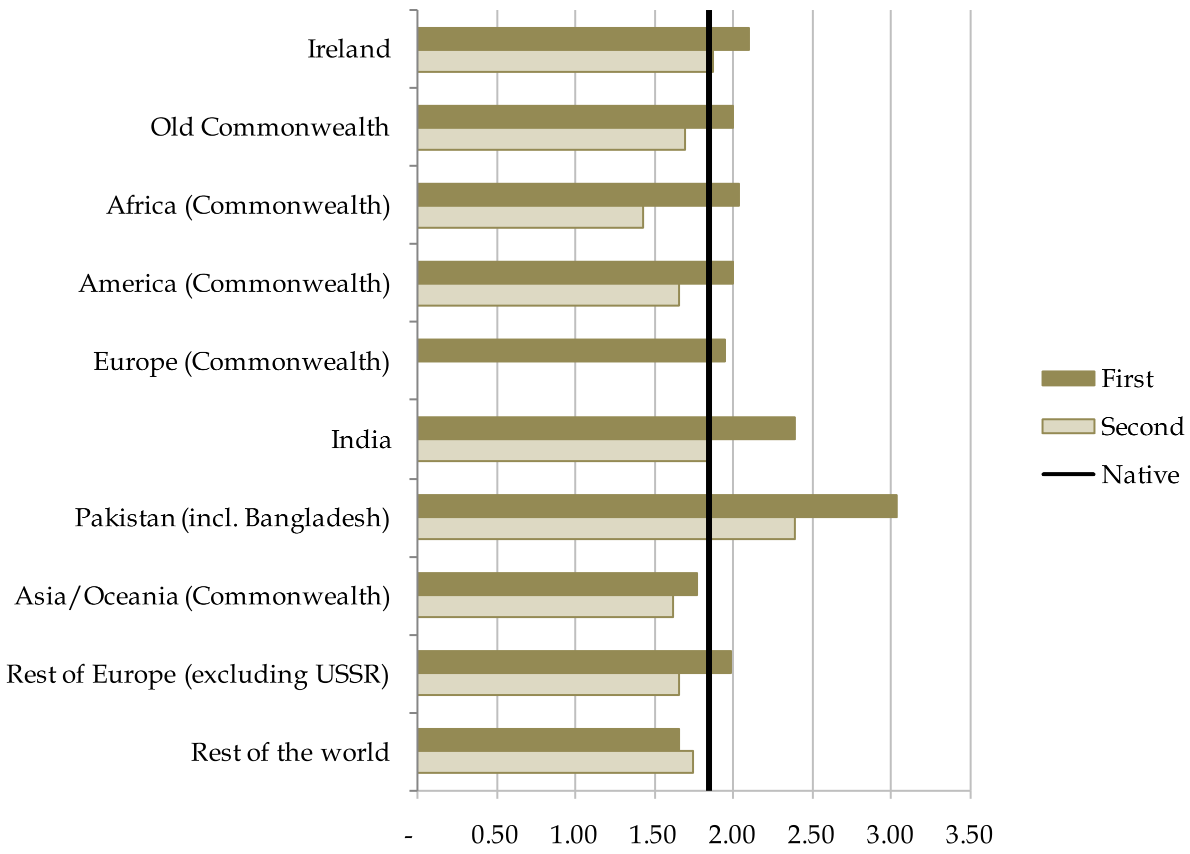
## Table 4: Community culture and fertility - models for Indians

| | *model C1* | | *model C2* | | *model C3* | |
|---|---|---|---|---|---|---|
| | **Ranked size of Indian population** | | **Ranked proportion of population that is Indian** | | **Ranked index of dissimilarity for Indian-born population** | |
| **Variable** | **IRR** | **SE** | **IRR** | **SE** | **IRR** | **SE** |
| **Factors measured for Indians only** | | | | | | |
| Area rank: foreign-born child migrants | | | | | | |
| Top 2% | 1.28** | 0.10 | 1.30** | 0.11 | | |
| 3-5% | 1.31** | 0.11 | 1.29** | 0.11 | | |
| Bottom 95% | 0.91 | 0.17 | 1.06 | 0.14 | | |
| Top 40% | | | | | 1.34*** | 0.08 |
| Bottom 60% | | | | | 0.94 | 0.12 |
| Area rank: second generation | | | | | | |
| Top 2% | 1.06 | 0.07 | 1.05 | 0.08 | | |
| 3-5% | 1.04 | 0.07 | 1.06 | 0.06 | | |
| Bottom 95% | 0.94 | 0.06 | 0.94 | 0.05 | | |
| Top 40% | | | | | 1.11* | 0.05 |
| Bottom 60% | | | | | 0.87* | 0.05 |
| **Covariates (for all sample members)** | | | | | | |
| Age (in 1971) | 1.01*** | 1.01 | 0.00 | 1.01 | 0.00 | 1.01 |

Note: In this table p-values are indicated as †p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001; The outcome for all models is completed fertility (the number of children born to each woman up to 2009); All results are obtained from hierarchical multilevel Poisson models where women are nested in Local Authorities; Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

FIGURES

**Figure 1: The completed fertility of different ancestry and generation groups relative to ancestral natives**




Note: The figure shows the mean completed fertility for migrants (by generation and ancestry) relative to the average cumulative number of births for natives (which is equal to 1.85); There are no second generation women from the European Commonwealth; "Old Commonwealth" includes Australia, Canada, and New Zealand. "Africa Commonwealth" includes Ghana, Kenya, Malawi, Nigeria, Rhodesia, Sierra Leone, Tanzania, Uganda, Zambia, and other African Commonwealth countries, "America Commonwealth" includes Barbados, Guyana, Jamaica, Trinidad and Tobago, as well as other Commonwealth countries in America, "Europe Commonwealth" includes Gibraltar, Malta, and Gozo, "Asia/Oceania Commonwealth" includes Ceylon, Cyprus, Hong Kong, Malaysia, Singapore, and other Commonwealth countries in Asia and Oceania.

Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

# APPENDIX TABLES

## Table A1: The analytical sample

| | N | % of all | % of sample with missing |
|---|---|---|---|
| **All women under 16 in 1971** | 64,370 | | |
| drop Scotland and Northern Ireland | 531 | 0.8 | |
| drop communal establishments [1] | 622 | 1.0 | |
| not enumerated at 2001 Census [2] | 10,903 | 16.9 | |
| **Sample with missing values** | 52,314 | 81.3 | |
| missing COB | 128 | | 0.2 |
| missing age at migration | 37 | | 0.1 |
| missing parental COB | 1,440 | | 2.8 |
| missing address one year ago | 460 | | 0.9 |
| foreign-born migrants who lived in a different LA one year ago [3] | 97 | | 0.0 |
| **Total missing** | 2,162 | | 4.0 |
| **Analytical sample** | 50,152 | | 96.0 |

1: All women are dropped is they live in a communal establishment, which includes hospitals, nursing homes, and prisons; 2: Assumed to have emigrated or died; 3: Those living in a different LA (Local Authority) one year ago;
Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

## Table A2: Descriptive statistics by generation

| | Ancestral natives | Second generation | Foreign-born child migrants |
|---|---|---|---|
| **mean number of children** | | | |
| maximum (own child + registered) | 1.85 | 1.77 | 2.06 |
| registered births in 2009 | 1.79 | 1.70 | 1.90 |
| difference | 0.06 | 0.07 | 0.15 |
| **mean age (years)** | | | |
| age in 1971 | 7.4 | 7.0 | 9.4 |
| **parental social class in 1971 (n)** | | | |
| Either parent has high SEC | 17,571 | 1,629 | 355 |
| Neither parent has high SEC | 23,744 | 2,777 | 455 |
| SEC unknown for both parents | 2,853 | 504 | 264 |
| **parental social class in 1971 (%)** | | | |
| Either parent has high SEC | 40 | 33 | 33 |
| Neither parent has high SEC | 54 | 57 | 42 |
| SEC unknown for both parents | 6 | 10 | 25 |
| **observations (n)** | **44,168** | **4,910** | **1,074** |

Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

**Table A3a: Proportion of foreign-born child migrants in each of the area groups**

| | Areas grouped by rank | | |
|---|---|---|---|
| | Top 5% | 5-25% | Lower 75% |
| Size of foreign-born population | 0.54 | 0.30 | 0.16 |
| Proportion of foreign-born population | 0.39 | 0.33 | 0.27 |
| | | | |
| Size of individual's COB group population | 0.57 | 0.27 | 0.16 |
| Proportion of same COB group population | 0.46 | 0.26 | 0.28 |
| | | | |
| Ranked index of dissimilarity (IoD) | 0.18 | 0.34 | 0.48 |
| Ranked IoD of same COB group population[1] | - | 0.25 | 0.75 |

1: Result for 5-25% is for 0-25%;
Source: Authors' analysis using Office for National Statistics Longitudinal Study data.

**Table A3b: Proportion of the second generation in each of the area groups**

| | Areas grouped by rank | | |
|---|---|---|---|
| | Top 5% | 5-25% | Lower 75% |
| Size of foreign-born population | 0.55 | 0.27 | 0.18 |
| Proportion of foreign-born population | 0.43 | 0.29 | 0.28 |
| | | | |
| Size of individual's COB group population | 0.57 | 0.26 | 0.17 |
| Proportion of same COB group population | 0.45 | 0.28 | 0.27 |
| | | | |
| Ranked index of dissimilarity (IoD) | 0.15 | 0.35 | 0.50 |
| Ranked IoD of same COB group population[1] | - | 0.18 | 0.82 |

1: Result for 5-25% is for 0-25%;
Source: Authors' analysis using Office for National Statistics Longitudinal Study data.